

CONFERENCE PROCEEDINGS

Editors: Ivana Đurđević Babić and Vjekoslav Galzina

1ST INTERNATIONAL ONLINE SCIENTIFIC CONFERENCE ICT IN LIFE

Contemporary society meeting
ICT challenges and issues



Sveučilište Josipa Jurja Strossmayera u Osijeku
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Contemporary society meeting ICT challenges and issues

Editors: Ivana Đurđević Babić and Vjekoslav Galzina

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Preface

The 1st International Online Scientific Conference *ICT in Life* was held on May 13, 2022 with the conference theme *Contemporary society meeting ICT challenges and issues*. A proven and secure platform was used to share research and opinions between scientists from different fields whose work highlights the importance of the role of ICT and contributes to shaping modern society.

This conference aims to provide answers to some of the important questions about the use of ICT, offering experiences and research results of others to increase the quality, but also to maximize the impact of its use in various aspects. Through the ICT sphere, highlighting all the challenges, the conference participants emphasized and discussed ways to promote and developing different skills, achieve learning outcomes, implement and experience the use of different learning and teaching environments and systems, especially in light of the changes caused by the Covid 19 pandemic and the impact on the physical and social factors, as well as the transformation and informatization of some general public systems such as the justice system. The authors of the 34 papers published in this conference proceedings, which underwent a rigorous peer review process, are from different countries (Albania, Croatia, Cyprus, Denmark, Germany, Ireland, Moldova, Serbia, Spain, Turkey, Ukraine), so that an international perspective on these topical issues has been achieved.

We would like to thank all the conferees, authors and reviewers for their excellent work in making the conference and proceedings as good as possible. We hope that this conference proceeding will encourage others to use ICT and improve the use of ICT in the future.

Editors

Ivana Đurđević Babić & Vjekoslav Galzina

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User Centered Design of a Curriculum for Teaching Creativity Online

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Abstract

Creativity was identified as one of the four cornerstone skills of future engineers and is said to rely on direct connection to others, and on teaching settings allowing for face-to-face phronetic experience. Against the background of the pandemic-caused online teaching, the main objective of the European project TICON – Teaching creativity online - is to identify barriers in engineering Higher Education for teaching creativity online, and to upskill the teachers in terms of digital teaching with appropriate pedagogical approaches.

The underlying curriculum, was developed following a User-Centred Design approach. In the first step, Experience Interviews with 32 Higher Education engineering teachers in Turkey, Ireland, Denmark and Germany have been conducted. As a result, barriers and best-practises as well as further needs and interests have been identified.

On this basis, a first draft of the curriculum – the curriculum prototype - was designed and presented to the target group in Focus Groups in each of the four countries. Within each Focus Group, participants were introduced to the project and findings of the interviews. A group discussion was then held by going through the draft curriculum for three aims: To understand, if the curriculum prototype fits into the problem space derived by the Experience Interviews; to derive further needs and ideas for the curriculum and to validate the prototype. The final curriculum consists of three lessons: 1) Why - Introduction to creativity teaching and its relevance for engineering; 2) What - Method and tool skills for online teaching and 3) How - Skill development for how to teach.

Keywords: Online Teaching, Creativity, User-Centred Design, Experience Interviews, Focus Groups

Introduction

Now the second most common sector in higher education in the EU-27, which is engineering, manufacturing and construction, attracted 15.8% of the 17.5 million students in tertiary education in 2018 (Eurostat, 2020). Engineering curricula in tertiary education have shifted in recent years from teaching purely technical skills to complementing management competences and innovation capabilities (Kolmos, Hadgraft, & Holgaard, 2016). These changes are a response to trends that require visionary problem-solving skills to improve outcomes such as human health, responsible production and greater sustainability (Haase, 2014) (Sheppard, Pellegrino, & Olds, 2008) and to promote entrepreneurial activities (Kolmos, Hadgraft, & Holgaard, 2016). In addition, emerging technologies such as artificial intelligence, machine learning and robotics may pose a threat to job loss through automation. However, "occupations that involve the development of novel ideas and artefacts are the least vulnerable to computerisation" (Frey & Osborne, 2017). As a result, creativity has recently been identified as a critical competence for future engineers, as it cannot be replaced by technology (Brown, 2018) (Kim, Kim, & Lee, 2017). Therefore, HE engineering teachers are increasingly challenged to activate and enhance engineering students' creative abilities.

The global crisis caused by the COVID -19 pandemic has recently triggered another shift in engineering education in higher education institutions (HE): Universities have been "forced to move learning online due to nationwide shutdowns" (Giridharan, 2020), leading to a move towards hybrid and online learning environments, which is expected to continue (Li & Lalani, 2020) (Zancajo, Verger, & Bolea, 2022). As digitalisation becomes a key activity across all sectors (Gandhi, Khanna, & Ramaswamy, 2016), the future of engineering education is being steered towards distance learning. For example, the European Commission prioritises "enhancing digital skills and digital transformation competences" (p. 12) in its "Digital Education Action Plan" for 2021-2027 (European Commission, 2020). However, experts believe that such a transformation requires further training of teachers in the use of digital teaching tools as well as the development and implementation of appropriate curricula (ibid.). Although creativity is hailed as an essential skill in engineering (Cropley, 2015) and HE engineering teachers know that creativity techniques can help improve their students' innovative thinking skills, they believe that it is difficult to apply creativity techniques in the classroom (Anderson, et al., 2022). According to our observations since March 2020, this challenge is exacerbated in an online environment.

Objective

Despite the fact that the awareness, knowledge, willingness and ability of HE teachers to use digital learning materials has increased dramatically since the onset of the COVID -19 pandemic (Giridharan, 2020), we find that current online engineering curricula at European universities are not sufficient to teach and adequately reward creativity. One reason for this could be that creativity requires a direct connection with others, which requires a teaching environment that allows for a face-to-face phronetic experience (e.g. Nonaka & Toyama, 2007) (Kaiser & Fordinal, 2010). This poses a major challenge for teaching creativity online. To make matters worse, there is a lack of systematic approaches to help engineering teachers incorporate the subject into online teaching environments. In addition, student anxiety and discomfort have been found to increase in online environments, preventing participation in creative tasks that require the presentation of ideas outside of normal thinking paths (Giridharan, 2020). Altogether, this represents a significant barrier for engineering students.

Moreover, there are few pedagogical studies that address the teaching of creativity online in HE institutions, which is both surprising and worrying given the urgent need for educational institutions to move to hybrid and online teaching. In order to teach creativity online, systematic approaches need to be explored to enable HE engineering educators to integrate creativity methods and techniques into online teaching environments (Mbatia & Minnaar, 2015) (Bashir, Bashir, Rana, Lambert, & Vernallis, 2021).

To address these shortcomings, the research questions are: 1) How could a curriculum for upskilling HE engineering teachers to teach creativity in online classes be designed and 2) what elements should this curriculum have to take existing challenges and needs into account and can be implemented in an online toolbox?

The answer on the first research question is presented in the chapter on Design and research methodology. The second question is answered in the chapter “Final Curriculum”

How: Design And Research Methodology

Within the European project TICON (Teaching creativity online) with project partners from Turkey, Ireland, Denmark and Germany, we had the opportunity to design a curriculum for teaching creativity online using a qualitative (Flick, 2014), iterative and user-centred approach (ISO 9421-210, 2019). The User-Centred Design process foresees four activities with active engagement of future users: (1) Understand the needs of the user, (2) specify the requirements, (3) produce design solutions and (4) evaluate the solutions. These steps are repeated to iteratively refine the design solutions until a satisfactory result is obtained.

For the first step, we conducted Experience Interviews (Zeiner, Laib, Schippert, & Burmester, 2016) with 32 HE engineering educators (eight from each country) from various engineering disciplines to gain insights into challenges, best practices as well as upskilling needs of teaching online. Experience Interviews are a variant of narrative interviews (Flick, 2014) in which interviewees are asked to relate both their most positive and most negative experiences. The interviews were recorded, transcribed, thematically coded (Guest, MacQueen, & Namey, 2012) and analysed over all four countries with Affinity Diagrams (Courage & Baxter, 2005).

Based on the specified findings, we prototyped a draft curriculum as the first design solution. For evaluation and to derive further needs and ideas, this curriculum prototype as well as the findings of step one was presented to 60 HE engineering educators (15 of each four countries) in Focus Groups (Fern, 2001). Focus groups are group discussions that not only make it possible to evaluate the previously collected findings, but also to gain deeper insights into their meaning from the perspective of the respondents (Grudens-Schuck, Allen, & Larson, 2004). The focus group sessions were recorded and analysed with a content analysis similar to the interviews. On this basis, the curriculum prototype was enhanced and refined during a cross-case comparison of all findings in a group interpretation session of the project partners.

Since the specific engineering (Sarsar, et al., 2021) and cultural perspectives (Semmler, Uchinokura, & Pietzner, 2018) influence the practices of teaching as well as its conceptualisation, we used a purposive, variant sampling strategy (Flick, 2014) to recruit HE engineering teachers for the whole process.

Detailed Design Process

Experience Interviews

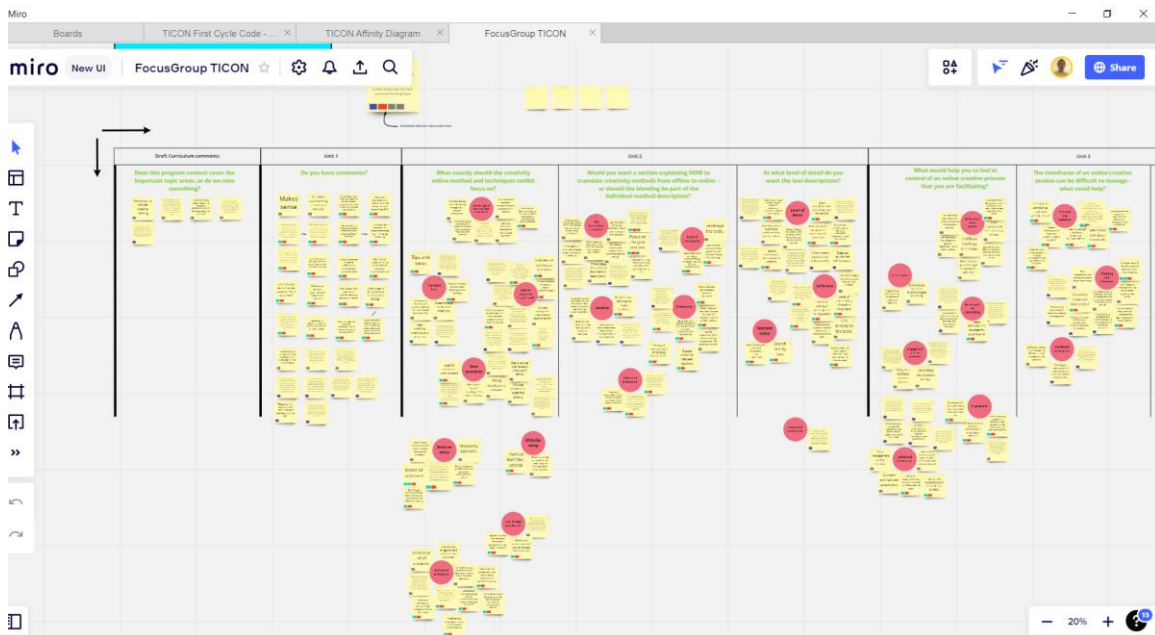
As stated above, the main goal of conducting Experience Interviews in the first needs analysis step of the target group was to identify the specific barriers, challenges and best practices related to using creativity methods and techniques in online teaching as well as to gain insights into upskilling needs. Therefore, interviewees were asked for the elaboration of positive and negative experiences when using creativity methods and techniques in both classroom and online teaching. In addition to socio-demographic data and previous experience, they were additionally asked what knowledge and skills make them successful at teaching creativity, what technical material they use and what and why they would like to learn about online teaching.

The interviews took place in four different countries with attendance of 32 HE engineering teachers (eight from each country) from different engineering disciplines. 14 of

them were female and 18 male. Each interview had an average length of 40 minutes. The experience with using creativity methods or tools in physical teaching has been between one and 30 years with an average of 7.7 years and in online settings between one and 10 years with an average of 2.4 years. Figure 1 shows the according Affinity Diagram above.

Figure 1

Miro board screenshot affinity diagram of first cycle code



While 26 of 32 interviewees had a positive experience with creativity methods and techniques when teaching in classroom less than 50% had a positive experience in online settings. As online positives were mentioned that it is easier to reach and involve more students online, that anonymity can enable student participation, and that there are potentially fewer negative group effects. The main negative mentions were technical difficulties, challenging time management and process moderation or control and that the lack of eye contact and interaction is affecting the motivation and outcome of the teaching for both students and teachers. Also, no one-to-one translation of creativity techniques from classroom to online is possible.

The interviewees expressed interest to learn more about the following topics:

- Creativity methods and techniques that work well online (best practices), and how to blend online and offline environments
- Facilitation skills that relate to the planning and application of the creativity methods and techniques in online classes (session design and time planning, process control)

- Personal soft skills that allow for building trust, enabling engagement and interaction, avoiding negative group effects
- Technologies – programs and applications that can be used when teaching creatively online

Curriculum Prototype

Taking all the findings of the Experience Interviews together, we designed a first prototypical curriculum and according contents with respect to the principles of Universal Design for Learning (Burgstahler, 2021). This early version was shaped by several factors, such as learner’s characteristics and needs, learning goals, activities that could support learning, effective assessment strategies, and the larger goal of creating an active learning environment that has the potential to respond to the complex needs of current higher education engineering programs, teachers and students. The initial structure followed the topics, which the educators expressed in the Experience Interviews.

- Unit 1 “Introduction to creativity teaching” covered the topics “creative thinking and teaching with creativity techniques”, “importance of creativity in engineering education” and “specific challenges of using creativity in online HE Engineering teaching settings”.
- Unit 2 “Improving skills for online education in creativity” was on “creativity methods and tools for teaching in online and hybrid settings”, “use of different tools blending online and offline teaching environments”.
- Unit 3 “Facilitation skills for online education in creativity” includes “teaching session design”, “time planning”, “facilitating individual and group”, “assessment and evaluation” and “best practices and examples”.
- Unit 4 “Soft skills for engineering teachers” covered “engaging students in online and facilitating interaction”, “avoiding negative group effects and building trust among groups”, “developing empathy in online teaching” and “dealing with the challenge of extra preparation time”.
- Assessment of participants: The assessment methodology was based on short quizzes at the end of each unit for registered users to earn an overall certificate.

Focus Groups

The aim of the Focus Groups was to understand to what extent the above curriculum prototype fits into the problem space derived from the experiential interviews and how the curriculum could be further developed based on the data gathered from the focus group interviews and the subsequent analysis and reporting processes.

In the focus group sessions, the curriculum prototype was used as stimulus material and 60 engineering teachers (15 from each of the four countries) were asked to review the curriculum in terms of scope, content, methodology and pedagogy. 28 of them were female and 32 male. Each focus group session lasted between 1-1.5 hours. Overall teaching experience ranged from one to 25 years with an average of 9.3 years. 27 of them stated low, 15 medium and 18 high knowledge of using creativity techniques in the classroom.

The engineering teachers provided constructive ideas about the curriculum, such as what an ideal toolkit for teaching creativity should contain, whether and how current creativity methods could be translated from offline to online, and how detailed the toolkit should be. They also described the specifics of ideal conditions that help one feel in control when conducting creative processes in class, how the time management aspect of a creativity session should be designed, what soft skills engineering teachers need in an online teaching environment, how to effectively motivate engineering students, and how to build trust in an online creativity session.

The engineering teachers also helped to gather further design refinements. According to them, the curriculum should be designed to integrate creativity teaching into online engineering education by putting more emphasis on the engineering design and implementation cycle aspects. For the respondents, the key to innovation is creativity itself, and creative learning exercises would help students improve this skill. As an essential component of a student-centred online creative session, the curriculum should provide efficient feedback in real time. In addition, the curriculum should provide enough room for pedagogical flexibility. More specifically, the curriculum and the final version of the online learning environment should be dynamic enough to allow users to make necessary changes depending on student needs and learning outcomes. The emerging learning environment should also benefit from the active knowledge sharing of all users, which would make it active and vibrant and enable its users to build a supportive community. Participants emphasised that the effective use of creativity skills online requires a significant amount of pedagogical knowledge. In this context, engineering teachers believe that they should be supported with relevant pedagogical information so that they can make productive decisions about their online creativity sessions. Encouraging interactive and group learning, peer learning and ensuring anonymity for students are among the specific skills that engineering teachers feel have room for improvement.

What: Final Curriculum

The insights and collected ideas from the focus group helped us to tailor the curriculum and its content more precisely to the needs of the HE engineering teachers. The final version of the curriculum was reduced to three lessons: 1) Why - Introduction to creativity teaching and its relevance for engineering; 2) What – Method and tool skills for online teaching and 3) How - Skill development for how to teach. Table 1 shows the details for the covered topics.

Table 1

Final curriculum

Unit	Topics covered
Unit 1 – Why Introduction to creativity teaching	Understanding creativity concept of creativity and creative thinking relevant forms of creativity importance of creativity for engineering stages and phases of the creative process, and their relation to the engineering process Understanding teaching creativity online the benefits of teaching creativity online (for both students and teachers) challenges in teaching creativity online Understanding creativity own level of expertise (assessment) knowledge own skills and experience Understanding this course/ program the curriculum (progression, structure, frame and focus) key terms used in the curriculum (e.g., tool/ method) preparation (what to do before starting the course)
Unit 2 – What Method and tool skills for online education in creativity	Overarching topics Effective technology integration and usage of different tools for given and tasks Managing the online classroom Presentation of creativity methods for teaching online for engineering / HE teachers in this learning environment Blending online and offline environments for using creativity methods
Unit 3 – How Skills development	Preparation of teaching creativity online Lesson design and framing Preparing technology usage Preparing students Preparing content Group- and teamwork when teaching creativity online Setting up teams Supporting, facilitating, and monitoring effective group- and teamwork Engagement of students Avoiding negative group effects

Facilitation of online creativity teaching
Facilitating in different lifecycle phases
Keeping time
Providing and receiving feedback
Engaging and motivating students
Ensuring and assessing skill attainment
Tips and tricks for effective teaching
Best practice and trick stories
Case examples
Trust building

Unit 1 has become more focused on basics such as creativity concepts, definitions and showcases of its benefits in the real world. Also, an assessment of the teachers own level of expertise has been included. Unit 2 emphasizes now on technology integration and managing the online classroom as well as blending online and offline. The initial ideas of a method collection now became an extra section of an interactive toolbox which helps to address design problems with specific methods. Unit 3 encompasses now all topics regarding skill development of engineering teachers with a focus on engaging group- and teamwork and a specific tips-and-tricks section from and for teaching experts. Also, the refined assessment methodology now has two levels: Level 1 is a self-directed assessment of own expertise level, which can be taken after each unit for individual development. Level 2 are digital badges which will be given by the system automatically once the teachers finish a task from the self-learning template.

Conclusion And Outlook

In light of the relevance of creativity in engineering curricula and post-pandemic online and hybrid teaching in HE institutions, we have presented a novel curriculum including its elements and associated design process for teaching creativity online to HE engineering teachers to help overcome existing barriers and challenges and to upskill the teachers on digital teaching. The resulting three units educate HE engineering teacher in why creativity is relevant, what to teach in terms of methods and tools and how to design and implement engaging creativity lessons. Moreover, the curriculum contains an assessment methodology for individual development and for gaining a badge, which can be used for having a further career. Following a User-Centred Design process by first investigating existing barriers and actual best-practises with Experience Interviews, prototyping a curriculum and evaluating that prototype in focus groups, we were able to gain deep insights on the challenges and needs of engineering teachers and to shape and refine the curriculum accordingly. The Focus Groups in particular

brought a wealth of relevant ideas for the enhancement, orientation and positioning of the curriculum.

Although the focus of the curriculum design was specifically on the HE engineering education on creativity, some parts of the curriculum such as topics on trust building, group work, motivation and engaging student may be generalised to other subjects of HE education or even to general online teaching. Which parts and how they can be translated to other teaching areas and audiences is the subject of future research.

References

- Anderson, R. C., Katz-Buonincontro, J., Bousselot, T., Mattson, D., Beard, N., Land, J., & Livie, M. (2022). *How am I a creative teacher? Beliefs, values, and affect for integrating creativity in the classroom* (Vol. 110).
- Bashir, A., Bashir, S., Rana, K., Lambert, P., & Vernallis, A. (2021). Post-COVID-19 Adaptations; the Shifts Towards Online Learning, Hybrid Course Delivery and the Implications for Biosciences Courses in the Higher Education Setting. *Frontiers in Education*, pp. 1-13.
- Brown, M. (2018). *4 Cornerstone Skills Engineers Need for the Future of Work*. Retrieved 01 2022, from <https://www.engineering.com/JobArticles/ArticleID/16807/4-Cornerstone-Skills-Engineers-Need-for-the-Future-of-Work.aspx>
- Burgstahler, S. (2021). *Universal Design in Education: Principles and Applications, Disabilities, Opportunities, Internetworking, and Technology*. Retrieved from <https://www.washington.edu/doit/universal-design-education-principles-and-applications>
- Courage, K., & Baxter, K. (2005). Affinity Diagrams. In *Understanding Your Users / A Practical Guide to User Requirements Methods, Tools, and Techniques* (pp. 714–721). ISBN 978-1-55860-935-8: Elsevier Inc.
- Cropley, D. H. (2015). Promoting creativity and innovation in engineering education. *Psychology of Aesthetics, Creativity, and the Arts*, 9(2), pp. 161-171.
- European Commission. (2020). *Digital Education Action Plan*. Retrieved 01 2022, from <https://education.ec.europa.eu/document/digital-education-action-plan>
- Eurostat. (2020, September). *Eurostat tertiary education statistics*. Retrieved 01 2022, from https://ec.europa.eu/eurostat/statistics-explained/index.php?title=Tertiary_education_statistics#Fields_of_education
- Fern, E. (2001). *Advanced Focus Group Research*. Thousand Oaks, California: Sage.
- Flick, U. (2014). *Introduction to Qualitative Research (5th ed.)*. London: Sage.
- Frey, C. B., & Osborne, M. A. (2017). The future of employment: How susceptible are jobs to computerisation? *Technological Forecasting and Social Change*, 114, pp. 254-280.

- Gandhi, P., Khanna, S., & Ramaswamy, S. (2016, April). *Which Industries Are the Most Digital (and Why)?* Retrieved 20 01, from Harvard Business Review: <https://hbr.org/2016/04/a-chart-that-shows-which-industries-are-the-most-digital-and-why>
- Giridharan, B. (2020). Engaging with Student Perceptions and Faculties Online in the Era of the Corona Virus Pandemic: A Higher Education Perspective. *Journal of Humanities and Social Sciences Research*, 2, pp. 103-110.
- Grudens-Schuck, N., Allen, B. L., & Larson, K. (2004). *Methodology brief: Focus group fundamentals*. 12 IOWA State University: Extension Community and Economic Development Publications.
- Guest, G., MacQueen, K., & Namey, E. (2012). *Applied thematic analysis*. Thousand Oaks, California: SAGE Publications.
- Haase, S. (2014). Engineering students' sustainability approaches. *European Journal of Engineering Education*, 39(3), pp. 247-271.
- ISO 9421-210. (2019). *ISO 9421-210:2019*. Retrieved from Ergonomics of human-system interaction - Part 210: Human-centred design for interactive systems: <https://www.iso.org/standard/77520.html>
- Kaiser, A., & Fordinal, B. (2010). Creating a base for generating self-transcending knowledge. *Journal of Knowledge Management*, 14(6), pp. 928-942.
- Kim, Y. J., Kim, K., & Lee, S. (2017). The rise of technological unemployment and its landscape on the future macroeconomic landscape. *Futures*, 87, pp. 1-9.
- Kolmos, A., Hadgraft, R. G., & Holgaard, J. E. (2016). Response strategies for curriculum change in engineering. *International Journal of Technology and Design Education*, 26, pp. 391-411.
- Li, C., & Lalani, F. (2020). *The COVID-19 pandemic has changed education forever. This is how*. Retrieved 01 2022, from <https://www.weforum.org/agenda/2020/04/coronavirus-education-global-covid19-online-digital-learning/>
- Mbati, I., & Minnaar, A. (2015). Guidelines Towards the Facilitation of Interactive Online Learning Programmes in Higher Education. *The International Review of Research in Open and Distributed Learning*, 16(2), pp. 272-287.
- Nonaka, I., & Toyama, R. (2007). Strategic management as distributed practical wisdom (phronesis). *Industrial and Corporate Change*, 16(3), pp. 371-394.
- Sarsar, F., Kale, Ö. A., Andiç-Çakır, Ö., Gueorguiev, T., Evstatiev, B., Georgieva, T., & van Leeuwen, M. (2021). Multicultural investigation of the students' acceptance of using digital learning materials in laboratory classes. *Computer Applications in Engineering Education*, 29(4), pp. 883-896.
- Semmler, L., Uchinokura, S., & Pietzner, V. (2018). Comparison of German and Japanese student teachers' views on creativity in chemistry class. *Asia-Pacific Science Education*, 4(9), pp. 1-29.
- Sheppard, S. D., Pellegrino, J. W., & Olds, B. M. (2008). On becoming a 21st century engineer. *Journal of Engineering Education*, 97(3), p. 231.

Zancajo, A., Verger, A., & Bolea, P. (2022). Digitalization and beyond: the effects of Covid-19 on post-pandemic educational policy and delivery in Europe. *Policy and Society*, pp. 1-18.

Zeiner, K., Laib, M., Schippert, K., & Burmester, M. (2016). Das Erlebnisinterview – Methode zum Verständnis positiver Erlebnisse. *Mensch und Computer 2016 - Usability Professionals*.

Coordination and Cooperation Practices of Creative Teams in Virtual Field-Level Events for Urban Revitalization

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Abstract

Organized field-level-events, such as temporary New Work formats (e.g. hackathons, urban labs) can be important mechanisms that play a central role in the transformation of a field as they may configure it. Here, cooperation work of an interdisciplinary and creative teams is crucial and requires adjusted coordination practices. Through research conducted as part of the dissertation initial results show important creative team coordination forms of mutual monitoring, back-up behavior, communication, leadership as well as of cooperation work during an organized virtual field-level for urban revitalization. Based on a qualitative case study, field investigations rely on multiple data sources such as video-observations, group discussions and expert interviews. They were conducted within the EU-Interreg-Project “CINEMA” which focuses on urban revitalization.

Within the framework of the investigations the organized field-level event represents a virtual hackathon, where creative teams worked on a solution to a pre-defined problem using digital collaborative tools (e.g. Zoom, Miro). The occurrence of the pandemic represents the unexpected field-level event throughout the length of the project. Generated results of the doctoral thesis are aimed to be scientifically and practically exploited in various areas due to the transdisciplinary nature of the project.

Keywords: coordination, cooperation work, creative teams, virtual field-level event, urban revitalization

Current State of Research

Virtual Hackathon as organized field-level-event for urban revitalization

Innovation has gradually moved from the work of lone geniuses to collaboration of large, multidisciplinary teams, making the efficiency of teams an increasingly important field

of study. This trend has led to a growing interest in studying different factors that have an impact on team efficiency (Gersick, 1989; Hirokawa, 1985). Within this field, researchers are primarily focussing on laboratory experiments (Lim & Klein, 2006; Williams Woolley et al., 2010) which may not fully capture the complex situations that teams encounter in real life. The alternative method, field studies (O'Reilly et al., 1998), is difficult to maintain and often takes a long time to produce results.

Within the framework of the dissertation a new methodological approach has been applied to bridge the gap between the laboratory and the field setting. By combining digital collaborative tools (Zoom, Miro) with an innovative setting, a virtual hackathon, a new environment for studying team performance has been created.

As an innovative format of New Work practices, hackathons have the potential to bridge the divergence between laboratory and practice by combining short work periods with the characteristics of real work environments of creative teams. Hackathons are dynamic events usually organised by companies, universities and online communities. They invite participants with different demographic characteristics and professional backgrounds to work together to develop concrete solutions to pre-defined problems in a timeframe of usually 24-48 hours. They tend to be public, but some remain private and allow only selected participants to join the event.

As organized field event they can sometimes serve as a measure to promote urban revitalization (Richards & Palmers, 2010). Organized and non-organized events may play a decisive role in the transformation and development (Lampel & Meyer, 2008) as well as configuration (Glynn, 2008; Lange et al., 2014) of a field. This impact can be perceived to be constructive by being capable of triggering innovation (Bower & Christensen, 1995), learning (Lampel et al., 2009) and institutional change (Hoffman, 1999).

Urban Revitalization projects with Creative Industries

On part of the dissertation, research was conducted during an organized field-level event with creative teams, a virtual hackathon, whose implementation served to generate ideas for a local urban revitalization project. In recent decades, academic interest in exploring the interaction and transformation of vacant, underused or underdeveloped spaces in urban environments has increased through projects in collaboration with the Creative Industries (CI) (Florida, 2002).

The exchange with representatives from the CI such freelancers, entrepreneurs or startups is increasingly sought by economy, society and politics (Lange et al., 2016; Pepler et al., 2018), because they are globally seen as an important and decisive economic factor, both in

urban (Domenech et al., 2014; Engstler et al., 2015) and rural (Engstler & Pepler, 2019; Heinzl & Engstler, 2021) regions.

As chosen field of investigation, the virtual hackathon had three interdisciplinary teams with a high proportion of participants from the CI working intensively together. In order to better understand which factors are particularly important to enable creative teams establishing a solution for a concrete problem, various predefined factors were observed during the innovative work process. Burke's Model of " Adaptive Team Performance" in particular was fundamental for studying the coordination practices of teams, as were studies on creative group coordination by Georgiades (Georgiades, 2015; Heinzl et al. 2021;). Extended observations of the cooperation work practices were based on findings of studies by Engstler (Engstler et al., 2015; Engstler & Heinzl, 2019; Pepler et al., 2018).

Coordination and Cooperation Practices in Creative Groups

According to Burke et al. (2006), established coordination structures can be observed and manifested especially in the third phase of the team adaptation process, the plan execution. This phase represents the actual performance phase (Rosen et al., 2011), where team members actively engage in a number of activities for the successful execution of the plan formulated in the second phase.

During these coordination processes all team members are involved in the organization of sequencing and timing of their actions (Marks et al., 2001). Regarding the interdependence of teams, continuous coordination of their actions is necessary in each team environment. Moreover, in a dynamic environment, teams must not only coordinate but also be able to adapt. The success of adaptive plan execution is related to the extent that teams and their constituent members display the following processes: coordination as mutual performance monitoring, communication, backup behavior, leadership (Burke et al., 2006).

Table 1

Important theses on coordination according to Burke (Burke et al., 2006)

Mutual monitoring	- contributes to a team's ability to adaptively execute a plan in several ways (McIntyre & Salas, 1995) - facilitates an awareness of timing and pacing of team member action, which is needed for effective adaptive coordination (Kozlowski, 1998)
Communication	- provided feedback as verbal suggestions can assist in getting performance back on track (Dickinson & McIntyre, 1997), teams with a higher speech rate work more effective under time pressure (Gervits, 2016) - feedback influences creative projects over time (Harrison & Rouse, 2014) through its interactive nature

	- feedback providers can co-construct a problem space (Cannon-Bowers et al., 1995) that provides openings for changing solutions
Backup behavior	- critical to both, the social and task performance of teams (Dickinson & McIntyre, 1997; McIntyre & Salas, 1995) - helping other team members perform their role especially when it is apparent that they will fail to reach those goals (Porter, 2003) - applied through temporarily take over of a member's responsibilities until the problem is resolved (Cannon-Bowers et al., 1995)
Leadership	- they can play a key role in facilitating a team's propensity to adapt by choosing how and when to intervene to promote review and revision of procedures (Gersick & Hackman, 1990; Hackman & Wageman, 2005) - extreme action teams can achieve rapid coordination and reliable performance by more dynamic delegation of leadership (Lim & Klein, 2006) or shared leadership (Brown & Giolia, 2002; Klenke, 1997)

In order to create an adaptive coordinated action related to the respective task, team and situational characteristics, the way the team member processes are interacting is crucial (Burke et al., 2006). When focusing for example on coordination to promote innovative and creative ideas within teams the adaptation of creative group coordination processes is essential (Georgiades, 2015). The dynamic nature of coordination becomes even more evident in creative group coordination because creativity seems to require a sense of independence from rules, restrictions, and even close relationships (Perry-Smith & Shalley, 2003) as creative work seems to happen outside the ordinary system of thought and action (Becker, 1995).

Cooperation work in organizations

Collaboration describes the work of two or more people on a joint project that has been designed to achieve a common goal (Leimeister, 2014). To achieve this goal, communication, coordination and cooperation of all participants are necessary. Collaboration thus encompasses more than mere cooperation.

Professional cooperation work is based on stable cooperation characterized by trust, which is supported by appropriate information and communication technologies (Engstler et al., 2015). In principle, the same language area and bridgeable geographical distances between cooperation partners simplify and favor regular personal exchange.

Research Gap, Question and Objective

In the context of the dissertation, it is assumed that not only team coordination practices of creative teams have a proven effect on the success on adaptive plan execution (Burke et al.,

2006), but also the design of cooperation work as crucial influencing factor. Although existing research on coordination and cooperation work in field-level events (Lange et al., 2014; Müller-Seitz & Schüßler, 2013; Glynn, 2008; Lampel & Meyer, 2008) is very extensive, there is still little knowledge on how modern organizations can best organize their coordination and cooperation practices in organized, dynamic field-level events, especially on a virtual level.

The described research gap gives rise to the following leading **research question**:
How do creative teams coordinate and cooperate during an organized field-level event for urban revitalization in current times of crisis?

The related **research objective** is the identification of important creative group coordination and cooperation work practices during the virtual hackathon (organized) in current times of crisis (unexpected). Furthermore, the aim is to test the third phase of Burke's model of "Adaptive Team Performance" (Burke et al., 2006) in the context of an innovative format and to extend this model/ phase paying attention to the influencing factor of "cooperation work".

2. Research Design

Qualitative Case Study Research

In order to reach the described research objective a qualitative case study research design (Eisenhardt, 1989) has been applied. For a structured analysis of collected data, categories of analysis were determined in advance in order to then search for within-group similarities in connection with intergroup differences during the evaluation. The field investigations of the dissertation rely on the following multiple data sources (Yin, 2003; Patton, 1990): (a) participatory and covered video-observations (creative team situation), (b) open group discussion (participants), (c) partly-guided/ partly-narrative expert interviews (stakeholders), (d) informal/ formal shorter meetings, (e) archive documents (weekly schedules, meetings minutes, team/ management concepts, Miro-Boards, OneDrive documents, emails). The qualitative research process was divided in four successive phases that build on each other. For data evaluation, the qualitative content analysis (Mayring, 2015) was applied.

PhD Case

All investigations have been conducted during the "Virtual Hackathon Herrenberg" a measure to create innovative solutions for urban revitalization within the regional pilot project of the EU- Project "CINEMA" (Interreg, 2021). The virtual hackathon was a series of events that took place in February 2021 mainly via Zoom consisting of a pre-coaching, two defined hack'days and the award ceremony with group pitches. All together one moderator, one

technical assistant, three coaches and three creative teams with summarized 17 interdisciplinary participants took the chance to work collaboratively on a creative floor space concept for empty spaces. The participants were local creatives and inhabitants of Herrenberg as well as students and startups from Stuttgart Media University. It was a privately organized hackathon.

3. Preliminary Results

The preliminary results refer to data from two sources for first evaluations:

- (a) Participatory & covered video-observations (team A, B, C) on two hack'days [928 min]
- (b) Group discussion (team A+B+C, three coaches, moderator) on the first hack'day [40 min]

Also, a coding guide (Mayring, 2015) was prepared according to the guidelines for qualitative content analysis. The analysis was carried out with MaxQDA software. With the help of the coding guide and established deductive codes (communication, backup behaviour, mutual monitoring, leadership, cooperation work), it was possible to evaluate all text passages. For the category "cooperation work", codes were also identified inductively and were applied in the further evaluation (see Table 2).

Table 2 Overview of all collected text passages for the categories based on Burke's Model (Burke et al., 2006)

Categories	MaxQDA Codes	TEAM A	TEAM A	TEAM B	TEAM B	TEAM C	TEAM C
	deductive codes	DAY 1	DAY 2	DAY 1	DAY 2	DAY 1	DAY 2
Mutual Performance Monitoring	observe/ coordinate team members work	6	16	10	6	9	5
	contributes to plan execution	7	13	9	12	5	11
	supports team situation awareness	6	10	7	10	5	10
	<i>subtotal</i>	19	39	26	28	19	26
Backup Behaviour	response to workload distribution problem	1	6	5	7	3	6
	supports adaptive coordination processes	2	5	0	1	0	0
	supports plan execution	4	6	1	4	2	4
	<i>subtotal</i>	7	17	6	12	5	10
Communication	supports mediation of shared knowledge	13	7	6	4	5	5
	supports effective monitoring behaviour	6	10	7	12	5	10
	<i>subtotal</i>	19	17	13	16	10	15
Leadership	supports team's propensity to adapt	4	6	6	5	5	5
	guiding/ coaching team members	10	14	5	6	7	9
	shared leadership to adapt to changes	5	4	4	4	5	6
	<i>subtotal</i>	19	24	15	15	17	20
	SUM (4 categories)	64	97	60	71	51	71
	inductive codes	DAY 1	DAY 2	DAY 1	DAY 2	DAY 1	DAY 2
Cooperation Work	cooperation through communication	8	6	6	8	7	9
	supports reaching a common goal	5	4	9	5	5	5
	(in)direct cooperation	1	4	1	2	0	3
	(im)aterial artefacts are created	2	20	4	11	5	10
	<i>subtotal</i>	16	34	20	26	17	27
	SUM (total)	80	131	80	97	68	98

Discussion of results

The observations during the virtual hackathon confirm the rich setting for studying coordination and cooperation work practices in creative teams, with opportunities to measure the effect on team efficacy. During the hackathon, the three teams temporarily broke into smaller working units and each unit focused on a different aspect of the problem. Continuous coordination and cooperation practices were essential to reducing uncertainties about others' work progress, establishing shared understanding of the tasks, eliminating redundant work, and ensuring that all of the pieces for the development of the solution fit together at the end.

Through the observation of creative team coordination practices according to the four pre-defined codes based on Burke's model (Burke et al., 2006) the following theses could so far also be confirmed or not confirmed in the setting of the virtual hackathon.

Table 4

Important (not) confirmed theses on coordination according to Burke (Burke et al., 2006)

Mutual monitoring	<ul style="list-style-type: none"> - contributes to a team's ability to adaptively execute a plan in several ways (McIntyre & Salas, 1995) CONFIRMED - facilitates an awareness of timing and pacing of team member action, which is needed for effective adaptive coordination (Kozlowski, 1998) CONFIRMED
Communication	<ul style="list-style-type: none"> - provided feedback as verbal suggestions can assist in getting performance back on track (Dickinson & McIntyre, 1997), teams with a higher speech rate work more effectively under time pressure (Gervits, 2016) CONFIRMED - feedback influences creative projects over time (Harrison & Rouse, 2014) through its interactive nature CONFIRMED - feedback providers can co-construct a problem space (Cannon-Bowers et al., 1995) that provides openings for changing solutions CONFIRMED
Backup behavior	<ul style="list-style-type: none"> - critical to both, the social and task performance of teams (Dickinson & McIntyre, 1997; McIntyre & Salas, 1995) NOT CONFIRMED (due to limited in-depth observation in virtual setting) - helping other team members perform their role especially when it is apparent that they will fail to reach those goals (Porter, 2003) NOT CONFIRMED - applied through temporarily take over of a member's responsibilities until the problem is resolved (Cannon-Bowers et al., 1995) NOT CONFIRMED
Leadership	<ul style="list-style-type: none"> - they can play a key role in facilitating a team's propensity to adapt by choosing how and when to intervene to promote review and revision of procedures (Gersick & Hackman, 1990; Hackman & Wageman, 2005) CONFIRMED - extreme action teams can achieve rapid coordination and reliable performance by more dynamic delegation of leadership (Lim & Klein, 2006) or shared leadership (Brown & Giolia, 2002; Klenke, 1997) CONFIRMED

First **hypotheses** (Iteration 1: literature & data) focussing on interdependences of cooperation and coordination practices according to Burke's Model (Burke et al., 2006) that could so far be developed through observations during the virtual hackathon:

- (1) Cooperation & communication: The alignment of interests of team members is reached through cooperation work and communication in virtual field-level events.
- (2) Cooperation & leadership: In dynamic and time-limited virtual field-level events, shared leadership is expressed through cooperative leadership.
- (3) Cooperation & mutual monitoring: Virtual field-level events require more mutual monitoring activities for the successful cooperation especially in dynamic work settings.
- (4) Cooperation & backup behaviour: Through the use of virtual tools, the backup behaviour of individual team members can be demonstrated as a success factor for successful cooperation.

Conclusion & Outlook

In this thesis, we evaluated the application of a qualitative methodology that combines digital tools and the Hackathon setting to create a new environment for studying creative team performance. This combination reduces the time and burden involved in such studies and offers new opportunities for examining coordination and cooperation practices of creative teams. Observations from our Hackathon studies found them to be potential settings for learning how creative team members interact with each other in order to achieve a shared goal. Relying on Burke's Model (Burke et al., 2006) different influencing factors of coordination supported the analysis of team behavior and showed how it changes and evolves throughout the event.

The following sections list some first suggestions for future research in the field based on time constraints and the limited scope of this study:

- The adjusted version of Burke's model (Burke et al., 2006), also including some cooperation work interrelations, could be tested in face-to-face meeting to test the validity of the model also in settings of real encounters and cooperation.
- Hackathons themselves can be studied as a new setting for innovative creative team work. This New Work format is believed to have increased potential for generating creative solutions through appropriate coordination and cooperation practices.

References

- Becker, M. (1995). Nineteenth-century foundations of creativity research. *Creativity Research Journal*, 8(3), 219-229.
- Bower, J. L., & Christensen, C. M. (1995). Disruptive technologies: Catching the wave. *Harvard Business Review*, 73(1), 43-53.
- Brown, M. E., & Giolia, D. A. (2002). Making things click: Distributive leadership in an online division of an offline organization. *Leadership Quarterly*, 13(4), 397–419.
- Burke, C. S., Stagl, K. C., Salas E., Pierce L., & Kendall D (2006). Understanding team adaptation: a conceptual analysis and model. *Journal of Applied Psychology*, 91(6), 1189-207.
- Cannon-Bowers, J. A., Tannenbaum, S. I., Salas, E., & Volpe, C. E. (1995). Defining team competencies and establishing team training requirements. In: Guzzo, R., & Salas, E. (Eds.). *Team effectiveness and decision-making in organizations*, 333–380, Jossey-Bass.
- Dickinson, T. L., & McIntyre, R. M. (1997). A conceptual framework for team measurement. In: Brannick, M. T. E., Salas, E., & Prince, C. (Eds.), *Team performance and measurement: Theory, methods, and applications*, 19-43, Mahwah, NJ: Erlbaum.
- Domenech, R.B., Capone, F., De Propriis, L., Lazzaretto, L., & Sanchez-Serra, D. (2014). Comparing creative industries in Europe. *European Urban and Regional Studies*, 23(4), 1-6.
- Eisenhardt, K. (1989). Building theories from case study research. *Academy of Management Review*, 14(4), 532-550.
- Engstler, M., & Heinzl, V. (2019). Coworking als progressives Arbeitsmodell. Transfer der Erfahrungen in der Kreativwirtschaft. [Coworking as a progressive working model. Transfer of experience in the creative economy]. In: Linssen, O., Mikusz, M., Volland, A., Yigitbas, E., Engstler, M., Fazal-Baqae, M., & Kuhrmann, M. (Eds.): *Projektmanagement und Vorgehensmodelle 2019. Neue Vorgehensmodelle in Projekten – Führung, Kulturen und Infrastrukturen im Wandel*, Lecture Notes in Informatics (LNI) - Proceedings, V.298, Bonn: Gesellschaft für Informatik und Köllen 2019, 185-198.
- Engstler, M., & Pepler, V. (2019). Study: Applying the coworking model in rural Germany, *The New Worker Magazine*, <http://newworker.co/mag/study-applying-the-coworking-model-in-rural-germany>
- Engstler, M., Mörgenthaler, L., & Nohr, H. (2015). *Trendbarometer Kreativwirtschaft Baden-Württemberg 2015 – Reale und virtuelle Orte der Kooperation von Kreativschaffenden in Baden-Württemberg*, Grin.
- Florida, R. (2002). *The Rise of the Creative Class. And How It's Transforming Work, Leisure and Everyday Life*. Basic Books.
- Georgiades, S. (2015). *Employee Engagement in Media Management – Creativeness and Organizational Development*, Springer International Publishing.

- Gersick, C. J. G. (1989). Marking time: Predictable transitions in task groups. *Academy of Management Journal*, 32(2), 274-309.
- Gersick, C. J. G., & Hackman, J. R. (1990). Habitual routines in task performing groups. *Organizational Behavior and Human Decision Processes*, 47(1), 65–97.
- Gervits, F., Eberhard, K., & Scheutz, M. (2016) Team Communication as a Collaborative Process. *Front. Robot. AI*, 3, 62.
- Glynn, M. A. (2008). Configuring the Field of Play: How Hosting the Olympic Games Impacts Civic Community. *Journal of Management Studies*, 45(6), 1117-1146.
- Hackman, J. R., & Wageman, R. (2005). A theory of team coaching. *Academy of Management Review*, 30 (2), 269-287.
- Harrison, S. H., & Rouse, E. D. (2014). Let’s dance! Elastic coordination in creative group work: A qualitative study of modern dancers. *Academy of Management Journal*, 57(5), 1256-1283.
- Heinzel, V., & Engstler, M. (2021). Next generation Coworking: Corporate, Pop-up, Rural, Virtual & Hybrid Coworking. Potenziale und Herausforderungen der Umsetzung des progressiven Arbeitsmodells Coworking. In: Werther, S (Eds.). *Coworking als Revolution der Arbeitswelt? Potenziale und Herausforderungen Richtung New Work*. Springer.
- Heinzel, V., & Engstler, M.; Georgiades, S. (2021). Corporate Coworking – A Catalyst for Collaboration, Creativity, and Innovation. In: Orel, M., Dvouletý, O., Ratten, V. (Eds.). *The flexible workspace: Coworking and other modern workspace transformations*. Springer Nature.
- Hirokawa, R. Y. (1985). Discussion procedures and decision-making performance. *Human Communication Research*, 12(2), 203–224.
- Hoffman, A.J. (1999). Institutional evolution and change: Environmentalism and the U.S. chemical industry. *Academy of Management Journal* 42(4), 351-371.
- Interreg (2021). CINEMA – Creative Industries for New Urban Economies, www.interreg-danube.eu/approved-projects/cinema
- Klenke, K. (1997). Leadership dispersion as a function of performance in information systems teams. *Journal of High Technology Management Research*, 8(1), 149-169.
- Kozlowski, S. W. J. (1998). Training and developing adaptive teams: Theory, principles, and research. In: Cannon-Bowers, J. A., & Salas, E. (Eds.), *Making decisions under stress: Implications for individual and team training*, 15-153, American Psychological Association.
- Lampel, J., & Meyer, A. D. (2008). Field-configuring events as structuring mechanisms: How conferences, ceremonies, and trade shows constitute new technologies, industries, and markets. *Journal of Management Studies*, 45(6), 1025-1035.
- Lampel, J., Shamsie, J., & Shapira, Z. (2009). Experiencing the improbable: Rare events and organizational learning. *Organization Science*, 20(5), 835-845.
- Lange, B., Power, D., & Suwala, L. (2014). Geographies of field-configuring events. *Zeitschrift für Wirtschaftsgeographie*, 58(4), 187-201.

- Lange, B., Knetsch, F., & Riesenberger, D. (2016). *Kollaboration zwischen Kreativwirtschaft und Mittelstand – Erfolgsfaktoren, Methoden und Instrumente*. Springer.
- Leimeister, J. M. (2014). *Collaboration Engineering: It-Gestützte Zusammenarbeitsprozesse Systematisch Entwickeln Und Durchföhren [Collaboration Engineering: Systematically Developing and Implementing It-Supported Collaboration Processes]*, Springer.
- Lim, B.-C., & Klein, K. J. (2006). Team mental models and team performance: a field study of the effects of team mental model similarity and accuracy. *Journal of Organizational Behavior*, 27(4), 403.
- Marks, M. A., Mathieu, J. E., & Zaccaro, S. J. (2001). A temporally based framework and taxonomy of team processes. *Academy of Management Review*, 26, 356-376.
- Mayring, P. (2015): *Qualitative Inhaltsanalyse*. Grundlagen und Techniken, (12th ed.). Beltz, Weinheim/ Basel.
- McIntyre, R. M., & Salas, E. (1995). Measuring and managing for team performance: Emerging principles from complex environments. In: Guzzo, R., & Salas, E. (Eds.), *Team effectiveness and decision making in organizations*, Jossey-Bass, 9-45.
- Müller-Seitz, G., & Schüßler, E. (2013). From Event Management to Managing Events. A Process Perspective on Organized and Unexpected Field-Level Events. In: Koch, J., & Sydow, J. (Eds.), *Organisation von Temporalität und Temporärem*, Springer, 193-226.
- O'Reilly, C. A., Williams, K. Y., & Barsade, S. (1998). *Group demography and innovation: Does diversity help?* Stanford University.
- Patton, M. (1990). *Qualitative evaluation and research methods* (2nd ed.). Sage.
- Pepler, V., Engstler, M., & Stiefel, K.-P. (2018). *Kooperationsarbeit zwischen Akteuren der Kultur- und Kreativwirtschaft in Coworking Spaces und Kreativzentren*. [Cooperation work between actors of the cultural and creative industries in coworking spaces and creative centres], Stuttgart Media University.
- Perry-Smith, J. E., & Shalley, C. E. 2003. The social side of creativity: A static and dynamic social network perspective. *Academy of Management Review*, 28(1), 89-106.
- Porter, C., Hollenbeck, J. R., Ilgen, D. R., Ellis, P. J., West, B., & Moon, H. (2003). Backing up behaviors in teams: The role of personality and legitimacy of need. *Journal of Applied Psychology*, 88(3), 391-403.
- Richards, G., & Palmers, R. (2010). *Eventful Cities: Cultural Management and Urban Revitalisation*. Routledge.
- Rosen, M. A., Bedwell, W. L., Wildman, J. L., Fritzsche, B. A., Salas, E., & Burke, C. S. (2011). Managing adaptive performance in teams: Guiding principles and behavioral markers for measurement. *Human Ressource Management Review*, 21(2), 107-122.

Williams Woolley, A., Chabris, C. F., Pentland, A., Hashmi, N., & Malone, T. W. (2010). Evidence for a collective intelligence factor in the performance of human groups. *Science*, 330(6004), 686-688.

Yin, R. K. (2003). *Case study research: Design and methods* (3rd ed.). Thousand Oaks, CA: Sage.

New collaboration opportunities with the use of digital tools

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Abstract

With ongoing disruption through modern work concepts supported by platform infrastructures, new forms of collaborations are established, especially with the use of digital tools. Not only coworking spaces but also enterprises establish and integrate highly flexible multipurpose working environments, so people can not only work where they want, but also across corporate boundaries.

However existing collaboration tools are relatively new to the market, thus scientifically unexplored. This study explored whether digital tools could establish new collaboration opportunities, support existing workflows and exploring measures to increase cooperation. For this purpose, the method of experience interviews was realized with six members of different coworking spaces. The results indicate the active use of digital tools to increase the efficiency of collaboration such as Microsoft Teams, Google's G-Suite, Slack or LinkedIn. In addition to telephony and email, instant messengers, channels and comment functions for shared data are important means of communication. As there is a high information load, users tend to need digital tools to organize their workflow in order the collaborate properly.

Nevertheless, face-to-face communication is still an essential part of collaboration. Especially when it comes to information and knowledge exchange, the participants of this study rely on spontaneous encounters with their cooperation partners whenever possible. The paper concludes with recommendations for the use of digital tools and gives an outlook on performant possibilities, for example to create synergy effects between personal and virtual cooperation.

Keywords: collaboration, communication, coworking, community, digital, tools

Introduction

Cooperation is one of the essential values of coworking spaces (Werther, 2021), therefore another publication defines coworking spaces as “open-source, community-based bussinessmodell” (Schürmann, 2013). To cooperate properly, coworking spaces employ community-managers, organise events and dedicate huge parts as collaboration spaces. But

especially with the upcoming of the pandemic Information- and Communication Technology (ICT) became way more relevant for members, while they were forced to stay at home. ICT was built to organise, use and communicate information more efficient. Coworking spaces and their aim to support cooperation seem to constitute an insightful field of application for ICT.

For independent workers cooperation is an essential routine: With cooperation self-employed persons can not only handle highly complex projects, but also deliver better quality results. According to *Trendbarometer 2014* successful cooperation is mostly characterized by the following features: *complementary competencies* (87%), *gain of know-how* (61%) and *addition of personnel capacity* (37%) (Engstler et al., 2014). In contrast previous research by Spinuzzi (2012) suggests that not every co-worker defines coworking as an environment to collaborate. The researcher divides the configuration of coworking spaces into two groups: *The Good-Neighbours* (foreground professionalism to support parallel work and to impress clients) and the *Good Partners* (backstage professionalism to solve common problems and to do collaborative work) (Spinuzzi, 2012).

In addition, research has provided evidence that there is always a mix between competition and cooperation in every space (Tsai, 2002; Cuérel et al., 2019). About 50 percent of social interactions between co-workers is informal social interaction, the other half consists of exchange of information, instrumental support and collaboration (Gerdenitsch et al., 2016).

Furthermore, it was reported in literature that *virtual coworking* has gained in importance due to the current pandemic and the following social isolation in the home office. Workers tend to perceive the workday as repetitive and lonely (Heinzel & Engstler, 2021). The authors present the key data of virtual coworking in a SWOT analysis:

Table 1

Virtual coworking SWOT analysis (Heinzel & Engstler, 2021)

Internal perspective	External perspective
Strengths	Opportunities
Flexibility (space/work organization)	Reduction of commuter flows
Hybrid ways of working	Digital competence
Compatibility of family and career	Internationalization
Weaknesses	Risks
Broadband connection	Social isolation
Lack of spatial proximity (project initiation)	Data protection, information security
Exclusion of non-digital creative industries	Maintaining the community spirit

One of the greatest strengths of virtual coworking is certainly its flexibility. It has even a direct and positive impact on the compatibility of family and career. In addition, virtual coworking promotes hybrid ways of working. In terms of opportunities, increased use can reduce commuter flows and the co-workers can improve their digital skills. Moreover, users can also benefit from the increasingly international networks regarding their own business. However, there are weaknesses like the reliance on a working internet connection, the lack of spatial proximity and the exclusion of several industries (e.g., creative craft). In line with further research virtual coworking is connected to various risks: Despite interesting and promising virtual community offerings, social isolation and maintaining a community are two of the main challenges, which are critically perceived. In addition, new regulations on data protection and information security are needed for risk-free collaboration (Heinzel & Engstler, 2021).

Definition of Cooperation

The term *Cooperation* stands for an activity of two or more persons, which ensures the achievement of a common goal under coordination and participation of the persons. Cooperation cannot occur without communication (agreements). The persons involved use appropriate technical aids as required to increase efficiency and effectiveness. The goal is the creation of a product (Piepenburg, 1991; Leimeister, 2014).

Different intensity levels can be assigned to cooperation. Starting with a simple exchange of information and experience, this is followed by agreements, joint work and even communities of goods or the establishment of a new cooperation management (Weerth, 2018). Furthermore, we can separate face-to-face cooperation from virtual cooperation. If information- and communication technology is used to cooperate, it is called collaboration (Höfferer & Sandriester, 2009).

In addition, we can separate collaboration tools in four different kinds: same time-same place, same time-different place, different time-same place and different time-different place tools. The first and third categories can be meeting utensils like beamers or physical Kanban boards. Whereas the second and fourth categories are for example video chat or e-mail. Same time-different place tools are also termed as *synchronous*, thus different time-different place tools are termed *asynchronous* (Lim, 2017).

Acceptance and use of Collaboration-Tools

According to *Trendbarometer 2015* one third sees virtual collaboration as important supplement to personal meetings and two thirds already use information- & communication

tools for ongoing cooperation (Engstler et al., 2015). *Document management & archiving* (49%), *project management functions* (49%), *calendar functions* (43%) and *social media functions* (39%) are the most relevant roles of information technology platforms (IT platforms) (ibid., 2015). Participants of the study named *too high effort (e.g., costs)* (57%), *lack of user acceptance* (46%) and *poor data protection* (43%) as the highest risks of IT platforms (ibid., 2015).

Finally, the study showed that *an equal level of information for all at all times* (66%), *ad-hoc response to changing information* (58%) and *time saving through central information storage* (53%) are the most relevant expectations (ibid., 2015). Nguyen-Duc et al. conducted a global-scale cross-sectional survey during spring and summer 2021 with 297 valid responses. The researchers found the following variety of digital tools being used:

Table 2

Use of Digital collaborative tools (Nguyen-Duc et al., 2022)

Digital tools	Examples	In percent
Video Conferencing	Teams, Zoom, Meet	87.27
Instant Messaging	Slack, Viber, WhatsApp	79.8
Cloud Storage	Private, One drive, Google drive, Dropbox	57.95
Calendar Sharing	Outlook, Google Calendar	55.12
Project Management Board	Team, Trello, Jira	48.4
File Sharing and Version Control	GitHub, Bitbucket	45.22
Collaborative tools for socializing	Facebook	24.02
Collaborative tools for specialized tasks	Adobe Illustrator for UX design, Overleaf for text editing	18.02
Not applicable		1.76

Research gap

A closer look at the literature on cooperation, especially in coworking spaces and digital tools, however, reveals several gaps and shortcomings. Most studies rely on the importance of non-technical cooperation, especially in-person interaction (Engstler et al., 2015; Espinosa et al.; 2002; Muthucumaru, 2021). Therefore, more work is necessary to address digital tools and their impact on collaboration, particularly during the pandemic (DeFilippis et al., 2020, Yang et al., 2022; Zuzul et al., 2021).

Our research goal is to examine the use of digital tools to collaborate and communicate. We want to identify which software functions of established tools are used to collaborate and which advantages are achieved with them. Therefore, we defined the following leading research question: *What features of digital tools support collaboration within a coworking space?*

Research design

This study used the qualitative method of experience interviews by Zeiner et al. (2016), a variation of the critical incident method by Flanagan (1954). Data collection was performed with an interview guideline separated in demographic data, cooperation experiences, technology in a cooperative context, finally needs and outlook.

There were six participants in this sample. All experiences were grouped into 21 categories, whereof 17 are part of the method and 4 were created specifically in the process of analysis. Do people still stick to e-mail, or did they already switch to extensive collaboration tools like Microsoft Teams?

Results

Out of 74 experiences about the half (33 of 74 experiences) are directly cooperation related. About one quarter (20 of 74 experiences) is communication related and about sixteen percent (12 of 74 experiences) of the experiences were about needs and faulty cooperation. Mutual exchange, creating something together and to get in touch with people are the most mentioned experience categories.

The participants used a mix of 23 different tools for communication and collaboration, whereof eleven tools were only used by one or two participants. Most co-workers use Microsoft Teams, Adobe Reader, Confluence, Jira and Microsoft Office. But only three tools were used by all participants (e-mail, LinkedIn and telephony).

Saving time is the most often named reason to use digital tools for collaboration. The use of different time-different location tools like the commenting feature of Microsoft Teams, Googles G-suits and its cloud-based document editors are just two examples on how to save time while collaborating. One participant mentions a coworking space intern social network they only used for announcements by their operator. The co-worker sees the reason for not using the service to get to know new people as a lack of content and support by his coworking spaces. In the early stage of the pandemic (2020), when the experiences where collected, the vast majority still relied on personal encounters like after work events or personal social settings like work breaks to meet new people or staying in touch with others.

Table 3

Use of digital tools across coworkers

Digital tools	CW1	CW2	CW3	CW4	CW5	CW6
Zoom	X					
Microsoft Teams	X		X		X	
WebX	X					
BigBlueButton	X					
Slack	X	X				
Canvas by Instructure	X					
Adobe Reader	X	X		X		X
Creative Cloud		X		X		
G-Suite		X		X		
Confluence	X		X		X	X
GitHub		X				
Jira	X		X		X	
Asana						X
Microsoft Office		X		X	X	X
GoToMeeting			X		X	
Dropbox				X		
Apple AirPlay				X		
LinkedIn	X	X	X	X	X	X
WeWork Network			X			
Facebook				X		
Instagram				X		
E-Mail	X	X	X	X	X	X
Telephone	X	X	X	X	X	X

Though the results showed that co-workers use social networks like LinkedIn, the participants see the tool as a preliminary stage for personal meetings or even as a marketing tool for events. The software Slack and its open channels are helping to achieve more interaction and transparency throughout projects.

The overall intensity of cooperation is based mostly on the level of information and experience exchange. Only two co-workers cooperated more intense, like agreements, teamwork or even the establishment of long-term joint ventures.

Discussion - New technology follows new forms of collaboration?

Spinuzzi (2012) stated that independent workers suffered from isolation, whereas a coworking space could provide their co-workers a type of community they can trust in. This problem was one of the main reasons for Brad Neuberg, firmly known as one of the first ever initiators of coworking spaces in 2005.

Today, two years after we conducted this study, it can be assumed that people are used to ICT in a more intense way than ever before. Recent findings by Yang et al. (2022) are in line with previous assumptions. The researchers demonstrated that there was a decrease of synchronous communication and an increase of asynchronous communication. Contrary to the growing features and increased use of ICT, the study showed a more static and soiled collaboration network, less connections between disparate parts and therefore making it harder for employees to share new information across their network. The dataset consists of more than sixty thousand Microsoft employees, conducted from December 2019 until June 2020 (Yang et al., 2022).

In line with Zuzul et al. (2021), compared to 2019, organisations became more siloed in 2020, proven by rising modularity. The authors term these changes *dynamic silos* (Zuzul et al., 2021). Furthermore, research confirms that asynchronous communication seems to replace traditional forms. With dedicated messaging channels, members of collaborative teams can submit updates and needs at any time. However asynchronous communication can counteract the trust among the team and make co-workers feel isolated (Comella-Dorda et al., 2020).

Especially with the beginning of the pandemic the demand for collaboration tools like Hangouts Meet, Houseparty, Microsoft Teams or Zoom went higher than ever before (Sydow, 2020). According to a recent study, tools like virtual whiteboards can be helpful for collaboration, but this requires reviewing norms and rules of teamwork, for example groups need to grasp the collective view, when brainstorming virtually, call out the next presenter by name or making up time for personal informal interactions. (Comella-Dorda et al., 2020). Informal culture like talks in between people's desks or the office kitchen shall be substituted with for example intern messaging applications. Although the feature to archive chats can have the opposite effect to create trust and collaboration. The author suggests developing "real-time flexible spaces for chat, notes, and meetings." (Muthucumaru, 2021).

In order to put updated norms and rules on record, Nguyen et al. asked their participants which new coordination and control mechanisms were implemented as parts of their working environment. The most frequently mentioned (more than twenty percent) are: Changed and/or flexible times for working & meeting (55.1%), daily reports (26.5%), changing the frequency of communication via written documents e.g., emails, wikis etc. (22.3%), assigned new roles or responsibilities in the team (21.9%) and changing the frequency of retrospective meetings (20.1%) (Nguyen-Duc et al., 2022).

In terms of productivity, a survey with more than 3.500 responses proved that the majority had no change or even improved their productivity (62-68%). Besides commute as the

most named benefit the participants mentioned schedule flexibility, focus and fewer interruptions and distractions while working from home (Ford et al., 2022). According to research of DeFilippis et al. (2020) the impact of COVID-19 on employee's digital communication patterns is clearly visible. Based on data from more than three million users, compared to pre pandemic levels, an increased number of meetings per person (+12.9 percent) and number of attendees per meeting (+13.5 percent) is found. Although employees spent less net time in meetings per day (-11.5 percent), evidenced by a decreased average length of meetings (-20.1 percent), there is a broad increase in length of the average workday (48.5 minutes).

An appropriate mix of digital tools can help to increase efficiency and to manage complex projects. In line with other research and our own, we suggest several collaborative technologies, for example Real-time Whiteboards, Informal Knowledge Sharing, Cloud-based storage, Information Sharing and Transparency to make collaboration satisfying and successful.

Conclusion

ICT is enabling huge changes in our work environment. Every project has different requirements, thus, it needs different tools for collaboration. As stated above, the all-in-one ICT is not programmed yet and maybe never will be. But without ICT, especially while the pandemic, working from home or elsewhere outside the office, would not be possible in its current mode. Working together on files in large teams, managing projects or simply communicate while being at different places are huge advantages of digital tools that are in high demand.

Although the opportunities are great, one must face the need for informal conversations, the general feeling of isolation at home, and the overload of too many different sources/information overloads. New rules for virtual communication must be developed. It is a question of future research to investigate key factors of face-to-face cooperation and how they could be transformed into virtual environments.

References

- Comella-Dorda, S., Garg, L., Thareja, S., & Vasquez-McCall, B. (2020, April). *Revisiting agile teams after an abrupt shift to remote*. McKinsey & Company.
- Cuérel, M., Loots, E., & Lavanga, M. (2019). Not from, but in, the Same Organization: Cooperation, Collaboration and Competition in Creative Coworking Spaces. *Journal of Creativity and*

- Business Innovation*, 5, 132–154. <https://www.journalcbi.com/cooperation-collaboration-competition-in-creative-coworking-spaces.html>
- DeFilippis, E., Impink, S. M., Singell, M., Polzer, J. T., & Sadun, R. (2020, July). *Collaborating During Coronavirus: The Impact of COVID-19 on the Nature of Work* (No. 27612). National Bureau of Economic Research. <https://doi.org/10.3386/w27612>
- Engstler, M., Mörgenthaler, L., & Nohr, H. (2015). *Trendbarometer Kreativwirtschaft Baden-Württemberg 2015: Reale und virtuelle Orte der Kooperation von Kreativschaffenden in Baden-Württemberg* (German Edition). Grin Publishing.
- Engstler, M., Nohr, H., & Suditsch, I. (2014). *Trendbarometer Kreativwirtschaft Baden-Württemberg 2014*. Hochsch. der Medien, Inst. für Kreativwirtschaft.
- Ford, D., Storey, M. A., Zimmermann, T., Bird, C., Jaffe, S., Maddila, C., Butler, J. L., Houck, B., & Nagappan, N. (2022). A Tale of Two Cities: Software Developers Working from Home during the COVID-19 Pandemic. *ACM Transactions on Software Engineering and Methodology*, 31(2), 1–37. <https://doi.org/10.1145/3487567>
- Gerdenitsch, C., Scheel, T. E., Andorfer, J., & Korunka, C. (2016). Coworking Spaces: A Source of Social Support for Independent Professionals. *Frontiers in Psychology*, 7. <https://doi.org/10.3389/fpsyg.2016.00581>
- Heinzel, V., Engstler, M. (2021). Next generation Coworking: Corporate, Pop-up, Rural, Virtual & Hybrid Coworking. Potenziale und Herausforderungen der Umsetzung des progressiven Arbeitsmodells Coworking. In S. Werther (Hrsg.). *Coworking als Revolution der Arbeitswelt? Potenziale und Herausforderungen Richtung New Work*. Springer. <https://doi.org/10.1007/978-3-662-62657-3>
- Höfferer, M., & Sandriester, B. (2009). Von der Zusammenarbeit im zweiten und der Collaboration im ersten Leben. *HMD Praxis Der Wirtschaftsinformatik*, 46(3), 4–5. <https://doi.org/10.1007/BF03340357>
- Leimeister, J. M. (2014). *Collaboration Engineering: IT-gestützte Zusammenarbeitsprozesse systematisch entwickeln und durchführen* (German Edition) (2014th ed.). Springer Gabler. <https://doi.org/10.1007/978-3-642-20891-1>
- Lim, F. P. (2017). An analysis of synchronous and asynchronous communication tools in e-learning. *Advanced Science and Technology*, 143(46), 230–234. <https://doi.org/10.14257/astl.2017.143.46>
- Muthucumaru, A. (2021). The future of collaborative technology within Scrum/Agile practices. *The IJournal: Student Journal of the Faculty of Information*, 7(1), 1–10. <https://doi.org/10.33137/ijournal.v7i1.37897>
- Nguyen-Duc, A., Khanna, D., Greer, D., Wang, X., Martinez Zaina, L., Maturro, G., Melegati, J., Guerra, E., Huong Le, G., Kettunen, P., Hyrynsalmi, S., Edison, H., Sales, A., Rutitis, D., Kemell, K., Aldaej, A., Mikkonen, T., Garbajosa, J., & Abrahamsson, P. (in press). Work-

- from-home and its implication for project management, resilience and innovation - a global survey on software companies. *Information and Software Technology*.
- Piepenburg, U. (1991). *Rechnerunterstütztes kooperatives Arbeiten* (Mitteilung Nr. 197). Universität Hamburg, Fachbereich Informatik.
- Schürmann, M. (2013). *Coworking Space: Geschäftsmodell für Entrepreneure und Wissensarbeiter (German Edition)* (2013th ed.). Springer Gabler. <https://doi.org/10.1007/978-3-658-02465-9>
- Spinuzzi, C. (2012). Working Alone Together: Coworking as Emergent Collaborative Activity. *Journal of Business and Technical Communication*, 26(4), 399–441. <https://doi.org/10.1177/1050651912444070>
- Sydow, L. (2020, March 30). Increased demand for Houseparty, ZOOM, Hangouts Meet and Microsoft Team surfaces due to work from home policies, social distancing measures and government lockdowns during the coronavirus pandemic. Data.Ai. Retrieved March 21, 2022, from <https://www.data.ai/en/insights/market-data/video-conferencing-apps-surge-coronavirus/>
- Tsai, W. (2002). Social Structure of “Coopetition” within a Multiunit Organization: Coordination, Competition, and Intraorganizational Knowledge Sharing. *Organization Science*, 13(2), 179–190. <http://www.jstor.org/stable/3085992>
- Weerth, C. (2018, February 19). *Kooperation*. Gabler Wirtschaftslexikon. Retrieved March 21, 2022, from <https://wirtschaftslexikon.gabler.de/definition/kooperation-39490>
- Werther, S. (2021). *Coworking als Revolution der Arbeitswelt: von Corporate Coworking bis zu Workation (German Edition)*. Springer. <https://doi.org/10.1007/978-3-662-62657-3>
- Yang, L., Holtz, D., Jaffe, S., Suri, S., Sinha, S., Weston, J., Joyce, C., Shah, N., Sherman, K., Hecht, B., & Teevan, J. (2022). The effects of remote work on collaboration among information workers. *Nat Hum Behav*, 6, 43–54. <https://doi.org/10.1038/s41562-021-01196-4>
- Zeiner, K. M., Laib, M., & Burmester, M. (2016). Das Erlebnisinterview – Methode zum Verständnis positiver Erlebnisse: Praktische Einführung und Diskussion von Implikationen zur UX-Gestaltungspraxis. Hess, S. & Fischer, H. (Hrsg.), *UP 2016. Aachen: Gesellschaft Für Informatik e.V. Und Die German UPA e.V.* <https://doi.org/10.18420/muc2016-up-0144>
- Zuzul, T., Pahnke, E. C., Larson, J., Bourke, P., Caurvina, N., Shah, N. P., Park, Y., Vogelstein, J., White, C., & Priebe, C. E. (2021). *Dynamic Silos: Increased Modularity in Intra-organizational Communication Networks during the Covid-19 Pandemic*. Working Paper. <https://doi.org/10.48550/arXiv.2104.00641>

Creative Teaching and Learning in Extracurricular Activities

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Abstract

Extracurricular activities are an important part of the school curriculum, the co-construction of which should include extracurricular leaders and students, and, if necessary, other stakeholders in the local community. Extracurricular activities are led by pedagogically competent teachers, they are free and available to all students in order to spend their time organized and in a stimulating atmosphere. The co-construction of the curriculum of extracurricular activities should be based on students' interests, encourage different student competencies, and influence students' physical, intellectual, aesthetic, and moral growth. By engaging in extracurricular activities, students develop self-esteem and self-discipline, and teachers create a stimulating classroom atmosphere in which student activity, independent learning and practical action are valued.

The aim of this paper is literature review and presentation of two extracurricular activities, Literary and Robotics, as an example of extracurricular activities in which teachers, students and parents are involved, and through which creative learning and teaching is encouraged. Analysis of documentation for the preparation of extracurricular activities during the four school years in one Croatian primary school in Osijek-Baranja County includes features of creative teachers, creative teaching models and creative thinking techniques used in extracurricular activities. Literary group and Robotics as extracurricular activities offer opportunities, through individual and team work, for critical thinking, practicing problem solving, creating new ideas and creativity, and thus strengthening students' social competencies necessary for the 21st century.

Keywords: creativity, curriculum, extracurricular activities, Literary group, Robotics

Introduction

Extracurricular activities encourage the individual development of students' creative abilities and interests, so through extracurricular activities the student's talents, inclinations and

aspirations are revealed, while teachers are given the freedom to create educational work aimed at students. If a choice is given to students to select activities according to their interests and if the curriculum is open, extracurricular activities become a place for quality leisure time. Students and teachers should jointly discover, learn and explore in an atmosphere of freedom and creativity, in socializing, respect and trust (Mlinarević & Brust Nemet, 2012). Creative extracurricular activities have an effective impact on all its participants, which can be seen through the development of democratic relations, a pleasant emotional climate, fearless atmosphere in which the evaluation of the teaching process is perceived as a celebration of learning (Dubovicki, 2016). For extracurricular activities, it is important that they are based on freedom of choice, voluntary involvement, satisfaction or internal motivation to engage in a particular activity that enables the student's personal development. If extracurricular activities in the school meet the above assumptions, students will decide to spend free time in the activities and develop their creativity through them. Trnova (2014) concludes that only a creative teacher can educate a creative student, and creativity is one of the most important factors for a student's lifelong learning and future success, so the most powerful way to develop creativity in your students is to be a role model. Children develop creativity not when you tell them to, but when you show them (Stenberg & Williams, 1996). Creativity is significant to every educational system, and it is interrelated with equality and applying modern education. Creativity as the first step of the innovation that defines the progress of education especially accelerates the growth of the entire economy within a society (Pllana, 2019, p. 136).

Extracurricular activities are attended by primary school students in a four-year cycle in primary school, and they are included or excluded on their own initiative, depending on the level of interest. These activities are conducted after the regular educational process in small groups. Creative processes and results that are achieved within the group contribute to its recognizability in the school itself, but also at the inter-school, local and wider community level. The paper will present the co-construction and realization of two extracurricular activities of the students of the primary school Josipovac. Success has been achieved in continuous (four-year) work in Literary creation and Robotics.

Extracurricular Activities in School Curriculum

Seeking different types of education and different teaching methods is not new. Throughout the history we recognize different attempts to make students center of educational process like Dalton plan, Winnetka plan, Montessori, Waldorf and many more. The task of contemporary school, as an educational institution, is to influence all segments of student's

development. Best way to do that, besides instructions, is through extracurricular activities. Guided by the individual interests and free choice, through various activities students develop personal potentials (Valjan Vukić, 2016).

Each school has its own curriculum which is unique and depends on the activities, projects and school-stakeholders cooperation. School can benefit from meticulously designed extracurricular activities in the sense that it can enhance the image of the school, shape the culture of work and bring new projects and cooperation with different stakeholders. That is why schools can freely create extracurricular activities to propose to students. School curriculum contains the title of the extracurricular activity, number of participants, time and place of the activity and number of hours. Students are able to choose the activity that best suits their needs. Students can, via extracurricular activities, develop creativity, create new ideas, concepts, and solve problems. A positive pedagogical culture in extracurricular activities emphasizes the importance of the upbringing in relation to education and the function of teachers, which are more than just the transfer of knowledge, but transfer of ethical and positive values and beliefs, appreciation of students' interests and abilities, development of independence and encouragement of students' creativity as key competence for lifelong learning. In this way, students and creative and flexible teachers co-construct the teaching, aim multiple intelligences, social competences, talents, creativity and critical thinking. Teachers' competences and personality are key factors that can liberate and stimulate students' enthusiasm, encourage creativity, and self-perpetuation, while teachers' main roles are serving as an initiator and counsellor, whose main goal is to encourage, counsel and guide students. By participating in the development of the curriculum of extracurricular activities, students and teachers are motivated to work, it encourages the intrinsic motivation, enthusiasm, creativity and self-realization. Through pedagogical management of extracurricular activities, teachers create a democratic atmosphere that implies providing professional support, fostering partnerships, promoting creativity and innovation, demonstrating understanding and encouraging students. Open and positive school culture makes easier for students to join extracurricular activities and to be more successful in tasks which are created in mutual cooperation of students and teachers.

By his commitment to a certain activity, the student also discovers his strengths, his talent, aspirations and inclinations that he would like to strengthen. The very possibility of choosing an extracurricular activity is a step towards freedom and expression in accordance with the possibilities and preferences in which the student's creativity can be expressed. It can be acting, dancing, sports, nature protection, studying customs, collecting data on traditional games that were once popular, ecology. Students enjoy all basic human rights and freedoms in

extracurricular activities, and their involvement is felt to a great extent. They organize and self-organize into educational groups, teams and other associations and make important decisions about their life and the work of the school (Mlinarević & Brust Nemet, 2012, p. 189).

Creativity in Extracurricular Activities

Creativity is our ability to see the unusual in the ordinary, to "buy ideas cheaply and sell expensively", to create new seemingly incompatible relationships, while having autonomy and freedom to choose the way, means and our own pace (Tokić, 2017, p. 21). Teacher is the most important figure in the quality of extracurricular activities, but the teacher's enthusiasm is not sufficient. Pejić Papak and Vidulin-Orbanić (2011) state that the pupils' creative productivity in extracurricular activities largely depends on the teacher's professional competences, work methods and relationship with the students. The same authors emphasise the pedagogical role of a teacher which is manifested in „assisting, inciting, coordinating, counselling, teaching and directing pupils towards a correct, cultured and rational usage of leisure time“ (Pejić Papak & Vidulin-Orbanić, 2011, p. 8).

Participating in extracurricular activities has many benefits for the students, such as higher level of academic achievement, more positive educational experience (Christison, 2013), reduced space for risk factors to affect children and young people in their free time (Valjan Vukić, 2016) and higher self-concept (Wilson, 2009). Well managed students' extracurricular activities, can help students to build their own attitudes and behaviour, enabling them a positive development and socially acceptable conduct (Antovska & Kostov, 2016). Teachers and students work together on ideas without the pressure of grades creating an environment of success and positive culture. It is the transfer of positive values and skills needed in today's society that makes extracurricular activities a place of growth and creativity for both students and teachers. In Croatian schools there are a number of different extracurricular activities which vary from school to school. They usually cover different fields like: science, sports and recreation, national and cultural heritage, literary and drama activities, humanitarian work and many more (Nastavni plan i program za osnovnu školu, 2006).

Method

The aim of the paper is to present the realization of the co-construction of two extracurricular activities and the model of creative teaching and learning in the Literary and Robotic extracurricular activities of a Croatian elementary school in Osijek-Baranja County.

Method used in this research is content analysis of documentation for the preparation of extracurricular activities during the four school years from 1st to 4th grade of primary school (2015/2016, 2016/2017, 2017/2018, 2018/2019). It includes features of creative teacher, creative teaching models and creative thinking techniques used in extracurricular activities.

Literary Extracurricular Activity

The research results (Kuhar & Sabljic, 2016) show that extracurricular activities were very popular in primary and secondary schools in Osijek, Croatia, especially literary, poetry recitation, drama and journalist clubs. More importantly, it was shown that they do foster student creativity which was confirmed by the concrete examples in practice, i.e. students' creative results. Literary creativity is an extracurricular activity that has existed in the Josipovac Elementary School for many years, and the purpose and goal of the activity have been changed, modernized and adapted to the creative desires, preferences and potentials of students. The involvement of students in numerous projects, participation and rewards in numerous competitions are an indicator of the creativity that students achieve by continuously attending this extracurricular activity. Objectives, learning outcomes and implemented activities are shown in Table 1.

Table 1 Literary extracurricular activity-aims, learning outcomes and activities

Aims:

-
- Encourage creativity in students;
 - Develop student's written and oral expression;
 - Discover the skills of literary expression;
 - Nurture a culture of speech and writing;
 - Use information technology in order to participate in literary competitions;
 - Encourage students to publish papers;
 - Nurture the Croatian language in the written word;
 - Adopt new words and expressions - develop students' active vocabulary;
 - Learn to connect sentences harmoniously and compose larger logical units;
 - To become aware of the importance of knowing and respecting orthography;
 - Nurture a culture of speaking and writing;
 - Awareness of the lexicon of the Croatian language;
 - Be aware of the basic determinants of the text, stylistic exercises, composition exercises;
 - Develop a critical attitude towards one's own work - notice shortcomings, correct mistakes;
 - Present your literary work to teachers and students of the school and participate in competitions.

Activities:

- Word games;
- Creating a story according to the stimulus (a series of pictures, a song, a story, an event);
- Listening and communicating with each other in the mother tongue and language of the project participants (usually English);
- Research and search;
- Reading and writing;
- Establish active engagement in reading and encourage questioning;
- Creative material making workshops;
- Expressing using some of the web tools: tagul; vimeo*.

Learning outcomes:

- Talking and speaking according to the communication situation;
 - Listen to different texts, extract important data and retell the content of the listened text;
 - Read the text and retell the content of the text using notes;
 - Write texts according to a simple structure;
 - Form a text applying knowledge of nouns, verbs and adjectives respecting grammatical and spelling rules;
 - Express the experience of a literary text in accordance with one's own reading experience;
 - Read a literary text and explain the features of a literary text;
 - Read literary texts according to your own interest and explain your choice;
 - Express yourself creatively with literary text, and experiences;
 - Extract important data using a variety of age-appropriate sources;
 - Distinguish between electronic media appropriate to the age and interests of students;
 - Distinguish and describe the cultural events he attends and express his opinion about them.
-

To prepare Literary extracurricular activities, teachers use the basic educational outcomes derived from the curriculum for the subject Croatian Language (Odluka o donošenju kurikuluma za nastavni predmet Hrvatski jezik za osnovne škole i gimnazije u Republici Hrvatskoj, 2019), especially in the field of literature and creativity, as well as interdisciplinary topics Personal and social development (Odluka o donošenju kurikuluma za međupredmetnu temu Osobni i socijalni razvoj za osnovne i srednje škole u Republici Hrvatskoj, 2019), Learn how to learn (Odluka o donošenju kurikuluma za međupredmetnu temu Učiti kako učiti za osnovne i srednje škole u Republici Hrvatskoj, 2019), Entrepreneurship (Odluka o donošenju kurikuluma za međupredmetnu temu Poduzetništvo za osnovne i srednje škole u Republici Hrvatskoj, 2019), Use of information and communication technology (Odluka o donošenju kurikuluma za međupredmetnu temu Uporaba informacijske i komunikacijske tehnologije za osnovne i srednje škole u Republici Hrvatskoj, 2019). Language competence is developed in

* <https://vimeo.com/330852019>; <https://vimeo.com/329136072>, <https://vimeo.com/328797515>, <https://vimeo.com/314787847>

all subject areas and the mastery of language skills of listening, speaking, reading, writing and their interaction is encouraged, as well as the development of vocabulary.

In contemporary, media world, where children and young people usually communicate through short messages it is important to nurture Croatian language in speech and writing and to be able to express one's own opinion in polite and appropriate manner as well as to recognize ill written texts on the Internet which can be misleading.

Extracurricular Activity – Robotics

Educational robotics provides an active learning environment and allows learners to acquire 21st century skills (Sisman & Kucuk, 2019). Robotics as an extracurricular activity in the elementary school Josipovac was offered to students with the aim of developing the STEM area. The implementation of the activity requires quality preparation, responsibility and creativity of teachers and students, which has resulted in excellent results at the regional, national and global levels. Objectives, outcomes and implemented activities are shown in Table 2, and examples of creative tasks in Robotics can be found on the links in the footnote[†].

Table 2 Robotics- aims, learning outcomes and activities

Aims:

-
- Enable the inclusion of robotics, automation and programming in education in primary school age;
 - Adopt appropriate procedural technical-technological knowledge and purposefully and meaningfully integrate the acquired knowledge with knowledge from other fields, especially with natural sciences, informatics, mathematics and social fields;
 - Improve and develop cognitive, psychomotor, social and communication skills necessary for purposeful, safe and socially acceptable use of technique and technology, in accordance with their own interests, abilities, preferences and needs;
 - Adopt a systematic and algorithmic way of thinking and acting, as well as computer skills and abilities needed to solve technical problems and independently develop, create, present and document a technical creation, technology or own activity;
 - Develop the skills needed for self-organized, independent, responsible and active learning and advancement in the technical-technological, living and future professional environment;
 - Adopt the knowledge, skills and attitudes needed to make sensible decisions relating to work and production, the environment, sustainable development while respecting safety, ethical, economic, environmental and cultural principles.

[†] Creative tasks of the students of the elementary school Josipovac on Robotics: <https://vimeo.com/271772237>, <https://vimeo.com/271773568>, <https://vimeo.com/271773690>, <https://vimeo.com/271773790>, <https://vimeo.com/271773903>, <https://vimeo.com/258381320>, <https://vimeo.com/258381225>, <https://vimeo.com/258381185>, <https://vimeo.com/258381106>, <https://vimeo.com/258381068>, <https://vimeo.com/258380998>, <https://vimeo.com/247542273>, <https://vimeo.com/247541670>, <https://vimeo.com/247541619>, <https://vimeo.com/247541565>, <https://vimeo.com/247541361>, <https://vimeo.com/247540769>, <https://vimeo.com/247541726>, <https://vimeo.com/257200437>

Activities:

- Problem solving;
- Practical work and practice, by building various devices and robots;
- Assembling models of various machines and creating control programs;
- Demonstrate the basic principles of robotics by guiding robotic models using computers;

Learning outcomes:

- Independently and collaboratively assemble a robotic construction from finished elements and show and explain the purpose and mode of operation of the same;
 - Independently represent your own or already assembled robot and present your own assessment of the aesthetic and functional value of the same;
 - Describe the means, procedures, materials and mechanisms used to make your own robot;
 - Independently or collaboratively design your own robot program and write a report on your own activity and describe the program using a computer;
 - Research and select a ready-made software solution, and study it and describe how to improve and / or change the program;
 - Independently and / or collaboratively create a more complex program for ones own robot;
 - Independently organize and use simple hand tools, accessories, instruments, devices and appliances, taking into account your own safety and the safety of other participants.
-

Educational outcomes for Robotics are based on the cross-curricular theme The use of information and communication technology (Odluka o donošenju kurikulumu za međupredmetnu temu Uporaba informacijske i komunikacijske tehnologije za osnovne i srednje škole u Republici Hrvatskoj, 2019). Information and communication technology is close to children and young people and they accept it with ease. Publishing and sharing content, adding your own work, comments and links, searching for information, and serving a variety of sources are ways in which they participate in the community and meet their informational, social, and cultural needs. In the educational environment, this same technology becomes a means of enriching and enabling different learning experiences. Children and young people are supported for independent, conscious, creative and responsible learning and the realization of educational expectations. Using technology, independently or with the support of teachers and parents, they decide where, when and how to learn, which greatly contributes to developing a sense of responsibility, self-esteem and digital identity (Odluka o donošenju kurikulumu za međupredmetnu temu Uporaba informacijske i komunikacijske tehnologije za osnovne i srednje škole u Republici Hrvatskoj, 2019).

Proper use of information and communication technology is one of the prerequisites for effective participation and decision-making in the digital age. Teaching and learning supported by computers and other digital devices, located in real as well as virtual classrooms and cloud

computing, greatly contributes to the development of digital, computer and media literacy of children and young people. Therefore, the school environment should enable everyone, regardless of the environment they come from, to use modern technology equally. Children and young people must show solidarity by helping peers and the community by cooperating, communicating and sharing their content, respecting others and their work and protecting privacy. Computer programs allow students to express themselves aesthetically, create concept maps and overviews, interactive works, drawings and posters, sound recordings, animations and films with which they can present themselves and the world around them and what they would like to create. Students get the opportunity to express their creativity and innovation by presenting their ideas and creating new content, and to express their originality by combining and rearranging existing knowledge and content. Using information and communication technology, teachers can creatively and innovatively supplement traditional teaching methods, tools and aids, more dynamically realize, monitor and evaluate the teaching process and individualize the approach to each student (Odluka o donošenju kurikuluma za međupredmetnu temu Uporaba informacijske i komunikacijske tehnologije za osnovne i srednje škole u Republici Hrvatskoj, 2019).

Therefore, the goals of learning and teaching are to provide students and teachers with opportunities in which they will:

- apply information and communication technology for educational, work and private needs; responsibly, morally and safely use information and communication technology; effectively communicate and cooperate in the digital environment; critically evaluate and select technology; use technology to manage information in the digital environment; create and edit new content and express oneself creatively with the help of digital media.

Achieving the mentioned goals enables the strengthening of basic competencies in a way that is interesting to children and young people because it takes place in a digital environment close to them. Also, the possibility of applying this topic in all subject curricula, its strong emphasis on connecting different areas, subjects and topics provides additional opportunities for development for all children and youth (Odluka o donošenju kurikuluma za međupredmetnu temu Uporaba informacijske i komunikacijske tehnologije za osnovne i srednje škole u Republici Hrvatskoj, 2019).

Learning and teaching Robotics requires the integration of several technical and information fields, so appropriate material and technical conditions require lifelong learning of leaders of extracurricular activity Robotics to help students develop science literacy, awareness of technical and technological impact and interdependence of technology with humanity,

society and natural environment (Lapov Padovan, Kovačević & Purković, 2018). The study conducted in Russia (Soboleva, Suvorova, Zenkina & Gerasimova, 2020) found that participation in extracurricular activity Robotics, as well as competitions in Robotics, contribute to the development of students' research competencies and the formation of critical thinking.

Robotics helps students develop skills necessary not only for developing psychomotor, social and communication skills but also help in preparation for future work place. Creative potential that is developed through this extracurricular activity could be beneficial for creating their own path and job opportunities especially with practical work like building their own robots. Participating in different competitions on different levels help students see their improvement and also meet other students who share the same interests.

Discussion and Conclusion

In contemporary society, students need more creative activities through which they can express themselves and achieve higher level of knowledge and skills in a field that most interests them. In this paper two extracurricular activities are presented that are held in Josipovac elementary school in Josipovac. First one is the Literary extracurricular activity which is important in the world of scarce communication. Students through word games, web tools, reading, writing and workshops learn new words, develop their vocabulary and learn how to express their opinion in a creative way by respecting grammar rules of Croatian language. Second one is Robotics. In this extracurricular activity students develop the skills needed for self-organized, independent, responsible and active learning and advancement in technology and future professional environment. Both extracurricular activities emphasise life-long learning and creativity.

Extracurricular activities are an important part of the school curriculum because they enable all students to spend quality free time under the guidance of a pedagogical expert. The choice and quality of extracurricular activities mostly depends on teachers themselves, who should listen to the needs of students and enable them to co-construct an open curriculum that will meet the needs of students themselves, but also teachers. Since participation in extracurricular activities is voluntary and without the pressure of grades, students are not hindered during their work, and their freedom, choice, creativity, responsibility, imagination and emotions come to the fore and thus put extracurricular activities at the center.

At the Josipovac Elementary School in Josipovac, as an example of good practice, two extracurricular activities stood out in which students are happy to get involved and further develop their competencies by discovering new knowledge and from the first school days they

are professionally oriented towards their future jobs. Goals, activities and learning outcomes show respect for the cognitive, affective and psychomotor domains that intertwine and thus educate student as a holistic person whose active participation in extracurricular activities helps in self-realization.

References

- Antovska, A., Kostov, B. (2016). Teachers, students and extracurricular activities in primary education. *International Journal of Cognitive Research in Science, Engineering and Education*, 4(1), 49-54.
- Christison, C. (2013). The Benefits of Participating in Extracurricular Activities. *Journal of Graduate Studies in Education*, 5(2), 17-20.
- Dubovicki, S. (2016). Kreativnost u sveučilišnoj nastavi. Osijek: Sveučilište Josipa Jurja Strossmayera u Osijeku, Fakultet za odgojne i obrazovne znanosti.
- Kuhar, K., Sabljic, J. (2016). The Work and Role of Extracurricular Clubs in Fostering Student Creativity. *Journal of Education and Training Studies*, 4(4), 93-104.
- Lapov Padovan, Z., Kovačević, S., Purković, D. (2018). Razvoj kurikuluma osnovnoškolske nastave robotike. *Politehnika*, 2(1), 7-34.
- Mlinarević, V., Brust Nemet, M. (2012). Izvannastavne aktivnosti u školskom kurikulumu. Osijek: Sveučilište Josipa Jurja Strossmayera u Osijeku, Učiteljski fakultet.
- Nastavni plan i program za osnovnu školu (2006). Ministarstvo znanosti, obrazovanja i športa. https://narodne-novine.nn.hr/clanci/sluzbeni/2006_09_102_2319.html
- Odluka o donošenju kurikuluma za nastavni predmet Hrvatski jezik za osnovne škole i gimnazije u Republici Hrvatskoj (2019). Ministarstvo znanosti i obrazovanja. https://narodne-novine.nn.hr/clanci/sluzbeni/2019_01_10_215.html
- Odluka o donošenju kurikuluma za međupredmetnu temu Osobni i socijalni razvoj za osnovne i srednje škole u Republici Hrvatskoj (2019). Ministarstvo znanosti i obrazovanja. https://narodne-novine.nn.hr/clanci/sluzbeni/2019_01_7_153.html
- Odluka o donošenju kurikuluma za međupredmetnu temu Učiti kako učiti za osnovne i srednje škole u Republici Hrvatskoj (2019). Ministarstvo znanosti i obrazovanja. https://narodne-novine.nn.hr/clanci/sluzbeni/2019_01_7_154.html
- Odluka o donošenju kurikuluma za međupredmetnu temu Poduzetništvo za osnovne i srednje škole u Republici Hrvatskoj (2019). Ministarstvo znanosti i obrazovanja. https://narodne-novine.nn.hr/clanci/sluzbeni/2019_01_7_157.html
- Odluka o donošenju kurikuluma za međupredmetnu temu Uporaba informacijske i komunikacijske tehnologije za osnovne i srednje škole u Republici Hrvatskoj (2019). Ministarstvo znanosti i obrazovanja. https://narodne-novine.nn.hr/clanci/sluzbeni/2019_01_7_150.html

- Pejić Papak, P., Vidulin-Orbanić, S. (2011). Stimulating active learning in extracurricular activities through contemporary work strategies. *Metodički obzori* 12, 6(2), 5-21.
- Pllana, D. (2019). Creativity in Modern Education. *World Journal of Education*, 9(2), 136-140.
- Sisman, B., Kucuk, S. (2019). An Educational Robotics Course: Examination of Educational Potentials and Pre-Service Teachers' Experiences. *International Journal of Research in Education and Science*, 5(2), 510-531.
- Soboleva, E.V., Suvorova, T.N., Zenkina, S.V. and Gerasimova, E.K. (2020). The development of Critical Thinking Through the Involvement of Pupils in Competitive Robotics (from work experience). *Perspektivy Nauki i Obrazovania*, 43(2), 268-284
- Sternberg, R. J., Williams, W. M. (1996). *How to develop student creativity*. Alexandria: Assn for Supervision & Curriculum.
- Tokić, R. (2017). Kreativnost u trećoj životnoj dobi. *Andragoški glasnik*, 21(1-2), 7-25.
- Trnova, E. (2014). IBSE and Creativity Development. *Science Education International*, 25(1), 8-18.
- Valjan Vukić, V. (2016). Izvannastavne i izvanškolske aktivnosti učenika – višestruke perspektive. *Školski vjesnik*, 65(1), 33-58.
- Wilson, N. (2009). *Impact of Extracurricular Activities on Students*. University of Wisconsin-Stout: The Graduate School.

The Influence of Students' previous Achievements on The Activity In E-Learning Environment

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Abstract

The Covid 19 pandemic led to an accelerated digitization of the education system, forcing teachers and students to increase their use of information and communication technology in their daily lives. Some students and teachers found this easy and coped well in the new learning environment, but some found it challenging and needed additional help.

This paper focuses on investigating the relationship between students' performance in earlier elementary school subjects and their activity in using Microsoft Teams. Some weak positive and negative correlations were found between variables used to describe students' online behavior in MS Teams and their prior academic performance. Additionally, association rules were created to uncover interesting patterns between these elements. The best rule selected showed an association between the great academic success students showed in II. foreign language and their great prior success in music and art.

Keywords: primary school students, association rules, e-learning, digital activity, previous achievement

Introduction

The spread of Covid-19 led to the closure of schools and the exclusive use of distance learning for instruction. This presented a particular challenge to everyone involved in the education system, from teachers and principals to students and their parents. The success of distance education depended on the digital literacy of teachers, students and their parents. Due to the epidemic, the education system in the Republic of Croatia still combines different teaching models, from face-to-face to distance education, depending on the situation. Since there was no mandatory platform for distance education, teachers chose the platform depending on their competencies. Teaching took place through communication platforms (Viber, Messenger, What's up, Zoom...), email, some of the tools available with Office 365 for Schools (Yammer, Teams, etc.) or G Suite for Education (Google Classroom). Some teachers have chosen to teach

through Microsoft Teams. This is a digital platform that allows teachers to create a personalized, interactive learning environment by connecting apps, content and conversations, enabling the individualization of assignments, facilitating communication and collaboration with students and colleagues in professional learning communities (Microsoft, 2022).

Literature Preview

The impact of distance education on students' academic success and educational outcomes has been the focus of many researchers' attention in the last two years. This is supported by numerous studies.

A study conducted by Sokele, Alajbeg, and Brkić (2020) found that distance education can be a useful method to complement face-to-face teaching and can also be used as the main method in teaching, but with lower achievement success.

Graham (2021) investigated whether students' participation in online courses affects their learning success. The results of a study conducted at nine public universities showed that participation in online courses had a positive effect on graduation. The results suggest that the positive aspects of online education, in addition to its accessibility and flexibility, are its impact on student success and effectiveness (Graham, 2021).

The meta-analysis of 27 studies examined the impact of online education on student success in several countries from 2010 to 2021, and the results showed that "the effect size of online education on academic achievement is at a medium level. The results of the heterogeneity test of the meta-analysis show that the effect size does not differ in terms of grade level, country, online education approaches, and lecture moderators" (Ulum, 2022, pp. 429). This study also found that the applications used in online instruction were moderately effective.

A case study conducted by Lubis and Dasopang (2021) highlighted the most common characteristics and challenges that elementary teachers and learners encountered in distance education during the COVID -19 pandemic. The results showed that the most common opportunities were technological capabilities, increased accessibility to learning, and expanded learning references. The main challenges were high cost, unstable Internet network, and difficulty in achieving learning objectives (Lubis & Dasopang, 2021).

Although little research has been conducted, much attention has been paid to predicting student performance in education. Namoun and Alshantqi (2021) conducted a systematic literature review to investigate the prediction of student learning outcomes. They used machine learning

and data mining models "with a focus on three perspectives, (1) the forms in which learning outcomes are predicted, (2) the predictive analytics models developed to forecast student learning, and (3) the dominant factors impacting student outcomes" (Namoun & Alshanqiti, 2021, pp. 1).

Masangu, Jadhav, and Ajoodha (2021) also used data mining techniques to predict student academic success. The authors focused on student engagement, online activity, number of hands raised, forum postings, and number of times instructional materials were accessed. The Support Vector Machine algorithm is found to be the best at predicting student performance in their research.

There is very little research on the impact of using MS Teams on elementary students' academic achievement, and there is almost no research analyzing the impact of prior academic achievement on activity in MS Teams during the COVID -19 pandemic. Therefore, the focus of this study is to examine the relationships between students' prior performance in elementary school subjects and their activity in Microsoft Teams.

Methodology and results

The study was conducted in January 2022. The Microsoft Teams application was used to collect data on the activity of 101 upper primary school students. Participants in this study and their teachers have been using MS Teams as their official tool for communication and online learning since the beginning of the 2021/2022 school year. Until then, they did not officially use MS Teams to achieve educational goals, but since then they have been using it not only for online teaching, but also to enrich regular classroom instruction with the use of information and communication technologies.

Additional data were also collected on the students, such as the grade they were attending, the students' academic performance in terms of final course grades from the previous year, and overall achievement. Slightly more than a quarter of the students (29.70%) were seventh graders. The distribution of students across their classes can be seen in Table 1.

Table 1.*The distribution of students across their classes.*

Class	Count	Percent
5	25	24.75
6	23	22.77
7	30	29.70
8	23	22.77

Depending on the type of variable, Pearson's correlation coefficient (r), Fisher's exact test (two-sided), and Kendall's tau-b (τ_b) were used to determine if there was a relationship between the variables.

The Shapiro-Wilk W test for normality was used to test whether the continuous variables for which the Pearson's correlation coefficient was used were normally distributed. The results are shown in Table 2.

Table 2.*Test of normality.*

Variable	W	p
number of days of online activity	0.91	.000003
Posts	0.39	.000000
Replies	0.72	.000000
Reactions	0.89	.000001

At a significance level of 0.05, there was a statistically significant, moderately positive correlation between the variables number of days' students were active online and posts ($r=.34$) and the variables number of days and reactions ($r=.33$). The other Pearson's correlation coefficient results are shown in Table 3.

Table 3.*Pearson's correlation results.*

Variable	Means	Std. Dev.	Number of days of online activity	Posts	Replies	Reactions
Number of days of online activity	14.05	5.15	1.01	0.34	0.04	0.33
Posts	1.71	4.62	0.35	1.00	0.17	-0.02

Replies	16.38	17.71	0.04	0.17	1.00	-0.07
Reactions	22.24	17.63	0.33	-0.02	-0.07	1.00

Fisher's two-sided exact test revealed that at the 0.05 level, there was a statistically significant relationship between the class attended and previous success in Croatian language ($p=.014$), art ($p=.00$), and computer science ($p=.00$). At the same 5% level, there was also a correlation between prior success in Croatian language and prior success in art ($p=.002$), music ($p=.001$), mathematics ($p=.00$), physical education ($p=.00$), religious education ($p=.00$), II foreign language ($p=.00$), and computer science ($p=.00$). There was also a statistically significant relationship (significance level 0.05) between prior achievement in art and prior achievement in music ($p=.005$), I. foreign language ($p=.006$), mathematics ($p=.049$), physical education ($p=.001$), religious education ($p=.007$), and II foreign language ($p=.001$). At the same level of significance, there was a correlation between prior achievement in music and prior achievement in: I. foreign language ($p=.035$), physical education ($p=.008$), religious education ($p=.002$), II. foreign language ($p=.002$) and computer science ($p=.002$). At the same level of significance, there was also a statistically significant relationship between prior achievement in first foreign language and prior achievement in mathematics ($p=.00$), physical education ($p=.00$), religious education ($p=.00$), II. foreign language ($p=.000$), and computer science ($p=.00$). There was also a statistically significant relationship between prior achievement in mathematics and prior achievement in: physical education ($p=.008$), II. foreign language ($p=.002$), and computer science ($p=.000$). Then, a significant relationship at 5% significance level was found between performance in religious education and performance in physical education ($p=.005$), II. foreign language ($p=.00$) and computer science ($p=.010$) and between the performance in Computer Science class and: Physical Education class ($p=.010$) and II. foreign language ($p=.008$). At the same level of significance, there was also a statistically significant relationship between achievement in physical education and II foreign language ($p=.012$).

At the same significance level of 0.05, Kendall's Tau-b revealed a statistically significant weak negative correlation between the variables post and art ($\tau_b=-.213$), a very weak negative correlation between music and replies ($\tau_b=-.19$), a very weak positive correlation between religious education and the number of days worked in the MS teams ($\tau_b=.185$) and a weak negative correlation between religious education and reactions ($\tau_b=-.204$), a very weak positive correlation between II. foreign language and number of days ($\tau_b=.20$) and computer science grades and the variable *Replies* ($\tau_b=.177$).

Association rules were used as a data mining method to represent some interesting patterns occurring between all variables, with minimum rule support set at 60 and rule confidence set at 80. Twenty rules in the form *if... then* were extracted and the most interesting rule, the rule with the highest lift, was selected. It had a support of 60.40, a confidence of 95.31, and a lift value of 1.17 and said: *if the final grade from the subject II. foreign language is 5, then the final grade from the subject Music is 5 and the final grade from the subject Art is 5.*

Conclusion

With the advent of the COVID -19 pandemic, online education expanded. It is likely that some of the information and communication skills acquired, as well as the use of tools such as Microsoft Teams, will continue to be used to supplement regular classroom instruction.

The main objective of this study was to investigate the correlation between students' performance in previous elementary school subjects and their activity in using Microsoft Teams. To determine this, Pearson's correlation coefficient, Fisher's exact test (two-sided), and Kendall's tau-b were used.

Focusing only on online activity, the results showed a moderate positive correlation between the number of days students were active online and their reactions throughout live meetings in the form of emojis or likes. The number of days of online student activity also showed a correlation with the frequency with which they posted something to MS Teams. When looking at the association between variables related to online activity and variables describing past success, some negative correlations were found. For example, the number of posts an individual student posted was negatively correlated with achievement in art, the number of student reactions to other students' posts or messages was negatively correlated with achievement in religious education, while the number of reply messages was negatively correlated with achievement in music.

The best association rules revealed that students who had excellent prior achievement in II. foreign language showed also excellent performance in music and art. Educators could benefit from this uncovered hidden knowledge in such a way that it can guide them in adapting their teaching methods, which could have a great impact on increasing student achievement not only in terms of online teaching.

The limitations of this study are related to the sample size. Therefore, it is suggested to increase the number of respondents in future studies and to include more data mining methods that could reveal additional hidden knowledge.

References

- Graham, M. (2021). Impact of Online Education on Student Success Outcomes and Institutional Effectiveness: Study of Florida State University System. West Chester University Doctoral Projects (106). Retrieved 8. 2. 2022. from https://digitalcommons.wcupa.edu/all_doctoral/106/
- Lubis, A. H., & Dasopang, M. D. (2021). Online learning during the covid-19 pandemic: How is it implemented in elementary schools? *Premiere Educandum: Jurnal Pendidikan Dasar dan Pembelajaran*, 11(1), 120 – 134. doi:Doi.org/10.25273/pe.v11i1.8618
- Masangu, L., Jadhav, A., & Ajoodha, R. (2021). Predicting Student Academic Performance Using Data Mining Techniques. *Advances in Science, Technology and Engineering Systems Journal*. 6 (1), 153-163.
- Microsoft (n.d.). Microsoft Learn Educator Center: Teams for education on Microsoft Learn. Retrieved January 14, 2022, from <https://docs.microsoft.com/en-us/learn/educator-center/product-guides/teams>
- Namoun, A., & Alshantiti, A. (2021). Predicting Student Performance Using Data Mining and Learning Analytics Techniques: A Systematic Literature Review, *Applied Sciences*, 11 (1), 1-28.
- Sokele, M., Alajbeg, T., & Brkić, F. (2020). The impact of distance learning on student success for electrical engineering professional courses, *Proceedings* (pp.617-621). 2020 MIPRO - 43rd International Convention on Information, Communication and Electronic Technology. Opatija, Croatia, IEEE.
- Ulum, H. (2022). The effects of online education on academic success: A meta-analysis study. *Education and Information Technologies*, 27, 429–450. doi:<https://doi.org/10.1007/s10639-021-10740-8>

Developing Future Ship Engineers' Communicative Competence Using Virtual Classrooms

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Abstract

The utilizing of virtual rooms is one of the options for conducting distance learning foreign languages during a pandemic. The formation of communicative competence of future ship engineers is impossible without the fact that they should speak English during the lesson (it means for about 80% of the time from the whole lesson). In organizing of such distance classes, the BigBlueButton service allows us not only to conduct a video conference, but also: enrich the learning experience with screen-sharing (show a screen or video from an external source, upload a document of any format (including presentation) and virtual whiteboard features: keep general notes, write / draw / sketch on a whiteboard, record videoconf. Also virtual classroom allows for instant feedback, direct teacher-student interaction, and engaging activities to increase motivation and active participation. And one more plus the period of time is unlimited. Students can connect to virtual classroom platforms from any device that can connect to the Internet and they should have an official registered account in the Moodle. Conference is automatically displayed in the schedule. The research also describes other advantages of using BigBlueButton, which is integrated into the LMS Moodle of the establishment. We came to the conclusion that the use of this has a positive effect on the formation of the computer competence of future ship engineers. In our next researches, it is planned to analyze the influence of self-study platforms on the formation of the competence of future seafarers.

Keywords: ship engineers, communicative competence, Moodle, BigBlueButton, virtual classroom

Introduction

The development of computer network Internet has opened new opportunities in upgrading world educational system. By reason of, the most part of the time modern people spend communicating online. Taking into account of today`s reality it would be a little bit in hindsight to ignore this fact when deciding on the issue of studying. Online education becomes more and more essential and relevant direction when choosing the forms of studying nowadays. It is reflected both in the technical equipment of educational establishments, their access to world information resources, and in the use of new types, methods and forms of education focused on the active cognitive activity of students. Thanks to the means of new information and communication technologies, such form of the lesson as a virtual one has appeared.

The positive side in traditional system of studying is visual and emotional contact of the teacher with the student through which the material is learned much easier and more efficiently. Today in the Internet we can find different forms of education in which such communications are not expected between the participants (because of videos, courses, trainings with instructors). Modern conditions allow us to use and combine traditional forms with new technologies in distance learning.

The objective of our study is to analyze the use of distance classes using BigBlueButton service in order to formate communicative competence of future ship engineers.

Analyze of recent research

Virtual classrooms as main source of studying at higher education institution was examined by many scientins namely Maarif S., Maarif S.,Umam K.,Soebagyo J.,Pradipta T.R., Sengupta S., Nguyen T.-H., Nguyen T.-H.,Tran D.-N., Tran D.-N.,Vo D.-L., Vo D.-L., Mai V.-H., Mai V.-H.,Dao X.-Q. and others.

In their research on mathematics virtual classroom practice at the university Maarif S., Maarif S.,Umam K.,Soebagyo J. and Pradipta T.R. proved positive impact of virtual classrooms at the student`s motivation to study, to work in teams, etc. (Maarif et al., 2022; Diahyleva et al., 2020).

Sengupta S. investigated the impact of online studying at India. The challenge while COVID-19 pandemic there was to choose the most usefull resourses for conducting online classes (Sengupta, 2022).

Smart universities which use AI including virtual assistant robot were described by Nguyen T.-H., Nguyen T.-H.,Tran D.-N., Tran D.-N.,Vo D.-L., Vo D.-L., Mai V.-H., Mai V.-

H. and Dao X.-Q. The benefits of virtual classrooms use there were in the reduce of workload and enhancement of the effect in teaching and studying (Nguyen et al., 2022).

BigBlueButton as a resource to conduct online classes were the object of the research of following investigators: Belenko V.A., Serebrovsky V.V., Nemtsev S.N., Klepikova A.G., Geislinger R., Milde B., Baumann T., Biemann C. and others.

To check the efficiency of a university video conferencing system Belenko V.A., Serebrovsky V.V., Nemtsev S.N. and Klepikova A.G. described BigBlueButton and the Scalelite balancer. Both systems were used at National Research University "BelSU" to provide synchronous online classes. The benefits of their use were listed in the research (Belenko et al., 2021).

Geislinger R., Milde B., Baumann T. and Biemann C. investigated the software of BigBlueButton. They also created a plugin which improves studying process.

Despite substantial range of studies on BigBlueButton plugin on LMS MOODLE at universities a number of questions on its use to form communicative competence of future ship engineers haven't been fully answered. In our opinion these questions are of great interest.

Results

The backbone of virtual classes is to make the lesson interactive and to receive feedback opportunely. The training takes place under the teacher's supervision face to face with students.

It has much advantages and benefits among the other forms of education: it is easy to use; active participation of each student; online board (which can have advanced functionality through which one can create diagrams, draw shapes, write texts, download educational materials in different formats, broadcast video and audio material); the possibility to record the lesson (in any time students can repeat the material).

Online education is not only the webinar or training where the students can passively observe what is happening. Everyone is involved in educational process and takes active part in what is happening. The teacher can monitor every one and involve in discussion of the topic. Such form of education encourages the students to interact with each other and with the teacher. The activities can be made in groups or individually and teacher can assess them.

The COVID-19 pandemic stimulate the transition to a new format of education. As technology continues to transform all areas of life, teaching and online learning poses new challenges for both educators and students. The question of finding the resource during online education was arised. The source that should allow organizing of online education and meet all our requirements. We have gone through a lot of services such as Edmodo, Zoom, Google

Classroom, iSpring Learn, ATutor, but the only one that met the requirements for the training of marine specialists became BigBlueButton (Han, 2018).

It is a global teaching platform and a web conferencing system designed for online learning. BigBlueButton also exists as a plugin that can be **integrated with Moodle** which makes it a particularly interesting tool for those who use this platform. Educators appreciate the intuitive nature of the BigBlueButton's feature set, including tools that make it easier for teachers to focus students on the lesson. BigBlueButton offers a veritable virtual classroom and allows users:

- to upload documents: easy presentation upload with the support for PDF, text, images and Microsoft PowerPoint, Word, and Excel documents;
- to use whiteboard annotation of slides for highlighting content;
- to hold breakout rooms to get students engaged in collaborative learning;
- easy group polling that encourage more student engagement ;
- to share video options: low, medium, and high-resolution video options that serve all levels of WIFI bandwidth;
- to use public and private chat;
- to share notes for easier group collaboration;
- easy, intuitive screen sharing that keep students engaged;
- a hand rising feature;
- student feedback through the use of emojis;
- the ability to easily share video links within the main presentation area and playback is controlled by the instructor.

This service has pros and cons. Advantages of BigBlueButton are the following:

- the best open source software for video conferencing which contains all features having in paid software;
- very easy to set , implement and has very simple view help anyone to manage it;
- a flash player HTML5 with excellent sound, video and great presentational features (if you have a stable internet connection);
- perfect for teaching, explaining, giving lectures (Reyes Mogollón et al., 2018).

There are also disadvantages while using Big BlueButton:

- it is possible to host not more than 100 participants;
- the recording can start to fail and some times the conferences got wrong;

- it is impossible to upload more than one file;
- it has a horrible tendency to freeze up and distort video;
- some IOS users won't hear anything if they join in a listen-only mode;
- it has the limited screen for presentation (Faye et al., 2018; Vasconcelos et al., 2017).

In order to invite students (participants) to the conference educator can copy the link and send it to participants of the video meetings among the available means of communication e.g. e-mail, instant messengers, sms, etc. According to the time students enter the link address in the address bar of their browser, and enter a video meeting or use a button on their page. Meeting organizer`s (teacher) permission login is not required. It is comfortable especially when the lesson is started but some students are late. In such way the teacher doesn`t abstract himself from the lecture, explaining of the new material, interviewing, practical task, etc. The teacher can use the management tools to download presentation (or delete it) and set up its demonstration. Communication with the participants takes place in the video mode or in the chat mode. The video meeting organizer (teacher) can delete any participant, make host or send him a private message (Cherniavskiy et al., 2020).

The Moodle plugin BigBlueButton provides the possibility as a synchronous communication between participants in the educational process. For example:

- student and teacher can see the same page of the e-textbook;
- the teacher at his own discretion can play and stop video and audio materials of the lesson for the student;
- also the educator can monitor the real time exercise;
- the teacher can get feedback.

Mix up your activities to keep things interesting. Just because you're online, it doesn't mean students can't collaborate. Many platforms allow you to put students in pairs or groups to work together in designated chat rooms. As a teacher, you can drop in and out of these rooms to monitor how things are going, and give feedback just as you would in a regular class. The example is given below.

Figure 1

Maritime English online lesson for future ship engineers on BigBlueButton plugin of LMS Moodle.

Conclusions

In our country online education is on the rise nowadays. It is comfortable not only for the teacher but for the students too. Also, it breaks our barriers which can be offline. Moreover, due to Covid-19, online education solves the problem of the safety of the teacher and the students. Excessive online education is difficult to withstand for both students and teachers. But the transition to distance learning requires restructuring of educational approaches from the teacher`s side: instead of reading - use research, instead of control – use challenges. And from the students` side, distance learning also requires other skills – like self-organization. Unfortunately, students have no motivation to study, that is why all material should be explained in the most available and systematic way, because students usually master the material themselves longer than under the guidance of a teacher. It is better to involve different learning formats at the same time: for example, offer students several options for homework (make an advertisement, or a project). It is important to gather feedback: this way the educators will understand which activities students like and which are effective, and, on the contrary, which reduce the desire to study. Distance learning can get acquainted with new learning

technologies, learn to allocate time correctly, make education inclusive and accessible for learners and develop an individual approach for each students.

Distance education has allowed to crystallize new approaches to the educational process. It is a new opportunity, but not a limitation. The main thing is to study how to use them correctly.

In our next researches, it is planned to analyze the influence of self-study platforms on the formation of the competence of future seafarers.

References

- Belenko, V., Serebrovsky, V., Nemtsev, S., & Klepikova, A. (2021). Research of the efficiency of a university video conferencing system based on open-source software: The scalelite balancer and the BigBlueButton web conferencing system. VI International Scientific and Practical Conference Distance Learning Technologies, CEUR Workshop Proceedings, 3057 (pp. 280-289). Yalta, Crimea. <https://scopus.com>
- Cherniavskiy, V., Popova, H., Sherman, M., Voloshynov, S., & Yurzhenko, A. (2020). Mixed reality technologies as a tool to form professional competency of sea transport professionals. ICTERI 2020 - International Conference on ICT in Education, Research, and Industrial Applications, CEUR Workshop Proceedings, 2740 (pp. 217-231).Kherson, Ukraine. www.scopus.com
- Diahyleva, O. S., Gritsuk, I. V., Kononova, O. Y., & Yurzhenko, A. Y. (2020). Computerized adaptive testing in educational electronic environment of maritime higher education institutions. CTE2020 - 8th Workshop on Cloud Technologies in Education, CEUR Workshop Proceedings, 2879 (pp. 411-422). Kryvyi Rih, Ukraine. www.scopus.com
- Faye, P. M. D., Gueye, A. D., & Lishou, C. (2018). Virtual classroom solution with WebRTC in a collaborative context in mathematics learning situation. Lecture Notes of the Institute for Computer Sciences, Social Informatics and Telecommunications Engineering, 204 doi:10.1007/978-3-319-72965-7_6
- Han, W. (2018). A fundamentals of financial accounting course multimedia teaching system based on dokeos and bigbluebutton. International Journal of Emerging Technologies in Learning, 13(5), 141-152. doi:10.3991/ijet.v13i05.8433
- Maarif, S., Umam, K., Soebagyo, J., & Pradipta, T. R. (2022). Critical review on mathematics virtual classroom practice in private university. International Journal of Nonlinear Analysis and Applications, 13(1), 975-982. doi:10.22075/ijnaa.2022.5616
- Nguyen, T. -H., Tran, D. -N., Vo, D. -L., Mai, V. -H., & Dao, X. -Q. (2022). AI-powered university: Design and deployment of robot assistant for smart universities. Journal of Advances in Information Technology, 13(1), 78-84. doi:10.12720/jait.13.1.78-84

- Reyes Mogollón, J. S., Salcedo Parra, O. J., & Sánchez, L. C. (2018). Implementation of QoS to video conference service by means of BigBlueButton for the use of dyslexia experts. CICIC 2018 - Octava Conferencia Iberoamericana De Complejidad, Informatica y Cibernetica, Memorias, 2 (pp.126-131). www.scopus.com
- Sengupta, S. (2022). Possibilities and challenges of online education in india during the COVID-19 pandemic. International Journal of Web-Based Learning and Teaching Technologies, 17(4) doi:10.4018/IJWLTT.285567
- Vasconcelos, P. R. M., Freitas, G. A. D. A., De Araujo, G. A., & Marques, T. G. (2017). Virtualization technologies in web conferencing systems: A performance overview. ICITST 2016 - 11th International Conference for Internet Technology and Secured Transactions , (pp. 376-383). doi:10.1109/ICITST.2016.7856734

E-learning during the COVID-19 pandemic

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Abstract

Globalization and rapid changes in society also require adjustments in the field of science and education. These new changes bring a number of innovations in the field of education. One of them is certainly a global pandemic of the corona virus (COVID-19). Until then, no one had any idea how much an unknown virus would change the world. Changes were necessary in all aspects of life, including the education sector. Students, teachers and parents were exposed to the changes. The previous form of learning and education had to adapt to the new situation. This paper will show how the students have adapted to cope with the new teaching model, which Information and communications technology (*ICT technology*) was used in everyday school obligations, what are their experiences with virtual teaching and classrooms, what are the advantages and disadvantages of online learning/teaching, etc. In the conducted questionnaire on a sample of 99 students, the obtained results give only an insight into the students' attitudes about online teaching. All classes were conducted through the Microsoft Office Teams (*MO Teams*) platform and virtual channels. Most students and teachers were introduced to this platform for the first time, as well as many other online tools. The paper will show how the School of Economics and Administration Osijek organized classes in a virtual environment and how the educational process runs smoothly using ICT technology. ICT technology has globally "taken over" the world and entered our daily routine, because without it, education in a pandemic would not be possible.

Keywords: education, ICT technology, pandemic, students, virtual teaching

1. Introduction

The pandemic caused by the Covid-19 virus in early 2020 significantly affected everyday private and business life. Drastic changes also directly affect the use of free time, travel, grocery shopping, going to the doctor, but also the education system. In March of the

same year, educational institutions (kindergartens, primary schools, secondary schools and faculties) in the Republic of Croatia were closed, and distance learning took place via the Internet. Although such a change was extremely stressful and complex, it is important to emphasize that the education system has not stopped, but has only adapted to the new situation.

The main goal of the research is to examine students' attitudes about online teaching.

2. The beginning of the pandemic and impact on the education system

In early 2020, a pandemic caused by the Covid-19 virus (SARS-CoV-2 virus) began. The source of the infection was the Chinese city of Wuhan, the infection soon spread throughout the world, including to the Republic of Croatia, according to Skitarelić, Dželalija and Skitarelić (2020).

All this led to the complete suspension of work in many areas of life. Factories were temporarily closed, private crafts, medium and large companies, restaurants, government services, educational institutions, etc. were being closed, according to Regionalni ured UNICEF-a za Europu i Centralnu Aziju (2020).

The relevance and importance of this topic is proven by the fact that the International Association for the Evaluation of Educational Achievement (*IEA*) and United Nations Educational, Scientific and Cultural Organization (*UNESCO*) together with the Joint Research Center of the European Commission launched a study in 2020 in 11 countries to assess the impact of the pandemic on primary school education, according to Meinck, Fraillon and Strietholt (2022). How much the pandemic has had an impact on the education system around the world is perhaps best shown by the official UNESCO website, which provides data that tracks and shows the number of schools closed globally over time. Thus, it is evident that the worst situation was recorded on April 20, 2020, when educational institutions were closed in 151 countries around the world. This directly affected 1.291 billion pupils and students, and in percentage this amounts to 81.8% of all pupils and students in the world. By comparison, in November 2021, schools were closed in only 9 countries around the world and this affected 38 million pupils and students or 2.4% of all pupils and students in the world, according to UNESCO - Education: From disruption to recovery (2022).

3. Online teaching in Croatia

In March of the same year, all educational institutions switched to online teaching and this form of teaching took place until the end of the 2019/2020 school year. The beginning of

online teaching was marked by the disorientation and disorganization of the entire system, which was experiencing numerous technical difficulties, according to Tonković, Pongračić and Vrsalović (2020). In order for the whole system to function better, mutual cooperation between educational institutions, the Ministry of Science and Education, state education agencies, counties (founders of secondary schools), cities (founders of primary schools) and Croatian Academic and Research Network (*CARNET*) (technical support) was necessary. A big problem in some schools was the technical equipment as a basic requirement for online classes, but also the equipment for teachers and students who did not have access to computers or the Internet.

The method of conducting online classes was not precisely defined, so schools organized online classes depending on their abilities. Some schools have used various digital tools such as Zoom, Microsoft Office software package, social networks (e.g. Facebook), Yammer, Google Classroom, Microsoft Teams, Viber / WhatsApp groups, etc. For the purpose of uninterrupted teaching process, educational content is broadcast daily for lower grades of primary schools via national TV programs, and a number of educational content (videos, presentations, exercises) is available to upper grades of primary schools and secondary schools on the website of the Ministry of Science and Education, and other educational agencies. Also, the upper grades of primary school also had video lectures online or via Croatian Radio and Television (content available on the website: <https://skolazazivot.hr/raspored/>).

The state matura (graduation) exam was held in June, but the calendar of exams was minimally changed and adjusted to the new situation. Thus, the implementation of individual exams (e.g. Mathematics or the Croatian language) took place over two days in order to meet all epidemiological conditions according to the recommendations and guidelines of the Croatian Institute of Public Health, according to Štiglec (2021).

All extracurricular activities such as professional visits, trainings, seminars or multi-day study trips were canceled and did not take place.

4. Advantages and disadvantages of online teaching

Life changes do not necessarily have to be negative, therefore we can observe online teaching through its many disadvantages, but also through the advantages.

One of the biggest shortcomings proved to be limited social contact, which significantly affected the interpersonal relationships of students, but also employees of educational institutions. Although online classes were organized, they were somewhat less attended (less concentration and focus on the teacher). Given that many students do not have adequate

Information Technology (*IT*) equipment, there were a number of technical difficulties in joining online classes, and thus it can be concluded that not all students had equal learning conditions, which must be the foundation of the entire educational process. Such organized distance learning makes it difficult to control the students' work, but also makes it significantly more difficult to evaluate student achievement. It should be noted that some subjects (eg Mathematics or Accounting) were much more difficult to adapt to online teaching compared to subjects that are exclusively theoretical in content.

The advantages of online teaching include encouraging students to work independently, developing critical thinking and better organization of working time. Learning and communicating in the online environment was a great novelty for all students, but it can also be seen as an excellent preparation for future employment because online business meetings and distance business are increasingly being organized in the business world. Through online teaching, students and teachers used a number of digital tools and thus expanded their computer knowledge. A big change has also happened to teachers organizing lessons, who are becoming much more creative, flexible and relaxed in the online environment due to the way they communicate.

Research methodology

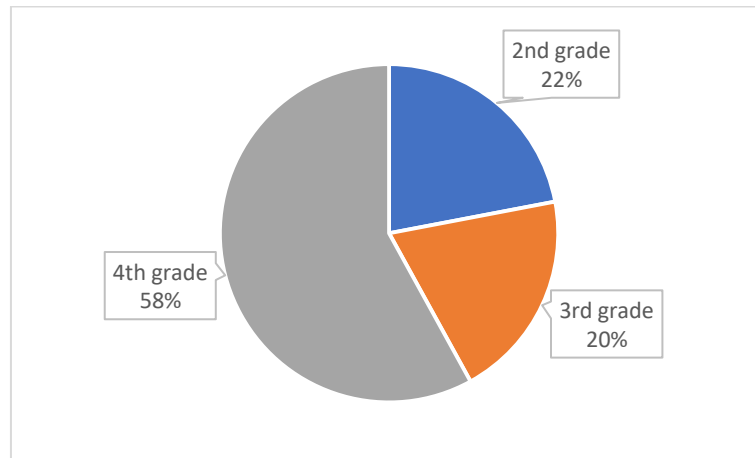
For the purposes of writing this article, a primary survey was conducted during October and November 2021. The research was conducted through Google Forms, a total of 99 students of 2nd, 3rd and 4th grade of the School of Economics and Administration Osijek participated. The survey questionnaire was completely anonymous in order to obtain relevant and reliable data.

Research results

The research included 22% second grade students, 20% third grade students and 58% fourth grade students (Figure 1). First graders did not complete the survey because they had just started secondary school and were not part of our online classes.

Figure 1

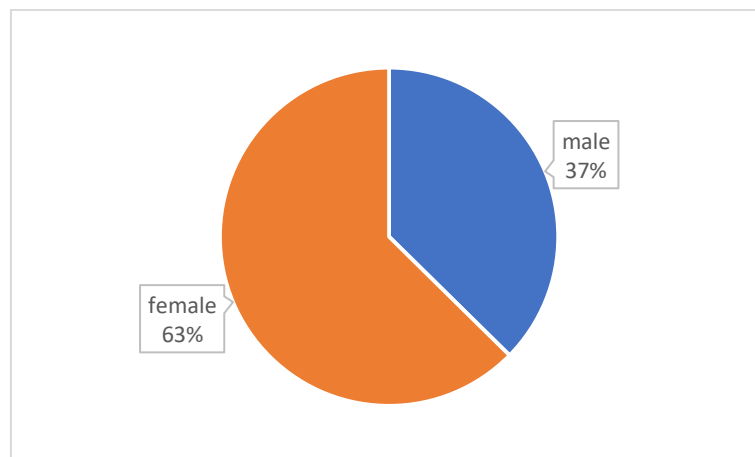
Student grades



If we observe the sample of respondents by gender, it can be seen that 63% of female students and 37% of male students participated in the research (Figure 2).

Figure 2

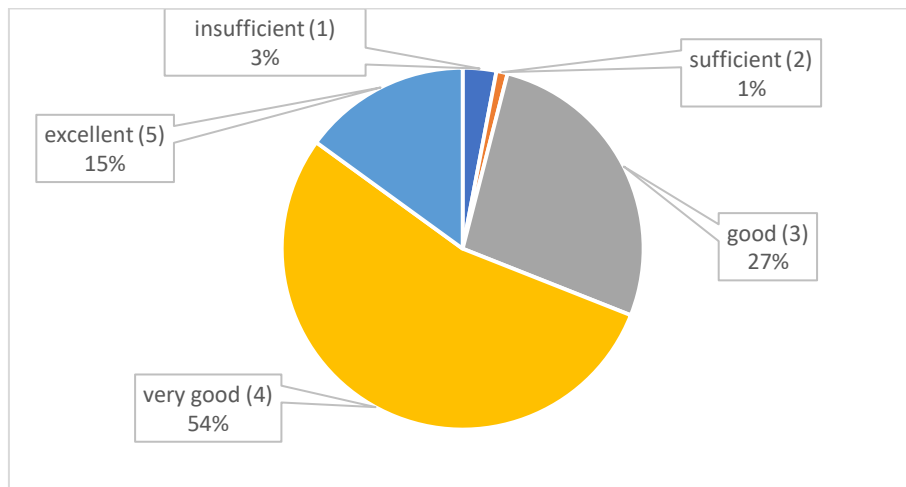
Student gender



Students were asked to write the marks they achieved. 15% of students achieved excellent results, 54% of students completed the transition class with very good results, 27% of students completed the class with good results, 1% of students had sufficient success, and 3 % of students repeated the previous grade because they were graded negative (Figure 3).

Figure 3

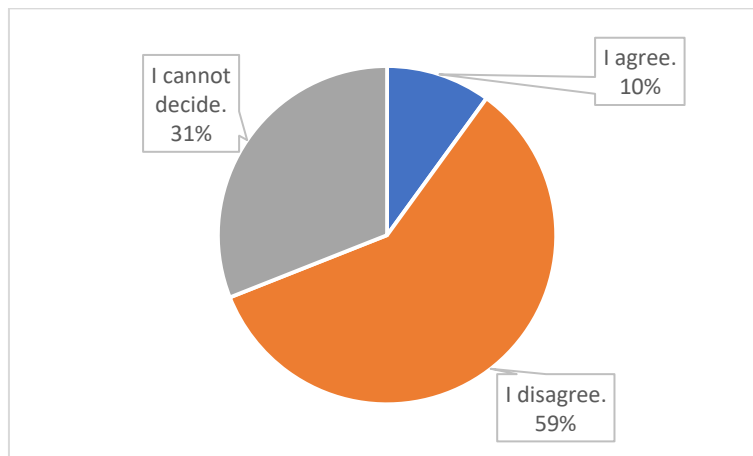
Success at the end of the previous grade (grade point average)



We were interested in how much the students actually liked or disliked online classes. The results showed that only 10% of students believe that online teaching is better than live teaching, 31% of students could not decide, and as many as 59% of students believe that online teaching is a worse form of teaching than classical live teaching (Figure 4).

Figure 4

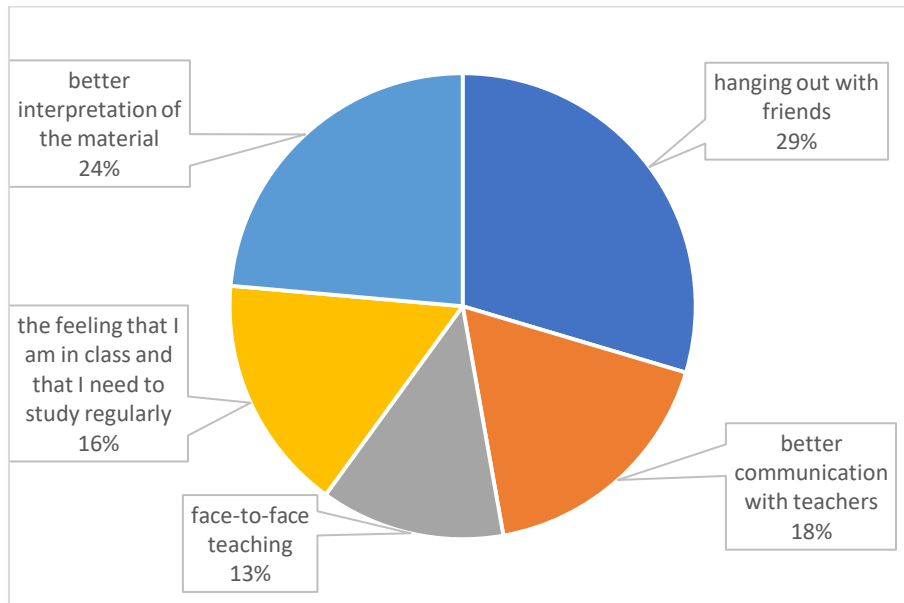
Online teaching is better than live teaching.



Given the change in the teaching process, we were interested in what exactly students are missing during online classes. Thus, 29% of students pointed out that they lack socializing with friends, 24% stated that during live teaching there is much better interpretation of the teaching content, better communication with the teacher is missing in 18% of students, as well as face-to-face teaching (13% of students). Interestingly, 16% of students believe that they would learn a lot more and work better if classes were held "normally" on school premises, and not via the Internet (Figure 5).

Figure 5

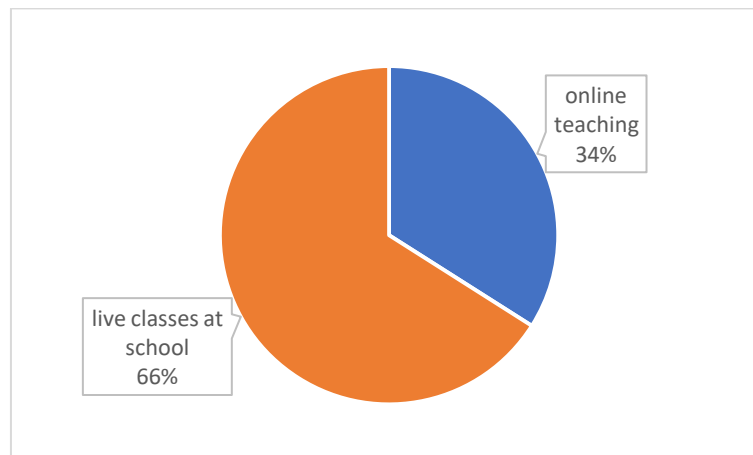
What the students miss the most during online classes (multiple answers were possible).



If students could choose independently, as many as 66% of them would opt for face-to-face teaching at school, and 34% of students would prefer to continue having online classes (Figure 6).

Figure 6

If students could, they would choose

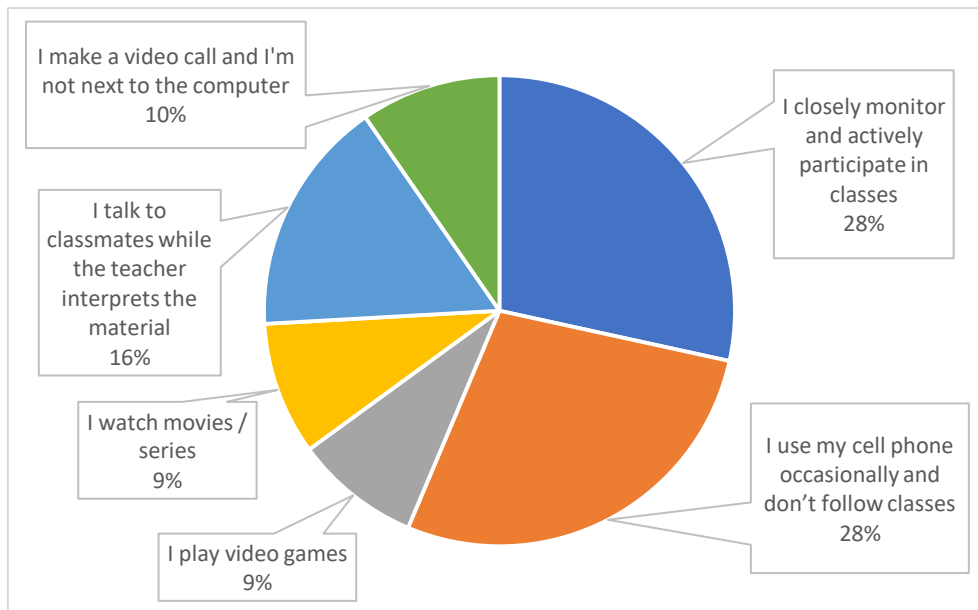


Given that it is much more difficult for the teachers to control and supervise the adoption of the teaching content in online teaching, it is to be expected that students will do other things while attending online classes. Thus, 28% of students stated that they carefully followed the lessons and instructions of the teacher, but also that they occasionally used a mobile phone during the lesson. 16% of students said that they regularly communicated (did not follow the

teaching process) with other people in the class during classes. In 10% of cases, students only joined the video call and were not available at the computer. It is also surprising that 9% of students watched movies or series during classes and even played video games (Figure 7).

Figure 7

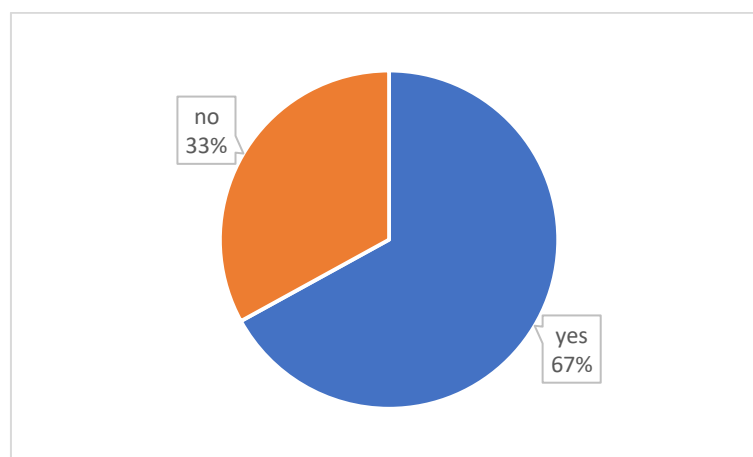
What students did during online classes (multiple answers were possible)



The research showed that teachers were not always ready to cooperate, so in 33% of cases the teachers did not even turn on the camera on the computer so that students could see them during online classes, while in 67% of cases they did (Figure 8).

Figure 8

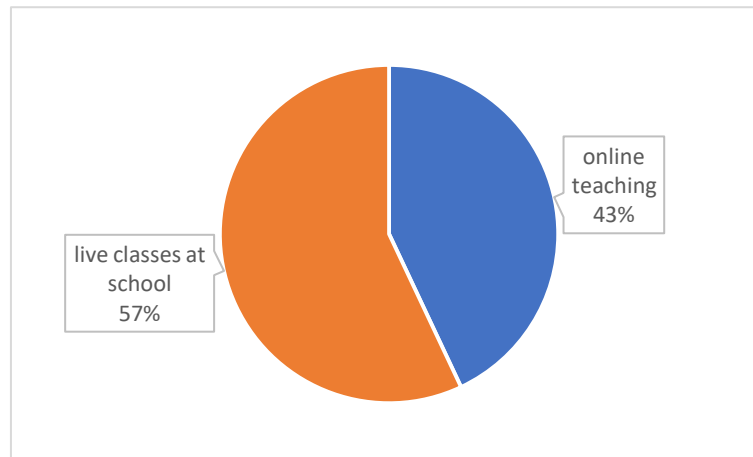
During online classes, the teachers had the camera on



Student feedback on fatigue after online or live classes is also important. According to the collected data, 57% of students feel more tired after live classes, and 43% of students are more tired after online classes (Figure 9).

Figure 9

The students felt more tired after.



The data shows all the advantages and disadvantages of online teaching. It is evident that students are characterized by a certain amount of irresponsibility, given that teachers find it much more difficult to monitor their progress and learning through video calls. However, students are aware that online teaching cannot replace social contact, the quality of the teaching process that takes place live in the school and two-way communication between teachers and students in the classroom.

Conclusion

The Covid-19 pandemic has brought great changes in our lives, as well as in the lives of students, teachers, professors and other educators. The changes came suddenly and unexpectedly, and were very drastic in terms of schools closing and moving to online teaching. Each educational institution has created a teaching process according to its capabilities, needs and desires, all in the interest of the students themselves. A large number of teachers and students were not prepared for the upcoming changes in the field of education and had to make changes in their way of teaching, learning and work habits. Teachers and students encountered new teaching methods that they had not used before, they had to adapt to new e-teaching tools, students were introduced to until now unknown platforms and e-communication. During the pandemic, all educators had to adjust their way of teaching and adapt to the new situation.

The School of Economics and Administration Osijek had the same difficulties, and after a period of adjustment, it created online classes through MS Teams. This form of teaching has its advantages and disadvantages, as shown by the results of research. When we talk about the shortcomings of teaching and maintaining the teaching process during a pandemic, almost everyone will point out the lack of communication. There is no substitute for face-to-face communication and the "living word", which is the best way to teach. But when an unforeseen

situation occurs, such as the Covid-19 pandemic, there must be ways to adapt, and we all need to be flexible. Our teachers and students quickly mastered online communication and tried to adapt and adopt the teaching content with various online tools. The advantages of online teaching include learning and teaching new online tools, critical thinking and exploring the online "world". Learning in an online environment is certainly a challenge for both the students and teachers. Following the new trends in the field of education, we will probably have to continue using new teaching technologies in the future and maintain a part of the teaching process through online platforms and online tools. Knowledge and education need to be created for the future, so the pandemic was a kind of preparation for such education. New generations of students require new teaching methods, and it is extremely important to adapt the entire educational system.

The biggest limitations of this research are the relatively small sample of respondents and the smaller volume of questions. Also, the research covered only one high school and its online classes. For more relevant and reliable results, the research should be conducted in the area of the city of Osijek. Teachers and professional associates of schools should also be included in the research.

References

- Goljevački, De., Goljevački, Do., Goljevački, L. (2021). Qualitative research conducted at the school level at the beginning of the school year 2021/2022.
- Meinck, S., Fraillon, J., Strietholt, R. (2022). The impact of the COVID-19 pandemic on education, UNESCO, International Association for the Evaluation of Educational Achievement. <https://unesdoc.unesco.org/ark:/48223/pf0000380398>
- Regionalni ured UNICEF-a za Europu i Centralnu Aziju (2020). Izgradnja na krizu otpornih obrazovnih sustava tijekom i nakon pandemije COVID-19. <https://www.unicef.org/croatia/media/4386/file/Izgradnja%20na%20krizu%20otpornih%20obrazovnih%20sustava%20tijekom%20i%20nakon%20pandemije%20COVID-19.pdf>
- Skitarelić, N., Dželalija, B. & Skitarelić, N. (2020). Covid-19 pandemija: kratki pregled dosadašnjih spoznaja, Medica Jadertina, Vol. 50, No. 1 (5-8). <https://hrcak.srce.hr/clanak/343774>
- Škola za život (2022). Nastava na daljinu. <https://skolazazivot.hr/raspored/>
- Štiglec, B. (2021). Povratak u škole tijekom pandemije COVID-19, UNESCO Hrvatska. <https://www.unicef.org/croatia/povratak-u-skole-tijekom-pandemije-covid-19>
- Tonković, A., Pongračić, L., Vrsalović, P. (2020). Djelovanje pandemije Covid-19 na obrazovni sustav diljem svijeta, Časopis za odgojne i obrazovne znanosti, Vol. 4, No. 4, str. 121-134.

UNESCO (2022). Education: From disruption to recovery.
<https://en.unesco.org/covid19/educationresponse>

University E-Education Of Future Preschool Teachers In The Age Of The Covid-19 Pandemic

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Abstract

Globalization and technological progress and social and economic changes have led to intensive online communication as well as new e-study programs in the new e-learning environment. In addition, the new extraordinary circumstances caused by the Covid-19 pandemic have led to the social isolation of the entire population, changed the teaching process, led to new experiences of students' learning and teaching. In higher education, these circumstances have changed the teaching process and led to changed conditions of study in the material and social environment. The paper discusses students' attitudes towards the new conditions of study in Osijek, Zadar and Slavonski Brod, which are reflected in student satisfaction and workload, their digital skills and student expectations. There are more and more online study programs, but it should be noted that the specificity of the study of Early and Preschool Education is the need for direct participation in the educational process of the curriculum of early and preschool education. The participation of students in the educational process is an integral part of methodological exercises and professional practice, and is reflected in the acquisition of professional competencies and application in direct educational work with preschool children and cannot be neglected.

Keywords: Covid-19 pandemic, digital competencies, e-teaching, students of early and preschool education, study conditions.

Introduction

At the beginning of 2020, Europe and the world were hit by the Covid-19 pandemic. The Government of the Republic of Croatia adopted a Decision to suspend teaching in higher education, secondary and primary schools and regular work of preschool education institutions and the establishment of distance learning (2020) and Additional instructions with the suspension of higher education (2020). Educational institutions at all levels of the education

system have established and implemented new technological solutions. It was necessary to ensure the continuity of teaching, information systems and applications as well as systems with information content important for the educational process and organize the implementation of the educational process, emphasizing the expectations of participants and the frequency of communication between them. Back in 2000, Russel conducted several hundred studies comparing traditional and distance learning and concluded that learning outcomes can be achieved equally successfully in distance learning (Simonson et al., 2006), which should have encouraged all participants in education processes in new learning and studying conditions.

Digital competencies of teachers and students

According to the European Parliament and the Council of the European Union (2006), digital competences include the secure use of information and communication technology for business, entertainment and communication purposes. These include digital skills and the use of word processing applications, spreadsheets, the use of databases, the storage and preservation of data and the protection against the dangers of the Internet. Undoubtedly, the advantages of digital technology and its application in teaching are visible, but it implies their rational application, digital competencies of teachers and professional development of all users of advanced technologies.

Getting to know modern information and communication technology provides students with essential knowledge of digital media, their capabilities, usability in everyday life, developing critical thinking skills, recognizing and applying quality content (Mlinarević et al., 2015).

Online learning and students

The teaching process has been improved by the use of digital media in teaching, which enables individualization, research learning, collaborative learning and game learning (Matijević & Topolovčan, 2017). Teaching technology contributes to the dynamics and modernity of the teaching process, and teaching focuses not only on the use of more applications, but also on the benefits of online applications for students. The Organization for Economic Cooperation and Development (2020) cites the lack of computer equipment for students as one of the problems in the implementation of distance learning, as well as the need to improve computer conditions in educational institutions.

The results of the study involving students from different universities show that students prefer traditional teaching, some students had difficulty adjusting to distance learning, and the most difficult was concentrating on online teaching from home and reconciling personal and educational commitments (Aguilera-Hermida, 2020). In the same research, students cite

financial challenges, lack of socialization and communication. A study conducted in India examining the impact of the Covid-19 pandemic on education shows that the impact is negative and leads to disruptions in student learning as well as taking exams, and there are increased obligations to better understand teaching materials (Gupta & Gupta, 2020). There are also positive impacts of the Covid-19 pandemic on education in research on a New Zealand campus where students enjoyed, accepted well and felt that their autonomy and enjoyment of learning increased (Samarasinghe & Piri, 2020). From several of these studies, conflicting results can be observed where satisfaction, dissatisfaction or workload and difficulties of students are expressed.

Educators' training includes scientific and professional education conducted through lectures, seminars, exercises and professional-pedagogical practice of students where students acquire competencies (knowledge, abilities, pedagogical, psychological and didactic-methodological skills and attitudes). Practical classes, i.e. exercises and professional-pedagogical practice in kindergartens have an impact on the future professional development of students because it gives them the opportunity to improve and upgrade their theoretical knowledge about children of early and preschool age, i.e. to connect direct practical work with theory because students learn through their own experience and activities. In this way, they discover how skilled they are in leading the group and in establishing contacts (Hmelak & Lepičnik-Vodopivec, 2012). It should be noted that this type of teaching was absent at the time of the Covid-19 pandemic, which is immeasurable for their future profession of educators because in this way they improve their competencies.

The paper presents the research methodology of student assessment of satisfaction with technological study conditions, digital competencies and teaching, and the advantages of new forms of teaching and learning.

Research Methodology

The aim of the research was to examine the attitudes of students of early and preschool education from three Croatian universities (Osijek, Zadar and Slavonski Brod) towards online study conditions. In accordance with the stated goal of the research, three hypotheses were set:

H1. Students are satisfied with the conditions of studying in an online environment.

H2. There is no difference in student satisfaction with online study in Osijek, Zadar and Slavonski Brod.

H3. Part-time students are more satisfied with the conditions of online study.

The research was conducted during the academic year 2020/2021. Total of 207 third-year undergraduate students of Early and Preschool Education from the Universities of Osijek, Zadar and Slavonski Brod, 2 (1.0%) male and 205 (99.0%) female students participated in the research. According to the participation of students in the research, 85 (41.1%) students were from Zadar, 69 (33.3%) students from Osijek and 53 (25.6%) students from Slavonski Brod.

According to the type of study, 80 (38.6%) students are in full-time study and 127 (61.4%) in part-time study. For the purpose of the research, a questionnaire was created consisting of 27 questions divided into 5 areas. The first part of the questionnaire referred to the socio-demographic data of respondents, the second part examined the technological conditions of studying in an online environment, the third part self-assessment of digital competencies of students, the fourth satisfaction with teaching, and the fifth part highlighted the benefits of online study. The questionnaire was available in digital form, was anonymous and was filled in voluntarily. A reliability analysis was carried out on the questionnaire comprising 27 items. Cronbach's alpha showed the questionnaire to reach highly acceptable reliability, $\alpha = 0.904$.

Research results

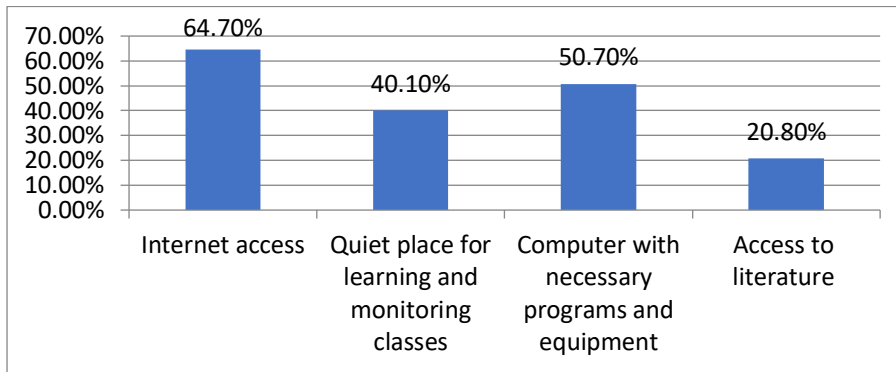
For the purposes of this paper, the results of research with significantly higher or lowest values are presented, i.e. students' self-assessment of satisfaction (dissatisfaction) with study conditions.

The criteria that make up the variable technological conditions of studying in an online environment are visible in Figure 1. Students used the Likert scale from 1 to 5 to self-assess their satisfaction with these conditions.

Most students, 134 (64.7%) expressed significant satisfaction with the Internet access, as shown in Figure 1.

Figure 1

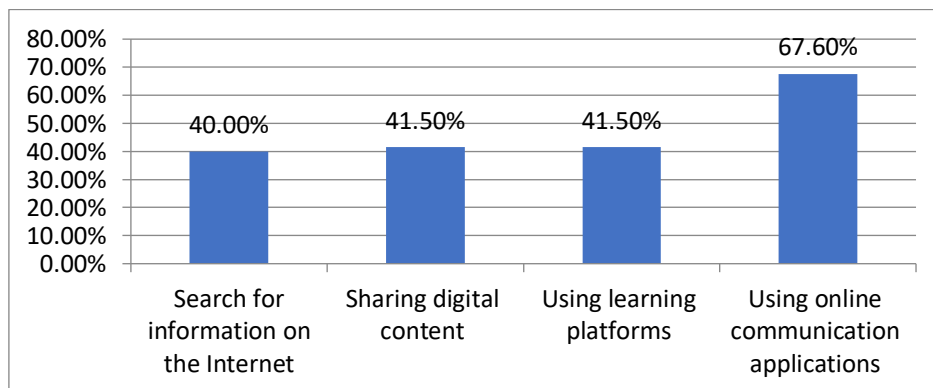
Students' attitudes about satisfaction with the technological conditions of studying



Students assessed their digital competencies by the criteria seen in Figure 2. Students rated significantly better (67.6%) coping in using applications (chat, mail and others) for online communication than using learning platforms (Big Blue Button, Microsoft Teams, Microsoft Meet).

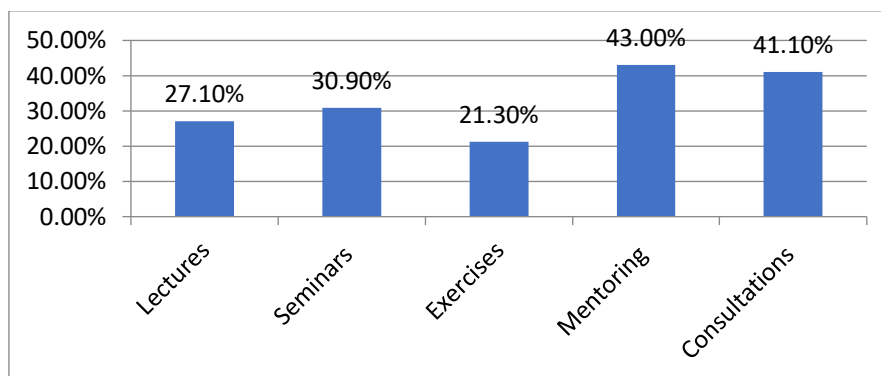
Figure 2

Self-assessment of digital competencies of students



Satisfaction with teaching was assessed by criteria: lectures, seminars, exercises, mentoring, consultations. Figure 3 shows that only 21.1% of students are satisfied with the lectures, and 21.3% of students are satisfied with the exercises through the applications used in teaching.

The advantages of online study were assessed through the criteria: spatial accessibility to study, time availability to study, comfort of working from home, work at your own pace, availability of study program content, raising the level of digital competencies and flexibility of teaching. Students are significantly most satisfied with the comfort of working from home (47.3% of students), improving their digital competencies (46.9% of students) and flexibility of teaching (40.1% of students).

Figure 3*Students' attitudes about the quality of teaching***Results of T-test and Anova test for independent samples****Table 3***Judging the level of student satisfaction with studying in relation to the place of study*

Student satisfaction with studying	Place of study	N	m	SD	t	p *
Technological conditions of study	Osijek	69	4,242	,651	2,164	,032
	Sl. Brod	53	3,971	,723		
Digital competences	Osijek	69	4,449	,614	2,569	,011
	Sl. Brod	53	4,155	,639		
Satisfaction with teaching	Osijek	69	4,014	,695	4,566	,000
	Sl. Brod	53	3,406	,770		
Satisfaction with teaching	Osijek	69	4,014	,695	2,410	,029
	Zadar	85	3,726	,768		
Benefits of online studying	Osijek	69	4,087	,693	3,696	,000
	Sl. Brod	53	3,614	,708		
Benefits of online studying	Osijek	69	4,087	,693	2,198	,029
	Zadar	85	3,835	,717		

Note: *p<, 05

Table 3 shows the differences in satisfaction with studying in relation to the place of study and a statistically significant difference in relation to the place of study and satisfaction with studying in the variables technological conditions of study, digital competencies of students, satisfaction with teaching and benefits of online study. Namely, students in Osijek are significantly most satisfied with the technological conditions of study compared to the surveyed students in Slavonski Brod ($t = 2,164$, $p = ,032$), as well as digital competencies ($t = 2,569$, $p = ,011$) and it is concluded that students have better conditions for online teaching in Osijek. To examine the correlation between the variables University and study satisfaction, the Anova test analysis was performed. One-way analysis of Anova variance shows a high positive correlation between the variables satisfaction with teaching and place of study ($F = 9,990$, $p = ,$

000). There was a statistically significant difference between the place of study and satisfaction with teaching ($P = , 000$). Students from Osijek again show greater satisfaction with teaching than students from Slavonski Brod ($t = 4,566, p = , 000$), and students from Zadar ($t = 2,410, p = , 029$). Anova shows the existence of a positive correlation between the variables of evaluation of teaching and place of study ($F = 6,305, p = , 002$). Anova also confirmed the existence of a positive correlation between the variables of online study advantage and place of study ($F = 6.797, p = .001$). Students from Osijek are more satisfied with the benefits of online study than students from Slavonski Brod ($t = 3,696, p = , 000$) and Zadar ($t = 2,198, p = , 029$). There was no statistically significant difference in any variable of study satisfaction and type of study (full-time, part-time).

Discussion and implementation

The results of the research suggest the satisfaction of the surveyed students with the technological study conditions and digital competencies in the online environment, which confirmed the first hypothesis of the research. The implication is particularly significant because responses came from students who had live and online experience. Most of the students were networked via the Internet, had a quiet place to study and computers with the necessary programs. The importance of a quiet place for learning and teaching from home was especially emphasized by the students in the questions about the advantages of online studying.

The results of the study by Velichová et al. (2020) confirmed the assumption that the technical equipment students need for online learning is an important factor influencing their perception of online learning. Students pointed out that by participating in online classes they develop their digital competencies, which consequently depends on the strengthening of teachers' digital competencies and the adaptation of applications, didactic methods and interaction in teaching. Lasić-Lazić et al. (2017) and Kuzminska et al, (2018) conducted similar research on students' self-assessment of digital competences and according to the results of the research concluded that it is important to follow technological trends and they should be reflected in the curriculum of the university. Some long-term trends (cloud computing and social networking) are partly present in the curriculum, while others, which require significantly more technology and financial resources, are still in the initial and experimental stages. Ally (2019) states that digital technologies will enable adaptable, flexible and individualized learning which will drastically change the role of teachers. They will have to adapt to education in the future. Furthermore, students expressed satisfaction with their digital competencies, especially the use of applications in teaching for written communication (Gmail, Outlook),

while less satisfied with their ability to cope with platforms for lectures, seminars, content sharing (Big Blue Button, Microsoft Teams, Microsoft Meets, Skype, etc.), especially when they had to share some content. The results show that students need knowledge and skills to better use learning platforms to be more successful in monitoring and academic success. The trend of digital technology development will continue in the future and all stakeholders in the educational process should be ready to face these changes (Lindberg & Olofsson, 2010).

Students from all three universities were not satisfied with the organization of lectures and exercises during the Covid-19 pandemic. In the Aguilera-Hermida study (2020), students also cite difficulties in understanding materials and the inability to perform exercises and practices, and point out that the quality of learning has decreased when moving to distance learning and students feel like they are not learning anything.

The Agency for Science and Higher Education (2021) conducted a survey on the challenges in higher education during the Covid-19 pandemic in the Republic of Croatia, and the results show that 82.0% of students express satisfaction with their own digital competencies, but 50.0% considers that the quality of online teaching performance through lectures is much worse than before the pandemic. The research of Biošić et al. (2020) on a sample of 2162 students gives results as 33.6% of surveyed students say that their higher education institutions conduct distance learning only for some subjects in the semester, while for some subjects it does not exist and despite this students give above average grade for experience distance learning, and the reason is the flexibility that such teaching offers. Zygouris-Coe & Swan (2010) in their research state that teachers have limited knowledge and experience with digital technology, many needed additional courses and support from the institution to be effective in online communities. Various studies (Ferrari, 2012; Lasić-Lazić et al., 2017; Kuzminska et al., 2018; Ally, 2019) have been published in the relevant literature in the field of online learning related to teachers' self-assessment of functioning skills with new technology. The results of this research show a lack of trust in teachers' digital competencies and their ability to use them in teaching. However, there is a positive attitude of teachers towards the integration of new technology into their work. Teachers are motivated and strongly express a desire to improve digital competencies, as well as to change the educational environment through the opportunities offered by e-learning (Kirova et al., 2012). During the Covid-19 pandemic, pupils, students and teaching staff jointly found the best solutions for more efficient online teaching from home with the digital technology they had at the time. It is possible that the attitude of students towards distance teaching was even more positive than there was a clearly agreed plan and program of performance during the closure of institutions (Jokić Begić et al., 2020). This

implies the need for innovative approaches and new models of study in the context of the development of modern digital technology and learning applications. The results of the research open up opportunities for other research in the field of e-learning and online teaching, especially in the field of motivation, workload and evaluation of learning outcomes that are not covered by this research. With all the advantages and disadvantages of distance learning, we should definitely continue to invest in its development. Programs in colleges that prepare students for teaching occupations should enable the design of learning environments and learning experiences that use digital tools, technology, and resources and impact learning outcomes (Borthwick & Hansen, 2017). Education today needs new curricular, didactic and organizational strategies, as well as the optimal development and training of education professionals if they are to contribute to increasing the competitiveness and quality of education (Reisoğlu & Çebi, 2020). According to the results of the research, it can be concluded that students-future educators of the University of Osijek have accepted distance learning significantly more positively, without resistance and are actively learning in the teaching process through the Big Blue Button platform. The second research hypothesis was not confirmed, which assumed that there was no difference in the perception of students regardless of where they study at three Croatian universities. The results of the research do not indicate a statistically significant difference in students' attitudes about online study whether they are full-time or part-time students, therefore the third research hypothesis, which assumes that part-time students are more satisfied with online study conditions, was rejected.

Conclusion

The impact of ICT in education due to the impact of the Covid-19 virus is peaking in 2020 and education systems around the world are beginning to conduct distance learning using ICT tools in the teaching process. The results of this research emphasize the need for further development of ICT tools in education and the possibility of a hybrid model of study, or a combination of contact and online learning during study. Exercises and practical work of students should certainly be held as a contact form, while individual lectures and seminars could be held through distance learning. All stakeholders in such learning should take into account the possibilities of digital technology, the wide range of content that technology provides access to, flexibility, comfort from work from home, independence of place and time for learning and studying. When benefits are aligned with learning and study goals, they promote the quality of teaching and learning. The application of digital technology in the educational process should

be approached with caution because it involves direct educational work with vulnerable groups, children of early and preschool age and is especially responsible for the initial education of future educators and their sensitivity to all the advantages and disadvantages of modern digital technology. Cooperation and coordination at all levels of education and the ministry, strategic and action planning of scientific and professional work, professional development and continuous organizational support at the faculty allow improving the quality of teaching, student satisfaction with studying and ensuring quality and learning outcomes of professionals for the technological society of the future.

References

- Agencija za znanost i visoko obrazovanje. (2021). Studenti i pandemija: Kako smo (pre)živjeli? <https://www.azvo.hr/hr/azvo-vijesti/2616>
- Aguilera-Hermida, A. P. (2020). College students' use and acceptance of emergency online learning due to COVID-19. *International Journal of Educational Research Open*, 1. <https://doi.org/10.1016/j.ijedro.2020.100011>
- Ally, M. (2019). Competency Profile of the Digital and Online Teacher in Future Education. *International Review of Research in Open and Distributed Learning* 20(2), 303-318.
- Borthwick, A.C. & Hansen, R. (2017). Digital Literacy in Teacher Education: Are Teacher Educators Competent? *Journal of Digital Learning in Teacher Education*, 33(2), 46-48. <http://dx.doi.org/10.1080/21532974.2017.1291249>
- Biošić, I., Miketek, D., Pnjak, I., Šarac, K. (2020). Istraživanje zadovoljstva studenata veleučilišta i visokih škola u Hrvatskoj s izvedbom online nastave. *Vijeće studenata veleučilišta i visokih škola Republike Hrvatske*. Zagreb.
- Dodatne upute vezano uz obustavu nastave na visokim učilištima. (2020). Republika Hrvatska, Ministarstvo znanosti i obrazovanja <https://mzo.gov.hr/UserDocsImages/dokumenti/Vijesti/2020/Dodatne%20upute%20vezano%20uz%20obustavu%20nastave%20na%20visokim%20ucilistima%20-%202013.%203.%202020..pdf>
- European Parliament and the Council of The European Union (2006). On key competencies for lifelong learning. Brussels: Official Journal of the European Union.
- Ferrari, A. (2012). Digital Competence in practice: An analysis of frameworks. JRC IPTS, Sevilla. http://jiscdesignstudio.pbworks.com/w/file/55823162/FinalCSReport_PDFPARAWEB.pdf
- Gupta, P. & Gupta, A. (2020). Impact of Covid-19 on Education sector. *Indian journal of applied research*, 10(12), 23-25.
- Hmelak, M. & Lepečnik-Vodopivec, J. (2012). Preschool teacher career and why individuals choose it. *Innovative issues and approaches in social sciences*, 5(2), 220-241. <http://www.iiass.com/pdf/IIASS-Volume5-Number2-2012.pdf>

- Jokić Begić, N., Hromatko, I., Jurin, T., Kamenov, Ž., Keresteš, G., Kuterovac Jagodić, G.,Lauri Korajlija, A., Maslić Seršić, D., Mehulić, J., Mikac, U. (2020). Kako smo svi mi? Rezultati istraživanja psihičkog zdravlja za vrijeme pandemije COVID- 19 u Hrvatskoj. Koronavirus i mentalno zdravlje: psihološki aspekti, savjeti i preporuke. Bogdan, A. (Ed.). Hrvatska: Hrvatska psihološka komora i HPD, 415-460.
- Kirova, M., Boyadzhieva, E. & Peicheva-Forsyth, R. (2012). Competencies and perceptions of teachers in the application of e-learning in science in secondary school. *Chemistry* 21(2), 282-295.
- Kuzminska, O., Mazorchuk, M., Morze, N., Pavlenko, V. & Prokhorov, A. (2018). Study of Digital Competence of the Students and Teachers in Ukraine. In *International Conference on Information and Communication Technologies in Education, Research, and Industrial Applications* (pp. 148-169). Springer, Cham https://doi.org/10.1007/978-3-030-13929-2_8
- Lasić-Lazić, J., Pavlina, K. & Pavlina, A.P. (2017). Digital Competence of Future Teachers. In *European Conference on Information Literacy* (pp 340-347). Springer, Cham, https://doi.org/10.1007/978-3-319-74334-9_36
- Lindberg, J. O. & Olofsson, A. D. (2010). *Online Learning Communities and Teacher Professional Development: Methods for Improved Education Delivery*. Hershey, New York: Information science reference.
- Matijević, M. & Topolovčan, T. (2017). *Multimedijaska didaktika*. Zagreb: Školska knjiga.
- Mlinarević, I., Stanić, I. & Zadavec, T. (2015). Primjena informacijske i komunikacijske tehnologije u odgojno-obrazovnom sustavu kao polazište nastavi usmjerenoj na učenika u osnovnim i srednjim školama. *Knjižničarstvo*, 19 (1-2), 47- 60.
- Reisoğlu, I. & Çebi, A. (2020) How can the digital competencies of pre-service teachers Be developed? Examining a case study through the lens of DigComp and DigCompEdu. *Computers & Education* <https://doi.org/10.1016/j.compedu.2020.103940>
- Samarasinghe, A.S. & Piri, I. (2020). Online Learning Experience of Construction Students during the Covid-19 Pandemic, Conference: Unitec Research Symposium, DOI: 10.13140/RG.2.2.24013.46565
- Simonson, M., Smaldino, S., Albright, M., & Zvacek, S. (2006). *Teaching and Learning at a Distance*. Foundations of Distance Education. New Jersey: Pearson Education.
- Organization for Economic Cooperation and Development (2020). *Education responses to COVID-19: Embracing digital learning and online collaboration*. Pariz: Organizacija za ekonomsku suradnju i razvoj. <https://www.oecd.org/coronavirus/policy-responses/education-responsesto-covid-19-embracing-digital-learning-and-online-collaboration-d75eb0e8/>
- Odluka o obustavi izvođenja nastave u visokim učilištima, srednjim i osnovnim školama te redovnog rada ustanova predškolskog odgoja i obrazovanja i uspostavi nastave na daljinu (2020). Vlada Republike Hrvatske, NN 29/2020.

- Velichová, L., Orbánová, D. & Kúbeková, A. (2020). The COVID-19 Pandemic: Unique Opportunity to Develop Online Learning, *TEM Journal*, 9 (4), 1633-1639, DOI: 10.18421/TEM94-40
- Zygairis-Coe, V.I. & Swan, B. (2010). Challenges of Online Teacher Professional Development Communities A Statewide Case Study in the United States In: Lindberg JO, Olofsson AD (ed.), *Online Learning Communities and Teacher Professional Development: Methods for Improved Education Delivery*, Information science reference (pp. 114-133). Hershey, New York.

E-Learning in Developing ICT Skills of Future Engineers

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Abstract

The aim of the research is to analyze the emerging didactic model in universities, determined by the integration of Information and Communication Technologies (ICT) into Education. The key component of the model is the e-learning approach. The adoption of this model was accelerated by the pandemic situation. The education institutions were challenged to adopt other ways of delivering study programs than face-to-face: distance, online or blended courses.

The paper presents the practice of implementing e-learning at the Technical University of Moldova (TUM); it highlights the strategies related to teaching, learning and assessment; the professional competences that teachers must demonstrate in the digital age; the impediments to the realization of this approach. The experience is demonstrated on the basis of transposing content for the course “Computer networks” into digital format for the bachelor students. A special focus was made on developing the ICT skills of future engineers, required for their professional careers.

The research revealed that the strong digital competences, the content knowledge and didactic competences of teaching staff are crucial in conceiving and delivering the e-courses. Different resources were offered – registered videos with teacher lectures and guides for laboratory tasks; case studies; presentation of the materials in a progressive difficulty. Development of students’ learning and technological skills was facilitated by real problems similar to the work context; by case studies that offered different learning experiences; by the participation of the students in the construction of knowledge.

Keywords: ICT skills, e-learning approach, e-course, distance education, blended education.

E-learning Concept

E-learning is one of the most frequently used subjects that are discussed all over the academic world during the last two decades. The Google search using the keywords “concept of e-learning” returned circa 8 billion results. The analysis of a set of resources – monographs, studies, textbooks, articles – mainly in English, revealed the existence of a multitude of

definitions for e-learning, with varying degrees of interference between them. Moreover, the concept of e-learning is misunderstood in various contexts, for various reasons, often because it refers to different things, and sometimes because the professionals from different domains interpreted it.

There exist studies and publications devoted to identifying and/or developing a unique definition for e-learning. Scholars from the Open University, Spain, had conducted a systematic review to agree on a definition of e-learning within an international project (Sangrà et al., 2012). We decided to follow this approach for several reasons:

- the extensive review of the e-learning concept was based on the analysis of the literature, drawing from peer-reviewed journals, books and open virtual spaces;
- the study used the methodology recommended by experts in educational research;
- the different definitions of e-learning were analyzed and aggregated into an inclusive definition that considers the four main categories in which authors conceptualize e-learning: technology, delivery systems, communication, and educational paradigms;
- the opinions of recognized experts in the field of education and technology were used to conclude the final version of the e-learning concept.

Understanding e-learning is crucial for academics as this concept is a technology-mediated learning approach of great potential from the educational perspective (Valverde-Berrocoso et al., 2020) that is implemented in practice in educational context to prove its effectiveness and the role for ICT in life. The inclusive definition of e-learning to which arrived the authors (Sangrà et al., 2012, p.152) provides a useful conceptual framework for further identification of the different models in which e-learning would apply:

“E-learning is an approach to teaching and learning, representing all or part of the educational model, that is based on the use of electronic media and devices as tools for improving access to training, communication and interaction and that facilitates the adoption of new ways of understanding and developing learning”.

This definition represents a common framework for scientists in developing theoretical and empirical research of e-learning models. The overall glue that links different elements, interrelated features and tendencies is the educational aspect. All components of the ecosystem, called e-learning, aim at facilitating and enhancing the learning process of learners and in the long term developing their competencies needed for life.

Kenneth Fee, a learning and research professional, performed a comprehensive analysis of the concept of e-learning and proposed a similar definition (Fee, 2009, p.16): “E-learning is

an approach to learning and development: a collection of learning methods combined with use of digital technologies that enable, distribute and enhance learning”.

Aparicio et al. (Aparicio, 2016) state that the e-learning concept was not the first term to be used in describing the use of ICT to enrich or facilitate the learning process. They identified 23 concepts that refer to the technology mediated learning (online learning, virtual learning, blended learning, distance education, etc.).

Discussions on the definition and different interpretations of the term e-learning can be explained if one considers that this concept is at the intersection of the fields of education, teaching and learning with the ICT, course delivery by ICT tools. Undoubtedly, the concept of e-learning resulted from educational technology and distance learning concepts. Both have really influenced the intensive use of ICT for educational purposes, but none can be strictly equivalent to e-learning.

E-learning Models

The large number of e-learning definitions is conditioned by the fact that each of them refers to a certain e-learning model, which each author/group of authors probably experienced or had points of contact with. Each model involves certain technologies, certain ways of communication between the subjects of the educational process and also certain models of learning design (Tchoshanov, 2013).

We present the short description of these models, as adapted versions of the models proposed by Kenneth Fee (Fee, 2009, p.20).

Model I – Online courses. This is a classic pattern that some authors and academics consider to be the only true form of e-learning. Content is delivered to the learner via online tools. Initially, this type was realized through the web. This is one of the most common ways, that was developed largely as new technologies and web services came forth. Another way of delivery is through the Intranet, using most often a Content Learning Management System.

Model II – Blended learning. It has roots in distance learning. This is a well-known model, in which students interact very intensely with the teacher or other students, having access to online content. There are different forms of blended learning.

- **Sandwich.** This is a classic mix, with pre- and post-course activities offered online. The filling of the sandwich is a traditional course, packed with digital resources.
- **Milestone.** The course starts online and continues face-to-face (group work or one-on-one) as milestone events, which contribute to the achievement of the course outcomes.

- Knowledge and skills. Online resources are used to develop mostly knowledge and the face-to-face approach is used for skills development.
- Complementary resources. Online resources are provided as a backup to face-to-face activities, and students have free access to course resources when they are not in the classroom.

Model III – Informal learning. This is called also self-managed learning. The students, usually being employed, use technology to communicate with colleagues and learn, without leaving their work place.

Model IV – Live e-learning. It includes synchronous live learning for students in different locations, who participate together at a set time.

Model V – E-performance support. It is a term for training and learning available in the workplace, facilitated by a technology system, designed to perform certain tasks or in the form of an instruction manual to perform certain procedures. It could include live contact with a tutor to discuss, for example, various difficult cases.

Model VI – The digitally resourced classroom. It represents a traditional classroom, but ICT upgraded, equipped with a set of digital tools, devices with Internet access, projectors and touch-sensitive screens, for sharing audios and videos, simulations and other digital assets This is similar to model IV, live e-learning, but de facto it is face-to-face.

This classification is not definitive. There can be more models and updates of the existing ones, with the development of new experiences, and technologies. When selecting for implementation one or another model, one should focus on the models' potential and benefits for the achievement of the learning goals. Different e-learning models may be suitable for different situations and needs, depending on the learners needs', teachers' competences, and study topics.

Implementation of E-learning in the course “Computer Network”

The necessity to implement the e-learning paradigm came as a shock for all decision makers, teachers, and students in 2020, with restrictions imposed by the pandemic. Before this mark, e-learning was like a free choice both for Higher Education Institutions, as entities, and for faculties within each institution. The need to implement the e-learning at scale challenged the teachers in the first run. The methodology adopted by the Ministry of Education, Culture and Research delegated the responsibilities for the identification of adequate solutions and their deployment to the decision makers of Higher Education Institutions with the successive

transmission of the duties to academic staff (Holotescu, 2020). Each institution adopted different approaches and technologies according to its experience and needs.

We present as a study case the implementation of the e-learning approach in the course “Computer Networks” which is included in the study programs for Bachelor students at the Technical University of Moldova. The course tackles the theoretical concepts, the roles of the components of a computer network and its functioning. The course covers real-world usage of networking technology to improve learners understanding of the phenomena behind the transporting data and use of the ICT for life services. Students learn about network topologies, physical devices, layered abstractions, routing algorithms and routing protocols. Also, they get an introduction to various concepts of security, and different vulnerabilities of networks, for understanding the security of physical media.

The practical component of the course is intended to improve students’ understanding of key concepts. They study how to describe different **types of computer networks**; about the design principles; **how to configure and simulate the functioning of the prototypes of small networks** and also understand **how data are transmitted securely**. They are supposed to gain enough confidence to learn this subject independently by using a software simulator. Tutor and peer-to-peer support are foreseen for difficult subjects that need more clarification.

This is a compulsory course for Bachelor level students as well as for employees who need to understand how a computer network work. By the end of the course, the learners got insights into how the inner functioning of a computer network takes place; what are the benefits of computer networks; how to effectively plan and design a computer network, what is the TCP/IP (Transmission Control Protocol/Internet) model, how routing algorithms and routing protocols act.

To be able to understand in the best possible manner the content of this course, the students should have a good knowledge of the basics of computers. Also, a stable Internet connection and a class of computers are required.

The e-course was projected to implement a suitable instructional design-based ICT integration to allow students to achieve both course outcomes and knowledge society skills. The adopted e-learning approach follows model 2 – blended learning. It suits most of the students’ needs and the teachers’ philosophy. It is a mixture of sandwich and milestone, as well as knowledge and skills versions. The lectures were delivered online in the form of recorded videos supplemented by additional digital resources structured in topics and placed in a Content

Learning Management System – MOODLE³, maintained by the TUM platform. Learning activities for each topic were provided to ensure the students' knowledge development, in the form of quizzes, mini-research tasks, and group discussions of tasks and possible solutions to lab problems.

The laboratory works were performed in a face-to-face environment using special software Cisco Packet Tracer for the simulation of the network configuration and tasks. Packet Tracer was created by Cisco Systems and is provided for free distribution to faculty, students, and graduates who are or have participated in the Cisco Academy program (Network Academy, 2020). It is an intelligent networking technology teaching and learning tool that allows learners to build simple and complex networks, investigate how networks function, perform different tasks settled in virtual labs and practice solutions to real life problems. This software allowed students to design models of virtual networks according to the lab requirements, to visualize the graphical representations of these networks, to monitor the transfer of data through the networks, to describe and save the outputs, to collaborate with their classmates, to ask questions, to discuss algorithms for solving constrain problems settled as learning and assessment tasks.

The participants consisted of 98 students, Faculty of Computers, Informatics and Microelectronics, who attended the compulsory course Computer Network at their first study year, Bachelor level, the first semester of the academic 2021/2022 year, along with a teacher and a mentor. The teacher had recorded a series of videos, with a total duration of 48 hours, divided into two categories – lectures and laboratories – associated with course outcomes, grouped in domains as follows: devices' configuration, connection types, editing tools, etc. The lectures were thought out, elaborated and taught in a logical order so that the students could apply to Cisco devices what they had learned about the fundamentals of functioning of computer networks. The explained theory was followed by concrete examples, which simulate the functioning of devices in a real environment. The students were presented in a smart way how to use the software in which they can create and simulate the activity of computer networks. The teacher explained in videos everything the learner needs to understand when working with networks, from setting up switches and routers, by configuring their interfaces and assigning IP addresses, to setting up virtual local area networks.

Laboratory activities are an important part of networking education. Packet Tracer provides visual simulation of equipment and network processes. The students can spend as

³ MOODLE. <https://moodle.org/>

much time as they want doing standard lab exercises with Packet Tracer, so they can choose to work from home for learning activities. Packet Tracer also includes a lot of demos in a variety of formats, from audio podcasts to longer or shorter explanatory videos to help the student explore how this technology can support technical needs (Tutotial Pit, 2020).

After completing the course, the students can practically configure the routers and switches, and implement IP addressing schemes that are used to maintain both small and large networks. As the students use the software Packet Tracer with a graphical interface to create the virtual simulation environment, then they use Command Line Interface to simulate the real environment, they gain experience in the case of a network created with real equipment and develop professional skills for the future workplace.

With this course the students got an overview of the fundamentals of computer networks, they understood the **principles of computer and information technology**, models, architectures, protocols, and networking components for a series of specializations in which they are enrolled in: Automation and Computer Science; Software Engineering; Applied Computer Science; Information Management. The skills they will further develop from these specializations are quite relevant to implementing ICT for life. The students earn a Networking Academy badge and are prepared for Cisco Certified Network Associate certification that is a must for anybody who wants to have a career in networking (The Cisco Learning Network, 2021). This certification validates the candidate's skills to install, configure and troubleshoot a network.

Discussion

Developing a set of competences in future engineers is a crucial task in order to align learning with the economy's needs. These competences refer to employees' professional activities and mandatorily include the digital skills. Both the e-skills for all European citizens (European Union, 2016) as well as specific e-skills required by industry represent challenges for tertiary education. E-skills are part of engineering competences, and their separate consideration is just for explicit evidence. In reality, the e-skills are developed in a concrete learning environment, applied to real life problems and tasks from specific domains.

In this paper we presented a study case of implementing the e-learning approach in a certain model, partly imposed by the pandemic situation, for setting the basics for developing the professional competences of future engineers. There is much emphasis on the use of technology to support the educational process at the policy level and at the society needs level (European Commission, 2020), but the success depends on many variables:

- the technology infrastructure;
- the teachers' readiness for the e-learning paradigm;
- the infused teaching and learning strategies;
- the students' knowledge level and motivation to learn.

These are key factors, in our opinion, for the improvement of learning results and for developing students' professional competences required by future jobs. The digital era needs reconceptualization of traditional didactics in the sense of revising its role. The new didactics, called e-didactics (D'Angelo, 2007), is the didactics for e-learning, for integrating ICT in the educational process. The change in learning is requested: passive learning must turn into more active learning, with the motivated involvement of the student, oriented towards the discovery of the meaning of the new knowledge; teacher-based learning are to be shifted to student centered learning. The need for this change has become obvious in the e-learning approach, where teaching in the traditional sense is limited: if in classical didactics the format of the educational process is face-to-face (and hybrid or mixed, in some cases), in e-didactics the format is in most cases mixed or online. With the change in the format of the educational process, the teaching and learning space changes: the classroom is replaced by the virtual space, represented by different learning management systems, interactive communication platforms and social networks.

The teachers' readiness for the e-learning paradigm is different, depending on several factors: their level of access to digital infrastructure, their level of digital and professional skills, their desire to implement e-learning in the professional activity, their degree of participation and involvement in various projects and professional development courses, either organized or free choice, individually (Dumbraveanu, 2021). We consider that the study case presented is a good example of promoting the e-learning approach in developing engineering students' ICT skills for life. The students develop competences needed for many computer networking jobs: Computer Network Architect, Network Systems Administrator, Computer Systems Analyst, and Computer Network Support Specialist.

The paradigm shift becomes more evident by changes in teaching and learning strategies and in educational resources. A combination of a variety of digital resources – video-lectures with explanations and demo cases, that can be accessed any time from any space; video-guides for laboratory works with descriptions of tasks and demo exercises; simulations of study situations available via Cisco Trace Packet software were used. Problem-solving activities in concept and skill-building, design, and troubleshooting; links to sites with examples of solved

problems, of explained difficult cases; step-by-step solutions to different study situations were provided. The modes and means of communication were also enriched: the exchange of ideas in face-to-face group meetings or online discussions, chats through social networks on subjects related to learning and assessment activities; group-work and interactions. The teacher became a mentor and the student changed the role: from a receiver of information to an active learner and seeker of study solutions. The assessment tasks were changed accordingly: from traditional tests and paper works to the presentation of the results as solutions to different scenarios using Cisco Trace Packet simulator: model building inquires with student explications and digital proves of networking concepts; algorithmic problem solving in the development of networking procedural knowledge; modeling of networking device algorithms and protocols; constraint-based problems with multiple correct solutions; diagnosing and fixing the simulated network from a previously network file with intentional errors.

The students enjoyed the way of studying and applying their knowledge. They were motivated by the real problems they were faced with and were challenged by the correct solution as well as the possibilities to find answers to their questions in provided resources. The group work and the teacher suggestions and tips were very much appreciated.

From students' opinions: "Very complete e-course, covering all the material in an easy way to study, very well structured in a logical manner. It is better than other courses I was involved in. The teaching style and delivery is spot on"; "After completing all the practical work, we were able to learn and understand how to configure equipment in a LAN using the Cisco Packet Tracer tool. We can apply this knowledge in practice when creating and manipulating a LAN for the individual project"; "By studying this course we can have a number of benefits: we can further study network administration by obtaining Cisco certificates, which are internationally recognized; we can independently create logical topologies for some small homes and offices; we can gain an advantage when we participate in an internship in the field of networking and it is also a very important factor in employment".

Conclusion

The e-learning approach is the biggest challenge for teachers, as well as for learners: it changes many components of the learning process and determines the efficiency and the success of the educational endeavors. This concept comprises technology, communication, delivery systems, and educational paradigms. The way of combining of these components enveloped by teacher philosophy in a concrete learning environment results in various e-learning models. The authors described the implementation of an e-learning model for developing engineering

students' competences. Learning with ICT tools about technology is an iterative process for future engineers that enriches their professional competences and lays the foundation for their future employment.

References

- Aparicio, M.; Bacao, F.; Oliveira, T. (2016). An e-Learning Theoretical Framework. *Journal of Educational Technology and Society*. 19(1), 292-307.
- D'Angelo, G. (2007). *From Didactics to e-Didactics: e-Learning Paradigms, Models and Techniques*. Napoli: Liguori.
- Dumbraveanu, R. (2021). Challenges in the Current Distance Education Paradigm. 17th International Scientific Conference "eLearning and Software for Education", Proceedings (pp. 433-443). Bucharest, Romania. [DOI:10.12753/2066-026X-21-197](https://doi.org/10.12753/2066-026X-21-197).
- European Commission. (2020). Digital Education action Plan 2021-2027. Resetting education and training for the digital age. https://education.ec.europa.eu/sites/default/files/document-library-docs/deap-swd-sept2020_en.pdf.
- European Union. (2016). The European Digital Competence Framework for Citizens. doi:10.2767/00458.
- Fee, K. (2009). *Delivering E-Learning: A Complete Strategy for Design, Application and Assessment*. Kogan Page London and Philadelphia.
- Holotescu, C., Ivanova, M., Grosseck, G., Andone, D., Gunesch, L., Nedelcu, V., Dumbraveanu, R., Constandache, L. Romanian Educational System Response during the Covid-19 Pandemic. 16th International Scientific Conference "eLearning and Software for Education", Proceedings (pp. 11-30). Bucharest, Romania. DOI:10.12753/2066-026X-20-171.
- Networking Academy. (2020). Cisco Packet Trace. <https://www.netacad.com/courses/packet-tracer>.
- Sangrà, A., Vlachopoulos, D., Cabrera, N.(2012). Building an Inclusive Definition of E-Learning: An Approach to the Conceptual Framework. *The International Review of Research in Open and Distributed Learning*, 13 (2), 145-159. <https://doi.org/10.19173/irrodl.v13i2.1161>.
- The Cisco Learning Network. (2021). Certification:Build your IT future. <https://learningnetwork.cisco.com/s/certifications>.
- Tchoshanov, M.(2013) *Engineering of Learning: Conceptualizing e-Didactics*. UNESCO Institute for Information Technologies in Education. <https://iite.unesco.org/pics/publications/en/files/3214730.pdf>.
- Tutorial Bit. (2020). Cisco Packet Tracer. <https://tutorialbit.com/cisco-packet-tracer/>.
- Valverde-Berrocso, J., Garrido-Arroyo, M., Burgos-Videla, C., Morales-Cevallos, M. (2020). Trends in Educational Research about e-Learning: A Systematic Literature Review (2009–2018). *Sustainability*, 12, 5153. doi:10.3390/su12125153.

Presentation of heritage topics using immersive technology while gaining STEM-based outcomes

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Abstract

The importance of science, technology, engineering, and mathematics (STEM) in education cannot be over-emphasised. But the importance of this does not diminish the unattractiveness and disinterest of students in STEM subjects. On the other hand, the importance of cultural heritage preservation as one of the sustainable development goals becomes a powerful ally in eliminating the STEM subjects' negative connotations. The living heritage, the mother tongue, is a tool for the transmission of values and information, and it is frequently employed in the preservation and transmission of intangible cultural heritage. By making cross-curricular interdisciplinary connections, STEM subjects become more likable and interesting. Applying immersive technologies with a change in teaching strategies and methods that rely on the specialized sets of terms and expressions makes learning the subjects easier and improves retention. It also increases the interest of the students, makes the learning process more enjoyable and provides them with a better understanding of the subjects.

The aim of this paper is to highlight the value and importance of using immersive technologies, such as augmented reality, as a powerful tool for the presentation of the living intangible cultural heritage of the Republic of Croatia as an integral component of digital storytelling in teaching STEM subjects. The paper is based on research whose main objective was to examine the positive impacts this interdisciplinary approach has on preserving intangible cultural heritage and promoting students' engagement and creativity, as well as identify potential challenges for the application of this methodology to selected STEM subjects.

Keywords: education, language, cultural heritage, augmented reality, storytelling, cross-curricular

Introduction

Each decade is unique due to rapid technological breakthroughs. Only thirty years or fewer ago, the majority of people had no concept what a touch screen was and could not envision a gadget reacting to simple finger touches, which we now use on a daily basis and see all around us. Life was much more different fifty years ago (Walker, 2012). These improvements have illuminated the globe, made life simpler and better, aided business growth, facilitated communication, made learning more exciting, and bolstered scientific study. Not only is technology improving, but individuals are also eager to adopt emerging technologies as soon as they are released.

The Fourth Industrial Revolution (Schwab & Davis, 2018) marked a significant change in the way people live, work, and interact. It is a new era of human growth, made possible by enormous technological advancements comparable to those of the first, second, and third industrial revolutions. This, along with the emergence of the Covid pandemic, greatly affected all aspects of our lives. It has also drastically changed and impacted the teaching processes, the ways we teach and deliver content. An integral part of every teaching process has become the use of ICT. Although the way today's young people communicate and interact is unthinkable without ICT, there is still a great need to humanize this technology and reduce the feeling of alienation.

Perception and attitudes towards mathematics

Mathematics will be the focal point of the STEM-based cross-curricular approach that will be presented. The reason is the author's experience, and results from various research analyses (Langoban, 2020), that it is the most disliked and "problematic" secondary school subject.

The survey employed to assert certain students' attitudes toward mathematics (Stenmark, 1991; Rehner, 2004), used open-ended statements - metaphorical questions, which were then evaluated. Some examples of such questions are: What kind of food would mathematics be if it were a food? What color would mathematics be if it were a color? What kind of music would mathematics be if it were music? These questions were posed to students in lower secondary school, with interesting results (Rehner, 2004). When asked what food would be math, the majority of students agreed that green vegetables such as broccoli, kale, or zucchini would be appropriate. They dislike the taste of these vegetables, but they must consume those because they are nutritious and beneficial to our physical wellbeing. As a result

of this, it can be concluded that students view math as a necessary skill, but it is an uncomfortable part of the "school diet." Students who really like mathematics compared it to bread ("basic food"), fruit salad ("contains a variety of ingredients"), and lasagna ("contains a variety of ingredients") ("consists of different layers"). These responses indicate that students have varying perspectives on acquiring the necessary math knowledge, which is diverse and layered in complexity. Students believe that the best color to represent mathematics would be black (which is associated with depression and evil), red (which is associated with anger and pain), or brown (associated with boredom). A small percentage of students who excel at math frequently stated that their favorite color would be blue because they believe it to be the color of intelligence and a sense of peace and tranquillity. The question of what mathematics music would sound like elicited a wide variety of responses. Numerous people have stated that mathematics is similar to classical music in that it is difficult to comprehend. Some have compared it to heavy metal music, which is considered to cause "headaches," while another student compared it to the music from the film "Jaws," which "instills fear in the bones."

Results obtained by TIMSS study⁴, also support these findings. The TIMSS - Trends in International Mathematics and Science Study is conducted within the IEA (International Association for the Evaluation of Educational Achievement). IEA research has gathered knowledge on various topics and subjects, and each of them has contributed to a deeper understanding of educational processes within individual countries and in a broader international context. TIMSS measures student achievement in mathematics and science in the fourth and eighth grades of primary school and in the fourth grades of secondary school (TIMSS Advanced). eTIMSS 2019, the main international survey of trends in knowledge of mathematics and science (Trends in International Mathematics and Science Study), was conducted in more than 60 countries around the world.

Higher achievements of Croatian students from both surveyed areas are related to attending early and preschool education, more frequent activities of parents related to pre-mathematical and pre-reading literacy at an early age, greater motivation to learn mathematics and science and a sense of belonging and safety.

⁴Nacionalni centar za vanjsko vrednovanje, Rezultati TIMSS 2019 – međunarodnoga istraživanja trendova u znanju matematike i prirodoslovlja, Nacionalni izvještaj za Republiku Hrvatsku. <https://www.ncvvo.hr/wp-content/uploads/2022/03/TIMSS-Nacionalni-izvjestaj-finale.pdf>

Fostering sense of belonging with cultural heritage

Preservation of cultural heritage and integration of it into the teaching process is becoming increasingly crucial as the twenty-first century introduces new potential for digital teaching and learning. While national curricula vary by country, the desire to understand our common European history, cultural legacy, and future concerns remains universal. Not only can cultural heritage be used to foster a feeling of belonging, it also provides a great foundation for STEM education.

According to the United Nations Educational, Scientific, and Cultural Organization (UNESCO, 2020), the protection of the world's tangible and intangible cultural heritage has become an increasingly multi - faceted effort due to the rate of cultural change. Therefore, it is essential for today's children and teenagers to acquire the heritage, traditions, and customs that define their identities and that of their country. In this study, we exploited the stratification of the Croatian language and local dialectisms to promote both education and the preservation of the rich stratification of the Croatian language.

Using ICT in Education

The advancement of information and communication technology (ICT) in the twenty-first century has resulted in significant changes in almost every aspect of human life, including school-based teaching and learning. Traditional classroom instruction is increasingly being supplanted by instruction that incorporates a variety of multimedia components and opens up new avenues for education. Additionally, the following objectives are stated in the European Commission's Digital Education Action Plan⁵:

1. improved use of digital technology for learning and teaching;
2. development of digital competencies and skills necessary for life and work in the age of digital transformation;
3. support for schools with regard to broadband networks and the use of a new tool for self-assessment of technology use in teaching and learning (SELFIE).

Innovation in education systems, defined as the acceptance of new services, technologies, and development competencies within educational institutions, has the potential to improve learning outcomes while also increasing the educational system's fairness and efficiency (OECD, 2016). There is a great significance of information communication systems in education (Tantall, 2020), as well as utilizing to facilitate learning and teaching.

⁵ European Commission's Digital Education Action Plan, 2018, <https://education.ec.europa.eu/focus-topics/digital-education/digital-education-action-plan>

Additionally, the European Commission⁶ noted that innovation is most effective and sustainable when well-trained teachers embrace it and are integrated into clear teaching goals, and that more work needs to be done to maximize the use of digital resources for educational purposes. These objectives emphasize the importance of researching effective ways to integrate ICT into classroom instruction, as well as the factors that contribute to the successful integration of ICT into teaching and learning, as well as the factors that represent the greatest barriers to the use of ICT in learning and teaching. It is critical to emphasize that digital learning enables self-regulation, independent and collaborative learning (Matijević & Topolovčan, 2017), which aligns with the constructivist pedagogical requirements of today's schools. It is also stated that constructivism is an approach and theory that is based on building knowledge through one's own experiences. It rejects learning (self) by listening to teachers/lecturers and instead emphasizes students' independent perception and processing of information. The constructivist approach fosters the child's initiative and independence, and the student becomes the center of the educational process. Constructivism rejects mechanical learning and acceptance of information content, and believes that understanding cognitions occurs through the interaction of newly acquired knowledge and prior experiences (Jukić, 2013). Digital technologies enable constructivist learning by allowing for the connection of learning to context and practice. The use of ICT in learning and teaching can aid in various aspects of knowledge construction, and as more students incorporate ICT into their learning processes, these benefits will become more pronounced. It is emphasized (Matijević & Topolovčan, 2017) that digital technology is an indispensable component of the modern learning environment and that it should be used to benefit the student and his constructivist learning by enabling learning through research and problem solving, learning through play and projects, and collaborative learning. The primary determinants of the modern teaching model are „the use of technology as a tool in the process of research and collaborative learning, data collection, project implementation, and presentation; avoiding technology as a substitute for human interaction and communication, that is, the use of technology as a means of communication in and of itself; encouraging multimodal communication and the use of multimodal materials and educational resources in teaching" (MZO, 2019).

Secondary school teachers can influence teenagers towards accepting ICT in all field of life and adopting technology as a tool for their development and future careers.

⁶ Communication From The Commission To The European Parliament, The Council, The European Economic And Social Committee And The Committee Of The Regions on the Digital Education Action Plan, <https://eur-lex.europa.eu/legal-content/EN/TXT/HTML/?uri=CELEX:52018DC0022&from=HR>

Augmented Reality (AR)

Schools and education systems have changed away from the conventional method of teaching facts and concepts in isolation in recent years and toward a more constructivist approach to learning. The need for a cross-curricular approach (Drake, 2012) is related to schools' objective of educating students for the pace and complexity of the twenty-first century, which demands individuals to draw from a variety of disciplines and solve problems with interconnected components. In the classroom, interdisciplinary links must be formed and structured properly. As a result, it is crucial to remember that when educators build an interdisciplinary connection, they begin by integrating educational materials or objectives and then work to fully show or solve a specific subject or problem.

AR (Augmented Reality) is a relatively new technology (in education) that enables a person to observe his or her environment by adding visual characteristics that "enhance" reality. As Fink (2018) points out, Augmented Reality has existed since the 1950s, when Morton Heilig, a cinematographer, believed that going to the movies should enable a person to engage effectively with their surroundings via the use of all of their senses. In the mid-1990s, mobile devices lacked the processing power required to facilitate the development of mobile Augmented Reality applications. With the increase in device power and the number of embedded sensors, applications became more accessible to the general public. The way we work, learn, play, and engage with the world as a whole is changing as a result of augmented reality. It is the ideal method for viewing things that would be difficult or impossible to see in any other way. With hundreds and thousands of compatible devices and countless of augmented reality programs accessible for download in app stores, augmented reality is fast growing into a large ecosystem. Large multinational corporations are not even considering new means of promotion without including AR/VR, and IT goliaths are always on the lookout for start-ups to invest in and assist the development ideas for this concept. They want to be a part of something interesting, but they also want to define the trends, not simply follow them. Immersive technology engages our students in ways that were previously impossible.

Integrating the stratification of the Croatian language, local dialectisms with building a sense of proportion and application of ICT in teaching

A scenario based on cross-curricular approach has been created and implemented for this research purposes. By placing a specific subject in a larger perspective, linking it to a science subject, and incorporating augmented reality technology, a genuine and knowledge-building learning experience is created. Numerous educators struggle to maintain student

engagement and motivation in their classes. The primary issue is mindset. We cannot engage pupils and enhance their success until we change their mentality, which is not only that math is difficult, but also that it is something to be disliked.

When it comes to presenting heritage successfully in education, specially in math classes, the most successful approach is using elements of gamification with storytelling. They increase pupils' motivation to do more than they initially intended. On the other hand, negative effects like time monitoring and rivalry should be avoided. It's because students dislike feeling pressured and dislike being diverted from their primary course of study.

The simplest method to incorporate all of this is by the use of a cross-curricular approach strengthened by ICT and gamification, which connects Croatian language learning, cultural heritage preservation and math. When an individual engages in an activity that brings him or her joy and fulfillment, other motivating reasons emerge, such as a desire to achieve, self-confidence, and comprehension.

According to the Ministry of Education's Decision on the Enactment of the Croatian Language Curriculum for Primary Schools and Gymnasiums in the Republic of Croatia (NN, 2019), the purpose of learning and teaching the subject Croatian language is to prepare students for clear, accurate, and appropriate communication in the Croatian standard language, as well as the acquisition of knowledge about language as a system, and free expression of thoughts and feelings. Additionally, the purpose is to raise awareness of the importance of preserving Croatian dialects and enabling people to express themselves creatively in local dialects. This was one of the main reasons for choosing dialect for cross-curricular connection.

The principles upon which the curriculum is founded in all of its components promote the development of integrity, linguistic and cultural identity, a sense of patriotism, nationality, and belonging to Europe's multicultural and multilingual community. Language stratification is taught and studied throughout all cycles and years.

For math topic was chosen a topic from cycle measurement: Determine measurable characteristics of objects or phenomena in everyday situation and apply measurement in solving mathematical problems and problems in other educational areas and everyday life.

The activity includes a map of Croatia with differently colored areas entitled "Grabilica", the Croatian word for ladle. In addition, students receive a worksheet in mathematics, which contains 6 tasks in which they need to calculate different volumes obtained using different ladles. Also, a different term (dialect) was used for term „grabilica“ in each task. At the end of the activity they should have a map like in the Fig 1., a map of Croatian names for soup utensil with the etymology of the word.

Another version, AR version of this activity, slightly modified, uses the same content and materials, only the map is presented in augmented reality, and with each click on number in a particular geographic area, a math task appears in the text of which is the dialectic of the word ladle.

Figure 1.

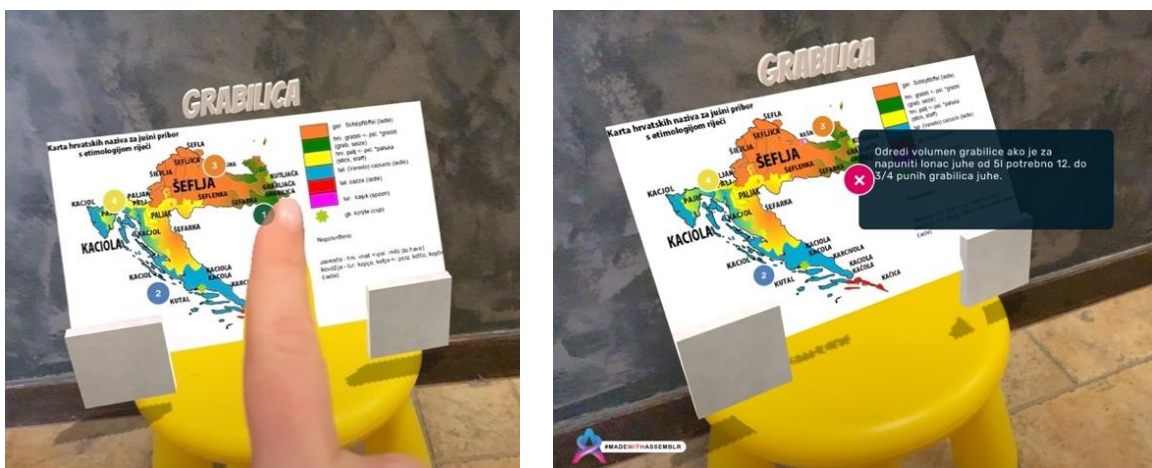
Croatian word for ladle by different dialects with etymology (Handelja,2014)



Among the large number of available AR applications for educational purposes (Bekeš, 2021), the AssemblrEDU application was selected and used to create an AR experience which is triggered by mobile device scanning an QR-like code that is given to students. The activated AR experience is shown in Fig 2.

Figure 2.

Presentation of dialect using AR and AssemblrEDU app, Author's own work, CC BY-SA



Determining the impact of presenting dialectism with AR

The purpose of this study was to determine the impact of incorporating heritage topics (dialectalisms) presented through augmented reality into a secondary school math class. When augmented reality is used in education, the primary goal is frequently to increase students' motivation. This paper contributes to this field by posing the following research question: Does incorporating augmented reality while presenting heritage topics into the teaching process of math lesson affects students' attitudes, motivation and achievement?

The study involved 63 students, all of whom were taught by the same teacher and were divided into two groups. With one experimental group of 21 students, augmented reality was used to present heritage topics, while the other 42 students served as a control group, using the same content without the use of AR elements. The attitudes of students aged 16–17 (2nd grade of secondary school) in the teaching of mathematics and the Croatian language after implementation of the teaching scenario and the influence of attitudes on student motivation were investigated. The research was conducted by surveying students. The survey instrument was a questionnaire containing 13 questions, of which 3 questions were open-ended, and 10 questions were in the form of an assessment scale (Likert scale).

Participants were asked to respond on a seven-point Likert scale with a response anchor at each rating point (1 = Strongly Disagree, 5 = Somewhat Agree, and 7 = Strongly Agree), followed by three open-ended questions for debriefing purposes. "I am satisfied with today's lesson," stated statement 1, followed by an open-ended question, "Please briefly explain your response to statement 1 above." The teacher stated that this was a question to assess the quality of future lessons and engagement and also motivate students to describe their truthful thoughts and ideas. The results of statement 1 indicate that students reacted positively to the use of augmented reality in presenting heritage topics. It was discovered that 86% of participants in the experimental group were extremely satisfied with the lesson, compared to 57% of students in the control group. Additionally, 59% of students in the experimental group stated that their satisfaction was primarily induced through the use of augmented reality. The 49% of students from control group stated that reason for satisfaction with the lesson was uncommon subject integration.

"I find the connection between dialectism and mathematics intriguing." - statement 8. was also followed by an open-ended question: "Please briefly explain your response to Statement 8." Only 7% of all students expressed disagreement with this statement. What's particularly satisfying is that 81% of students in the experimental group did not identify mathematics as unappealing in this case; rather, they saw it as a fun game element to incorporate

into their analysis of dialectisms. The control group agrees with this statement to a lesser extent, 51%.

It is clear that these differences emerged from using augmented reality, and it also illustrates the importance of making cross-curricular connection in order to motivate students in math classes while preserving cultural heritage.

Limitations

Replicating the experiment with a bigger sample size would undoubtedly improve the applicability of the research findings. Although the research revealed a significant difference in output between the experimental and control group, preferring the experimental group due to the fact that both groups had almost the same attitudes and motivation, it is not entirely certain that this is the result of incorporating cultural heritage elements with AR presentation into teaching. Also, there is a need to survey students prior to conducting described activity, about the level of augmented reality usage to be able to draw more conclusions about its impact.

Conclusion

To conclude, we would like to reiterate what has already been stated in the paper: cross-curricular connections integrated with ICT have a significant impact on students' learning and interest in the subject. The interaction of students with AR and cultural heritage topics should be studied more thoroughly and observed in action. All of this is done in order to improve and enhance the teaching quality, cultural heritage preservation and 21st century skills. Because measurement is such an integral part of life, it is critical that students grasp and comprehend the field of mathematics and are able to apply what they learn in class to real-world situations. Mathematics teachers should be aware that by teaching mathematics, they are imparting certain social skills to students and contributing to the development of a critical, rational, self-initiated society. Students must accomplish much more than simply repeating previously learned procedures for completing assigned tasks while studying math. Also, the presentation of cultural heritage topics with augmented reality in math classes not only humanizes technology but it also boosts sense of satisfaction. The augmented reality tools and techniques could be used in the incorporation of critical-thinking skills, cooperation, communication and problem-solving strategies.

References

- Bekeš, E.R. (2021). Creating multisensory learning experiences that go beyond the limitations of traditional media. 44th International Convention on Information, Communication and Electronic Technology (MIPRO). 587-590. doi: 10.23919/MIPRO52101.2021.9596652.
- Drake, S.M. (2012). Creating Standards-based integrated curriculum: the common core state standards edition, CA: Thousand Oaks.
- Fink, C. (2018). Metaverse - An AR Enabled Guide to AR & VR. Cool Blue Media, 1st edition.
- Hendelja, A. (2014). Klub putnika. Zbirka, putoskop, Šeflja, kutlača, paljak, kaciol, grabljača ili pak zaimača. <https://www.klubputnika.org/zbirka/putoskop/3822-seflja-paljak-kaciol-grabljaca-kutlaca-ili-pak-zaimaca>
- Jukić, R. (2013). Konstruktivizam kao poveznica poučavanja sadržaja prirodnoznastvenih i društvenih predmeta. Pedagogijska istraživanja. 10(2), 241–263.
- Langoban, M. (2020). What Makes Mathematics Difficult as a Subject for most Students in Higher Education?. Vol. 9., 214 – 220.
- Matijević, M. & Topolovčan, T. (2017). Multimedijaska didaktika. Zagreb: Školska knjiga.
- NN, Narodne novine (2019). Volume 10/19, 215 - 253
- MZO, Ministarstvo znanosti i obrazovanja (2019). Vrednovanje eksperimentalnoga programa Škola za život u školskoj godini 2018./2019. Zagreb: Ministarstvo znanosti i obrazovanja.
- OECD (2016), Innovating education and education for innovation. The power of digital technologies and skills, Paris: OECD Publishing. <https://doi.org/10.1787/20769679>
- Rehner, T. (2004). The interweaving of reading as a mode of learning and mathematics as a way of knowing in geometry. Dissertation Abstracts International, 65(07), 2534
- Schwab, K. & Davis, N. (2018). Shaping the Future of the Fourth Industrial Revolution: A Guide to Building a Better World. Penguin Random House.
- Stenmark, J. K. (Ed.). (1991). Mathematics assessment: Myths, models, good questions, and practical suggestions. Reston, VA: National Council of Teachers of Mathematics
- Tatnall, A. (2020). Encyclopedia of Education and Information Technologies. Springer.
- UNESCO. (2020). Basic texts of the 2003 Convention for the Safeguarding of the Intangible Cultural Heritage. Paris: Living Heritage Entity.
- Walker, G. (2012). A review of technologies for sensing contact location on the surface of a display: Review of touch technologies. Journal of the Society for Information Display. 20 (8), 413–440. <https://doi:10.1002/jsid.100>

Information and Communication Technology in the Function of Lifelong Learning

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Abstract

Man's need for learning is as old as humanity. The concept of organized education originate in ancient times, and the idea of lifelong learning originate in the middle of the twentieth century. By introducing information and communication technologies into the education system, time flexibility and even time duality have been enabled. A significant contribution is the overcoming of space constraints and enabling inclusion in education for all persons regardless of place and time. The concept of lifelong learning has provided education to all citizens who want to learn by teaching in a variety of institutions and forms, from formal, non-formal and informal. This concept has influenced the rejection of the elitist approach to education, the democratization of education, making it accessible to all, especially the introduction of information and communication technologies (ICT) in education. In addition to the above, lifelong learning arises as a need to raise the quality of life, but also the economic development of a society that is increasingly dynamic and requires learning even after formal education.

Keywords: future of education, ICT, lifelong learning.

Introduction

Accelerated development, constant reduction of prices and increasing presence of Information-Communication technologies (ICT) have a significant impact on society as a whole, and in particular on education and the role of teachers (at all levels of education) who are constantly changing (Kruschel and Hamisch, 2019). This focuses on the importance of lifelong learning, because being part of social events in an increasingly complex digital environment without the basics of digital literacy is almost unthinkable for a modern man. Adapting to innovative technologies in the new virtual conditions of interpersonal relationships and communication in all walks of life is becoming more complex and requires constant learning. Access to a large amount of information is a challenge for the education system of postmodern society. Wheeler (in Oyaid, 2009) lists 4 reasons why the use of ICT in education will change the role and status of teachers: 1) ICT will provide teaching media (instruments);

2) ICT will change the way of evaluation; 3) teachers must adapt to changes in education; 4) Teachers need to better align teaching with the characteristics of the human brain. This would mean moving away from the current teacher-centered (and program-oriented) approach to a more student-centered approach. Learning becomes independent of place and time, which significantly affects the new notion of upbringing and education, which in the world has already moved far away from that within the classroom (Snijders, et al., 2018). The emphasis is on the transition from memorizing information to critical thinking, responsible and safe use of information, and to finding and organizing information in the virtual world.

The informatization of education and the introduction of online educational programs have overcome many limiting factors for inclusion in education, from the distance from the place of residence to the educational institution, the inability to comply with private and work obligations to various limiting factors for people with health problems. Informatization of education includes the use of modern information technology such as computers, multimedia and network technology in education to promote the updating of educational concepts, reform of educational content and methods and ways of learning, to train high quality innovative talents and upgrade the quality of education, to establish new educational system that meets the needs of the social development (Wu, & Na, 2013). Despite the many benefits that the use of ICT in education brings us, there are many negative aspects. The application of ICT reduces the need for social contact and cannot replace the human element in the teaching process, although it can significantly improve it. The possibilities of organizing teaching processes that were unthinkable only a few years ago are opening up. Interactive, collaborative, creative learning are advantages that are developed by using ICT in the educational process, but obstacles and shortcomings must not be ignored, which is why it is crucial to recognize the advantages and limitations of integrating ICT into the educational process.

Yanez et al. (2019) point out that a society that is (live) with STEM technology is becoming more competitive and is showing its own progress in civilization, while on the other hand it is evident that innovations are increasingly obscuring important environmental and ethical conditions and violate social justice. The overshadowed rhetoric of educational “preparation” is insufficient covered the fields of educational sciences, especially pedagogy. Yanez et al. (2019) consider it important that students do not develop for some through the curriculum predetermined futures, rather than imposing themselves on them in the present. through certain critical scenarios, aggressive roles in which they will be able to negotiate real and controversial challenges real-world tools in authentic sociotechnical contexts (Luke et al., 2017; Thumlert, 2015).

The genesis of ICT in the context of lifelong learning

The beginnings of the use of ICT for educational purposes appeared in 1929 in the United States, Ohio State University, which developed "School of the Air", an educational radio program intended for school students, but the interest of the audience far outgrew the target group. More than a third of the audience were adults who were not involved in formal education (The Ohio State University, University Libraries). Several authors cite the idea of developing the concept of lifelong learning (Rajić, V., & Rajić, T.; Ovesni, K., & Alibabić, Š.; Kozarić-Ciković, M., Delač, I., & Duk, Ž.; Klapan, A. and Živčić, M., 2011). Attitudes over the usefulness of investing in education have changed throughout history. In the 1970s, in response to the global crisis of education that hit the world in the 1960s, the concept of lifelong learning emerged. During the 1970s and 1980s, these ideas were discussed and developed by international bodies dealing with education policy (UNESCO, OECD, ILO, European Commission). Globalization and the growth of the rapidly changing knowledge economy mean that people need to upgrade their skills during their adult lives in order to cope with modern life, not only in the field of work but also in private life (OECD, 2007). The process of globalization also imposes a new way of learning. Friedman cites (in Hutinski and Aurer, 2009) that at the beginning of the 21st century, humanity enters a new, third phase of globalization. The world is not only getting smaller, it's getting flatter. E-connection or e-inclusion are becoming extremely important factors. A positive consequence of this is the strengthening of the importance of individuals (Hutinski, & Aurer, 2009).

With the advent of computer technology in the 1980s and the development of communication technology in the 1990s, the potential for improving the quality and efficiency of distance learning has increased. This has resulted in the development of various learning technologies and the inclusion of a number of new elements in distance learning: video films, multimedia courses and live lessons delivered to remote classrooms (Laal, 2013). New opportunities for learning and education emerged in the early 1990s with the advent of the Internet. Various online courses and seminars are being developed. The ability to "learn how to learn" seems to be the most important, because what we know today will be obsolete long before we believe it (Hutinski, & Aurer, 2009). However, despite the rapid development of technology, the Internet, and social networks, access to education evolved more evolutionarily than revolutionarily, until the Covid-19 pandemic, when the world was forced to move from traditional classrooms to virtual environments and adapt to online teaching in no possible time. Distance learning is in Croatian andragogical practice and legislation has so far been accepted

as an integral part of adult education. This is evident from the Adult Education Act (OG 17/07, 107/07, 24/40, Article 7) which states that programs intended for adult education can be implemented through regular, consultative-instructional, open, multimedia teaching, teaching distance learning and other appropriate ways of learning and teaching (Koludrović, & Zbukvić Ožbolt 2020). Modern society is dynamic and the education system does not follow the changes in the labor market fast enough, which is a reflection of the development of technology and innovation. It is very difficult, but also extremely important to predict what the social and market needs will be in 20 to 30 years when the student, who is being educated now, is looking for a job in the free labor market (Dubovicki, 2020). Therefore, it is important to expand the focus from formal education to lifelong learning and to make students aware at an early age that education does not end with the completion of a formal educational program. The rapid growth of ICT caused significant changes in the twenty-first century. It is increasingly important in everyday life, the work environment and the education system. The European Commission has set as its objectives the encouragement of all Europeans to acquire the digital skills that are truly necessary in the twenty-first century. The current spread and use of ICT is particularly influenced by young people (digital generation). Acquiring digital competence today is an essential prerequisite for successful operation (Dubovicki, Jukić, & Topolovčan, 2022). The recommendations of the European Parliament and the Council on key competences for lifelong learning set out a framework of eight competences needed in the knowledge society (European Commission, 2006). One of these eight key competencies is digital competence, which is defined as the safe and critical use of information and communication technologies for work, leisure and communication.

Concepts of education for the future

We know that changes in the educational system at all levels are necessary, but the basic role of the school, upbringing and education must not be jeopardized! The application of modern educational technology in teaching has its didactic and methodological implications, while losing the traditional function of teachers as a source of knowledge disappears (Marin, 2019). New generations of students acquire knowledge in a different way from those in traditional schools. Thanks to ICT, we manage to meet many needs in a faster and more efficient way. Information is available to students from multiple sources and is not limited to the acquisition of new knowledge in school. Therefore, the school must find ways to transform its concept from an authoritative to a cooperative relationship with students. In terms of didactics, we can no longer talk about the Didactic Triangle consisting of teacher, student and teaching

content, but about the Didactic Quadrangle consisting of student, teacher teaching content and educational technology (Matijević, & Topolovčan 2017; Topolovčan, 2020). The assumption is that people will change their jobs several times during their lives, educate themselves for life. This is almost impossible for generations who are not ICT literate. Due to the Covid-19 disease pandemic, classrooms moved from the school building to the children's rooms behind the screen and forced us to take a drastic step that was inevitable but was constantly delayed. Through the experience we went through, we became even more aware of how irreplaceable social contact and the living word of teachers are, but also how many advantages of online teaching and virtual environment that should complement traditional school in the future. Therefore, it is important to manage to optimally align and identify the opportunities, possibilities, threats and weaknesses brought by such an environment. The most important approaches to learning in an educational context, supported by ICT, are: *e-learning, m-learning and hybrid learning*.

E - learning

Formal, non-formal and informal learning supported by electronic media and e-communication is called electronic or e-learning (Matijević, & Topolovčan, 2017; Marin, 2019). The revolution predicted by e-learning will not be based so much on new digital tools / applications as on the improvement of content management systems and learning processes, distance learning (Marin, 2019: 94). With the help of technology, the individual takes an active role and responsibility in their own education because it allows time and space flexibility of students. Developing the critical thinking is the key in finding quality and relevant information on the web. Babić and Etinger (2019) cite the results of research conducted by Ehlers and Kellermann (2019) with 53 international experts. The following four significant changes have been identified that will shape the revolution in learning and teaching in the higher education system: (a) developing students' ability to act successfully on a complex problem in an unknown future environment (so-called "future skills"); models of higher education institutions - networked study experience, (c) the "my university" scenario in which students can independently build higher education curricula with the support of teachers, and (d) continuing lifelong higher education.

M – learning

Mobile learning (m-learning) is often defined as a form of distance learning based on the mobility of a person using different technologies such as handheld computers, MP3 players, iPads, smartphones and tablets to access educational content (Trentin, & Repetto, 2013;

Dumančić, 2017; Matijević, & Topolovčan, 2017; Ricoy, Sánchez-Martínez, & Feliz-Murias, 2018; Trivunović, & Gajić, 2022). In this case, learning is no longer limited to time and space. However, although the results of some studies show that the use of technology, especially mobile phones and tablets, contributes to student motivation and encourages cooperation and interaction between students and teachers, the question arises why some schools insist on banning the use of mobile devices (Redjep, Lecek, Pavicic Zajec, 2020). According to Ozdamli and Cavus (2011), the features of mobile-assisted learning that make it a preferred way of learning are: 1. adaptability to different needs, interests and ways of learning (information can be accessed anytime and anywhere when needed and learned according to independently determined pace), 2. students can quickly enjoy the target content 3. Promote the learning with others, sharing information, collaboration and assessment of other people's knowledge as well as their own, 4. ensure a smooth transition between the context of formal and informal environment, 5. an interactive social experience is provided. Trivunović and Gajić (2020) believe that the use of mobile technologies has influenced the current practice of banning mobile devices in many schools around the world, creating a basis for the presentation and application of the concept of BYOD (Bring Your Owen Device). It is a concept that allows students to bring their mobile device to class and use it for educational purposes. Nowadays, it is very likely that each student will have a personal device that they can take to school and the advantage of this approach is that students are familiar with the device they will use in class and it is a mitigating circumstance for the teacher. Although tablets cannot be considered as a means of improving students 'academic achievement, they have a positive effect on increasing their motivation (Ricoy, Sánchez-Martínez, & Feliz-Murias, 2018).

Hybrid learning

Hybrid learning (blended learning) is learning based on various combinations of classic face- to-face lectures and online learning and the use of various other technologies (audio, video, etc.) in order to design as effectively as possible for users a more acceptable (enriched) learning environment (CARNET, 2009).

According to pedagogy based on social constructivism, the student is not a passive recipient of knowledge. Constructive learning can be explained as self-regulated, situational and collaborative construction of one's own knowledge based on one's own prior knowledge, activities, experiences, emotions, etc. (Maras, Topolovčan, & Matijević, 2018). An interactive approach to teaching means that the student is involved in personally creating teaching content through the interpretation and processing of information. Hybrid learning is based on the constructivist model. Learning is based on active discussion, collaboration and interaction. The

New York Times research shows that student performance in hybrid classrooms may even surpass their results compared to traditional teaching experience (Pauković, & Krstinić, 2021). The shortcomings of hybrid teaching are mainly cited in the context of technical difficulties, such as sound delays, disconnection and reduced involvement of individuals.

Research in the Republic of Croatia on satisfaction with online teaching

The experience of the pandemic, uncertainty and the existing and growing integration of information technology in education will accelerate the improvement of existing, the development of new ones, and application of an increasing number of available digital platforms and tools that will become an indispensable segment of education of the future (Pauković, & Krstinić, 2021). All over the world, similar or almost identical challenges have arisen on how to approach the new situation at the national level (Anđelić, Vučić, & Buić, 2020). As a result, a lot of research has been conducted on satisfaction with online teaching, experiences of students and teachers, and satisfaction and preferences of various platforms through which online teaching was conducted. By reviewing the available research conducted in the territory of the Republic of Croatia, it is evident that the participants are most satisfied with hybrid teaching (Anđelić, Vučić i Buić, 2020; Koludrović, & Zbukvić Ožbolt, 2020; Šenjug Golub, Rajić, & Dumančić, 2020). Interestingly, the preference for hybrid teaching was highlighted by all, primary school students, high school students, college students to adults who were involved in online educational programs that were combined with contact practice. For the purpose of conducting online classes, 78.9% of respondents improved their skills independently. It can be seen that platforms offered by state and public institutions were often used (MZO, Srce, ASOO, Carnet). The National Center for External Evaluation of Education conducted a survey related to distance learning in 2020 from April to July. A significant number of respondents pointed out that online teaching required a lot of effort and effort from them, which caused them additional stress. As many as 90% of teachers, 80% of parents and 75% of students said so (NCVVO, 2020). From the above we can conclude that the use of ICT in education has its advantages and disadvantages. The disadvantages are visible if we use ICT technology in an inadequate way, but there are certainly far more benefits that open the door to everyone who wants to (learn).

In conclusion, we can say that ICT is not the only factor in raising the quality of teaching and achieving learning outcomes, but only one of many that can interact with each other to contribute to raising the quality of teaching and learning.

Conclusion

Education is a key factor in an individual's personality and holistic development in order to adapt to the changes and challenges of today's dynamic society and work environment. The goal of lifelong learning is the availability of education to all under the same conditions, with the possibility of increasing the abilities and skills of each individual throughout life. Thus the quality of life of each individual will be improved and at the same time enable flexibility in working life and ensure adaptability to change.

Information and communication technology helps us achieve these goals. We need to understand it as a tool that helps connect all the components of an individual's successful progress. The school in the classical sense cannot take responsibility for preparing a young man for the labor market. It gives him the foundations and guidelines, but as our society changes and grows, so must the man in it change and grow. We need to upgrade and strive for the better. With the help of ICT, one can learn regardless of time and space, which is especially important in today's world. In this way, education has become available to all individuals who are unable to come to the classroom due to geographical distance or health problems, and often because of the work they do. In addition, it has become more affordable. ICT has proven to be of great help to the elderly, or people with disabilities, in terms of hardware and software. People with disabilities can use ICT to express their abilities, their skills, which were confined to them due to their disability.

In order for the teaching process to be successful, ICT should be integrated among other factors of good teaching aimed at developing a person who will be successful in new environments and who is ready for lifelong learning.

References

- Anđelić, V., Vučić, M., & Buić, N. (2020). Iskustva obrazovnih djelatnika u provedbi nastave na daljinu u sustavu strukovnog obrazovanja i obrazovanja odraslih Republike Hrvatske u uvjetima pandemije COVID-19. *Andragoški glasnik*, 24(39), 19-33. <https://hrcak.srce.hr/272380>
- Babić, S., & Etinger, D. (2019). Važnost razvoja kompetencija za e-učenje kod visokoškolskih nastavnika za primjenu hibridnoga okruženja za učenje. *Metodički obzori*, 14(1 (26)), 5-20. <https://hrcak.srce.hr/233164>
- CARNET. (2009). Hibridno učenje. CARNet: Referalni centri za e-obrazovanje. <http://edupoint.carnet.hr/referalni/obrazovni/mkod/metodika/hibridno.html>

- Dubovicki, S. (2020). Do We Focus on the Positive Future in Higher Education? In A. Peko, M. Ivanuš Grmek, J. Delcheva Dizarevikj (Eds.), *Didactic challenges III: didactic retrospective and perspective - Where/how do we go from here?: conference proceedings* (pp. 78-91). Osijek: Faculty of Education
- Dubovicki, S., Jukić, R. & Topolovčan, T. (2022). Izazovi nastavnčkog poziva u budućnosti. In D. Luketić (Eds.), *Ogledi o nastavničkoj profesiji* (pp. 155-178). Zadar: University of Zadar
- Dumančić, M. (2017). Mobilne tehnologije u obrazovanju. U M. Matijević (Eds.), *Nastava i škola za net-generaciju* (pp. 115–143). Zagreb: Učiteljski fakultet Sveučilišta u Zagrebu <https://doi.org/10.5937/AndStud2001197T>
- Đipa, A., & Mavrak, M. (2018). Edukometrija u andragogiji: Skala kompetencija za cjeloživotno učenje učitelja. *Obrazovanje odraslih*, 11, 31-55.
- European Commission.(2006). Recommendation of the European Parliament and of the Council of 18 December 2006 on key competences for lifelong learning. Official Journal of the European Union.
<https://eurlex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2006:394:0010:0018:en:PDF>
- Hutinski, Ž., Aurer, B. (2009). Informacijska i komunikacijska tehnologija u obrazovanju: Stanje i perspektive. *Informatologia* 42(4), 265-272. <https://hrcak.srce.hr/42347>
- Kiss, I. (2012). Faktorska analiza stavova odrasle populacije prema cjeloživotnom obrazovanju. *Napredak*, 153(1), 77-94. <https://hrcak.srce.hr/82861>
- Klapan, A., Vrcelj, S., & Kušić, S. (2013). Standardizacija izobraževanja odraslih v Republiki Hrvaški. *Andragoška spoznanja*, 19(1), 20-27. <https://doi.org/10.4312/as.19.1.20-27>
- Koludrović, M. i Zbukvić Ožbolt, S. (2020). Procjena kvalitete online nastavnog procesa u obrazovanju odraslih: perspektiva polaznika programa. *Andragoški glasnik*, 24 (39), 34-47. <https://hrcak.srce.hr/272381>
- Kruschel, R., & Hamisch, K. (2019). Schlüsseltechnologie ›Künstliche Intelligenz‹ – Überlegungen zur Zukunft schulischer Bildung (pp. 1-12). In S. G. Huber (Ed.) *Jahrbuch Schulleitung 2019. Impulse aus Wissenschaft und Praxis. Schwerpunkt: Digitalisierung – Chancen für Schule und Unterricht*. Carl Link.
- Laal, M. (2013). Lifelong learning and technology. *Procedia-social and behavioral sciences*, 83, 980-984. <https://doi.org/10.1016/j.sbspro.2013.06.182>
- Luke, A., Sefton-Green, J., Graham, P., Kellner, D., & Ladwig, J. (2017). Digital ethics, political economy and the curriculum: This changes everything. In K. A. Mills, A. Stornaiuolo, A. Smith, & J. Z. Pandya (Eds.), *Handbook of writing, literacies, and education in digital cultures* (pp. 20–32). New York, NY: Routledge 10.4324/9781315465258
- Maras, N., Topolovčan, T., & Matijević, M. (2018). Konstruktivistička didaktika i neurodidaktika u diskursu reformne pedagogije-Teorijska polazišta, dileme i komparacija. *Nova prisutnost*, 6(3), 561-576. <https://doi.org/10.31192/np.16.3.9>

- Marin, G. (2019). Sustavi e-učenja u promicanju novih pristupa vrednovanja. *Magistra Iadertina*, 14(1) <https://doi.org/10.15291/magistra.2957>
- Matijević, M., & Topolovčan, T. (2017). *Multimedijska didaktika*. Školska knjiga.
- Nacionalni centar za vanjsko vrednovanje, 2020. https://www.ncvvo.hr/wp-content/uploads/2020/09/NCVVO_Ispitivanja-o-nastavi-na-daljinu.pdf
- OECD (The organisation for economic co-operation and development, Annual report (2007). <https://www.oecd.org/newsroom/38528123.pdf07.indb> (oecd.org)
- Oyaid, A. (2009). *Education Policy in Saudi Arabia and its Relation to Secondary School Teachers' ICT Use, Perceptions, and Views of the Future of ICT in Education*. Exeter: University of Exeter.
- Ozdamli, F. & Cavus, N. (2011). Basic elements and characteristics of mobile learning. *Procedia - Social and Behavioral Sciences*, 28, 937–942. <https://doi.org/10.1016/j.sbspro.2011.11.173>
- Pauković, M., & Krstinić, M. (2021). Hibridna nastava-izazov i mogućnost" novog normalno. *Obrazovanje za poduzetništvo-E4E*, 11(2), 130-139. <https://doi.org/10.38190/ope.11.2.7>
- Ređep, T., Leček, T., & Pavičić Zajec, T. (2020). Ostvarivanje m-učenja korištenjem BYOD modela u osnovnoj školi. *Veleučilište*, 3(2), 27-34. <https://doi.org/10.36978/cte.3.2.3>
- Ricoy, M., Sánchez-Martínez, C. i Feliz-Murias, T. (2018). A Tablet in School and Family Context. *Croatian Journal of Education*, 20 (4), 1353-1379. <https://doi.org/10.15516/cje.v20i4.3190>
- Snijders, D.; Van der Duin, P.; Marchau, V., & Van Doorn, G. J. (2018). Scenarios for ICT-related Education: A Qualitative Meta-analysis. *Journal of Futures Studies*, 23 (2), 13–28. [https://doi.org/10.6531/JFS.201812_23\(2\).0002](https://doi.org/10.6531/JFS.201812_23(2).0002)
- Šenjug Golub, A., Rajić, V., & Dumančić, M. (2020). Zadovoljstvo studenata nastavom na daljinu tijekom COVID-19 pandemije na Učiteljskom fakultetu Sveučilišta u Zagrebu. *Andragoški glasnik*, 24 (39), 48-62. <https://hrcak.srce.hr/272382>
- The Ohio State University, Registar posebnih zbirki, Sveučilišni arhiv, Ohio Škola zračnih zapisa, <https://library.osu.edu/collections/RG.8.D.6/>,
- Thumlert, K. (2015). Affordances of equality: Rancière, emerging media, and the new amateur. *Studies in Art Education*, 56(2), 114-126. <https://doi.org/10.1080/00393541.2015.11518955>
- Topolovčan, T. (2020). Certain dilemmas and opportunities to research the role of digital media in teaching and learning. In A. Peko, M. Ivanuš Grmek, J. Delcheva Dizarevikj (Eds), *Didactic challenges III: didactic retrospective and perspective - Where/how do we go from here?: conference proceedings* (pp. 376-388). Osijek: Faculty of Education
- Trentin, G. i Repetto, M. (2013). *Using Network and Mobile Technology to Bridge Formal and Informal Learning*. Sawstone: Chandos Publishing.
- Trivunović, B., & Gajić, O. (2022). Primena koncepta BYOD–Bring Your Own Device u industriji i obrazovanju–implikacije za promenu prakse univerziteta3. *Andragoške studije*, 197-218. <https://doi.org/10.5937/AndStud2001197T>

- Yanez, G. A., Thumlert, K., de Castell, S., & Jenson, J. (2019). Pathways to sustainable futures: A “production pedagogy” model for STEM education. *Futures*, 108, 27-36. <https://doi.org/10.1016/j.futures.2019.02.021>
- Wu, S., & Na, T. (2013). Education informatization and university teaching reform. In *International conference on education technology and information system (ICETIS)*, 608-611.

Children's Interaction with YouTube Content from Parental Viewpoint

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Abstract

There has been an increase in the amount of time that children spend consuming digital media since the breakout of the COVID-19 pandemic, with YouTube videos being one of the most frequently used sources of fun and education. Despite the fact that YouTube has a plethora of affirmative and didactic contents, provides different perspectives on various issues, as well as a wide range of creative ideas for children and teenagers, recent studies suggest that children mostly watch videos with inappropriate content or content with product placement that aims at gaining more views, leading to greater profit and listing in recommended feeds. In this regard, parents as the first educators of their children can play a significant role.

Therefore, the aim of this research was to determine what kind of contents children follow on YouTube and explore the role of parents in choosing and controlling the content that children watch. The questions addressed in this research relate to whether children watch entertainment or educational content available on YouTube, and whether in that process they are exposed to the (c)overt advertising, and to what extent. For that purpose, a questionnaire was designed, distributed online and filled in by parents. The results provide insight into how parents perceive children's watching of YouTube videos, their own monitoring role regarding children's interaction with YouTube videos, and their assessment of the videos' educational value. The results also show that young children primarily watch entertainment rather than educational contents.

Keywords: digital advertising, educational video, entertainment video, parental control

Introduction

Children are becoming increasingly frequent users of various media, which affects their overall development. Traditionally, television was considered an important and relevant medium, being a source of entertainment and education for children, while having a direct effect on their social development and enculturation. The emergence of YouTube and wide-spreading of 4G and 5G networks have extended the possibilities for everyone to share their content on

personalized channels. Hence, YouTube has become a dominant media source for adults, as well as for children.

Never before had children been watching more videos online than live TV or streaming services (Rideout & Robb, 2020). The same study found that children under 8 spend 39 minutes a day on average watching videos online, doubling the time compared to 2017. A special platform for children, named YouTube Kids App, was released by YouTube in 2015, to ensure the experience of viewing that would be safer for children, meaning that children could watch content on YouTube, which is free of data collection or advertising (unlike the main YouTube platform), and the parents could control the search options. Regardless, Radesky et al. (2020) have found that children still use YouTube very often, even more often than YouTube Kids.

Recent research shows that a third of children under 8 watch videos online every single day (Rideout & Robb, 2020), and YouTube is watched by 53% of children under the age of 11, disregarding the fact that YouTube platform is not intended for children under 13 (Van Kessel et al., 2019). It is alarming that in the same age group there are 35% of children who watch it multiple times a day (Auxier et al., 2020). Moreover, there are 38 million active YouTube channels; 22 000 channels have over a million subscribers with channels intended for children being among the most subscribed ones (Social Blade, 2022). For instance, Cocomelon Nursery Rhymes Channel is the third top channel with 131 million subscribers, 734 videos and 122 342 653 471 views; Vlad and Niki Channel is in the 13th place with 79.9 million subscribers, 432 videos and 61 172 610 941 views (Social Blade, 2022). Globally, the Internet is used by 60% of the world population (Digital 2021 April Global Statshot Report), and in Croatia 78.3% of the population use it (World Bank Report, 2020). In light of these data, this paper explores children's exposure to the YouTube content while acknowledging the viewpoint of their parents.

YouTube Content and Children

The increase in viewership of YouTube (Kids) channels raises the question of the content quality. The child-centered content makes a substantial part of the YouTube's main platform. The analysis of the most popular YouTube videos by the Pew Research Center in 2019 revealed that many videos were directed at children and gained three times as many views compared to the videos which are not child-directed (Van Kessel et al., 2019).

Similarly, being a controlled platform for entertainment and learning, the YouTube Kids Channel plays an important role in bringing together millions of children subscribers. It enables them a secure online experience with over 80 000 educational applications on iTunes, which

makes it a high earning industry (Burroughs, 2017). There are many advantages of YouTube videos in terms of educational benefits for children, regarding their role in improving English as a foreign language; programming is also provided by YouTube Kids, and it is specially adapted to children's desired content. YouTube Kids channels are improving levels of infant and child involvement in language and learning skills (Jindal & Kanozia, 2019). The same study points to new parenting habits, for most parents believe that children learn faster by watching videos of songs and poems on the YouTube Kids channels. Hence, a majority of parents have the supporting attitude towards YouTube Kids channels, and perceive them as a source of infant learning and development. There are also socially oriented animations and videos with integrated music that promote helping, sharing, good manners, cleanliness, nature care, etc, thus contributing to the development of children's social competences and prosocial behavior.

The most viewed content in the history of YouTube are videos for children, e.g. Peppa Pig with 19.9 billion views (Social Blade, 2022). As Table 1 shows, the top YouTube channels for children have more than 100 million subscribers and over 100 billion views, Cocomelon being the most subscribed and most viewed YouTube channel in the education category.

Table 1

Top YouTube Channels for Children,
source: <https://socialblade.com/youtube/top/category/made-for-kids> (March, 2022)

Rank	YouTube Kids Channels	Subscribers	Video Views	Uploads
1	Cocomelon - Nursey Rhymes	131.0 M	124 281 709 878	741
2	Like Nastya	88.9 M	72 084 665 945	664
3	Kids Diana Show	91.6 M	71 111 544 568	970
4	Vlad and Niki	79.9 M	61 172 610 941	432
5	Toys and Colors	34.8 M	37 392 385 031	746

Appealing animation techniques harmonized with the musical rhymes that affect infants are used by all of these channels. Some of the songs reach very high number of views (e.g. *Five Little Ducks* with 791 million views or *Baa Baa Black Sheep* with 480 million views).

On the other hand, there are frequent reports of a wide range of inappropriate YouTube content that children may come across, even in cartoons, which are rather popular among children (Papadamou et al., 2020). In addition to that, constant consumption of YouTube content can cause an increase in mental stress among children. Even though the daily consumption of YouTube content amounts to 1 billion hours, there are few publications on the

content that children view on the main platform, types of advertising young children may encounter on the site, and how viewing behaviors correlate with the characteristics of the child or its family. Previous research has created a coding section for the quality of children's videos on YouTube, but failed to undertake a comprehensive assessment of YouTube content or link the viewing behavior to the demographic features of a child or its family (Neumann & Herodotou, 2020). A study by Jindal & Kanozia (2019) has shown that YouTube videos promote violent behavior to some extent in every fourth child and create demands for the products shown in particular videos. This raises alarm among parents and calls for their response.

Parental Perspective

Parents play the most significant role in children's development since they are the primary caregivers and educators. When it comes to children's media literacy, the role of parents is equally important, although insufficiently explored by researchers. Considering the growing presence of children online, especially from 2020 (Ofcom, 2021), parental attitudes and mediation strategies are of growing importance. Research shows that parents have had difficulties in controlling the time their children's spent in front of the screen during the lockdowns, resulting in a more permissive parenting style, i.e. they have relaxed the usual rules for spending time online and have recognized the value of the online presence for staying in touch with their friends. Despite the fact that most parents know of the digital tools available for limiting the amount of online time and controlling the type of content children watch, they rarely use any of them.

The ongoing trend of raising popularity of online viewing among children younger than 3 is especially alarming (Elias & Sulkin, 2017). The reason for this is the fact that online content has become extremely accessible at any time and place, allowing more frequent children's exposure to media. Furthermore, online content has not been regulated and limited to professional production, but can be created and uploaded by practically anyone. Elias & Sulkin (2017) have corroborated the findings of previous studies in the field and concluded that parents often initiate their children's use of YouTube when they need a babysitter or to fulfill their children's free time. Hence, even toddlers are sometimes exposed to YouTube (inappropriate) content.

When it comes to the parental role in supervising children's use of YouTube, not only does it require media literacy, but also digital literacy. This can be a source of parental reluctance to engage, since most of them would have to leave their comfort zone. Prensky

(2001) notices this discrepancy in attitudes towards ICT between the younger generation (digital natives) and older generation (digital immigrants). Parents, as digital immigrants, might feel inferior to their children that have been interacting with digital technology since birth, and take rather indifferent or uninvolved parenting style (Kuppens & Ceulemans, 2019), or they go to the other extreme and express domain-dependant parenting style while trying to prohibit children's use of technology in a rather authoritarian manner (Smetana, 2017).

Evans & Robertson (2020) report that the issue of digital natives and digital immigrant has gone through four phases so far: conception, reaction, adaptation, and reconceptualization. It has been known for a relatively long time that children today require support in acquiring new types of contemporary literacies (Varga, 2011; Vrkić Dimić, 2014), but most parents nowadays still struggle to find the right educational approach (Peran & Raguž, 2019). Only 10-15% of children in Croatia talk to their parents about media content (Hercigonja, 2019). More precisely, Ilišin (2005) detects that media content is a children's dominant discussion topic with peers, but not with their parents. The age differences or differences linked to school success among children have not proven to be significant. It has been shown that the level of parental education does not affect the use of the media by children or family communication about media content, which is confirmed by the research conducted by Sindik (2012). This tendency suggests that parents have not taken on the role of media literacy promoters, or at least not to the extent that would be expected of them as primary caregivers and educators.

Research Methodology

This study aims to explore children's interaction with the various contents available on YouTube and their parents' involvement. More precisely, it aims at answering the following research questions:

RQ1: How often are children exposed to the YouTube contents?

RQ2: What types of contents are children exposed to and in what degree?

RQ3: What actions do parents undertake during children's interaction with YouTube content?

Those questions are to be answered in order to gain greater insight in children's interaction with YouTube in terms of determining the kind of contents that children follow on YouTube and exploring the role of parents in choosing and controlling the content that children watch.

In order to find the answers to the research questions, a survey was conducted among parents. To collect quantitative data, a questionnaire was constructed using Google Forms for

virtual application. It consists of 21 items grouped into four sections: a) demographic data about a child; b) frequency of YouTube use; c) types of YouTube content a child use (educational, entertaining or commercial); d) parental actions and self-reflection. The questionnaire combines closed-ended questions with open-ended questions, alongside the 5-point Likert scale to measure self-reported frequency. Its internal consistency was measured (Chronbach's Alfa=0.73), and it is considered to be a reliable instrument.

Sample and Procedure

The questionnaire was distributed to parents of children aged 13 or under via social networks such as LinkedIn, Viber, WhatsApp and Facebook over a month time (March 2022) by applying the virtual snowball sampling technique (Goodman, 1961; Baltal & Brunet, 2012; Parker et.al, 2019). This technique enabled us to reach the targeted group of respondents, since it is considered to be a chain-referral sampling technique, where existing study subjects recruit future subjects from among their acquaintances, thus building up the sample group like a rolling snowball (Sharma, 2017). There were a total number of 73 children whose parents were eligible for the study. Parents with more than one child were cautioned to focus on a single child per questionnaire. All collected data are analysed in Statistica accordingly.

Research Results and Discussion

Frequency of Children's Use of YouTube

In order to find the answer to the first research question, participants were asked about the amount of time their children spent viewing YouTube content. The parents reported on their children's habits, and the youngest child in question was 1.5 years old while the oldest was 13 years old. There was an almost equal share of boys (50.7%,) and girls (49.3%,) involved. The majority of the children (82.2%) watch YouTube every day or almost every day, while the rest (17.8%) watch it less frequently. There is not a single child who never watches content on YouTube. This suggests that parents do not forbid their children the use of digital technology, no matter how young they are. Babić (2021) warns against total restrictions, noting that the development of digital competences is not important only for personal growth but also for the progress of society.

In Croatia, the majority of parents of young children would like to limit their use of digital technology to an hour a day (Marić et. al, 2022). Our study found that the time children spend viewing YouTube content goes beyond parental preference and is on average 75.6 minutes a day (Table 2). When interpreting the results, the developmental differences between toddlers (1-3 y.o.), preschoolers (4-5 y.o.) and older children (6 y.o. <) should be taken into

account. The results are therefore divided into those three categories, which consequently points to the following finding: as children grow older, they spend increasingly more time online - from 38.18 minutes for toddlers to preschoolers' average time of 65.74 minutes and 95 minutes for school-aged children (Table 2).

Table 2

Average amount of time spent viewing YouTube content depending on children's age

Children's age range	Minutes per day spent on YouTube				
	Mean	Median	Minimum	Maximum	Std.Dev.
1-3 (N=11)	38.18182	30	10	120	30.5397
4-5 (N=27)	65.74074	60	10	240	46.50690
6 < (N=35)	95.0000	60	30	360	70.11545
Total (N=73)	75.61644	60	10	360	60.53975

These results are in line with the previous finding that children at the age of 6 tend to change preferences and leave traditional play behind only to give priority to online games and entertainment applications (Oliemat et al., 2018). If we consider the amount of viewing time by gender, boys have the higher average time of viewing YouTube content (80.7 minutes) than girls (70.4 minutes).

Type of YouTube Content That Children Interact With

Children are usually the ones who ask to watch YouTube (84.9%), while in the remain cases the suggestion comes from their parents. Also, mostly children (80.8%) choose the videos they would like to watch, and only sometimes it is their parents who make that choice (15.1%), whereas a grandmother, friends or an uncle interfere occasionally (4.1%).

The second research question aimed to shed light on the type of content children use on YouTube: educational, entertaining or commercial. The results suggest that children mostly watch entertainment content (86.3%) on YouTube, while sometimes (54.8%) or rarely (28.8%) content that is educational.

Parents report that ads appear often (52.1%) or always (19.2%) while watching YouTube videos. While ads that promote the purchase of products related to content of viewing (e.g. cards, candies, toys) appear sometimes (54.8%) or often (38.4%), inappropriate ads appear sometimes (35.6%), rarely (30.1%) or never (28.8%). These findings indicate that the problem remains equally disturbing because a decade ago in Italy Buzzi (2012) detected

that one-third of the parents acknowledged that their children had accessed inappropriate content and that majority of them did not know how to increase the level of safety from questionable content. Apart from enticing consumerist behavior in children and exposing them to inappropriate content, YouTube targets children's physical health by unhealthy food marketing (Tan et al., 2018).

Parental Actions and Self-Reflection

The third research question focused on parenting with regard to children's use of YouTube. We have found that less than one third of parents (30.1%) regularly recommend educational content to their children while two thirds do it sometimes (52.1%). Their recommendation would mean direct involvement, but parents model their children's choices and behaviors also indirectly. Barnes & Potter (2021) point to the emergence of the "sharenting" phenomenon in contemporary parenthood that refers to creating their own digital narratives using personal information and photographs of their children, and not being concerned about privacy issues. The majority of parents (56.2%) believe that educational content available on YouTube has an important role in supporting the learning process. However, previous research has shown that much of children's YouTube content is of limited educational quality (Radesky et al., 2020) and that European children prefer videos that are playful and with absence of educational aspects (Lozano-Blasco et al., 2021), with the highest number of viewers reserved for cartoon channels. Parents should be aware that the types of YouTube content for children appears to be greatly motivated by financial interests. For instance, nursery rhymes, which are the most frequently viewed contents for young children, contain several advertisements that disrupt the viewing experience and probably reduce the educational aspect of a video (Radesky et al., 2020). Having a positive attitude towards children's use of YouTube should be applauded for it creates the stimulating home environment for the development of the digital literacy skills and competences in young children (Marsh, 2016), but it still calls for parental attention.

Parents are expected to be responsible for supervising and controlling their children's viewing habits and our study has found that close to a half of the parents (46.6%) regularly supervise their child's use of YouTube; more than one third (38.3%) do it sometimes; while 15.1 % of parents rarely check what their child is watching. Similarly, 52% of parents regularly control their children's viewing YouTube videos; around one third (34.2%) do it sometimes; and 13.7% rarely control it. When coviewing YouTube videos is considered, more than one third of parents (39.7%) sometimes watch YouTube videos with their children, while less than one third of them (31.5%) do it rarely. Regular coviewing is practiced by less than a quarter

(24.6 %) of parents in this study. Overall, parents tend to supervise and control their children's viewing habits, but covieing with their children is not that regular.

Moreover, the majority of parents (78.1%) have not set up any of applications that could be used for controlling children's YouTube viewing or limiting their access to inappropriate content. Among those who have used such applications (9.6%), *Google Family Link* and *Microsoft Family Safety* are most popular. 57.5% of parents are familiar with the YouTube Kids application, but 42.5% of parents have not heard of it.

Despite the fact that the results point to a rather poor parental control of children's viewing habits, only one-third of parents (32.9%) admit that they need additional information or assistance with time-limitation or content-control. As digital immigrants, they might expect to be taught by their children, whom they find to be more competent with digital technology. This bottom-up transmission reported by Correa (2014) was more likely to occur among women and people of lower socioeconomic status, and it was also associated with less authoritarian parents and more fluid parent–child interactions.

Conclusion

The average amount of time a child spends consuming YouTube content is continually increasing and is age-dependent. The results suggest that young children tend to choose entertainment videos over the educational ones, and their preferences change with time (toddlers and preschool children spend more time in free games and interaction with their environment, whereas school-age children turn to YouTube videos for entertainment more frequently). These findings call for pedagogical attention and more active parental role.

The recommendations for parents whose children view YouTube video include the following media-mentoring tasks: a) covieing, b) using content-controlling applications, c) selecting educational channels, d) discussing advertisements. More precisely, the activity of covieing is important in early childhood, but neglected by one in three parents. Parents should watch videos together with their children to learn the characteristics of the content they are exposed to. Further more, results indicate that many parents are unfamiliar with YouTube Kids, which is free of advertising, provides a safer content and allows parental control. In addition, parents should select and subscribe to validated educational channels that teach educational content based on science, tell instructive stories, or provide examples of creating new art pieces. They should also help their child discriminate between non-commercial and commercial videos, and recognize product placement within videos. To underline, parents must regularly

communicate with their children about the content they watch. This issues should be further researched and in-depth interviews are recommended as the next step to overcome the limitations of this study.

References

- Babić, A. (2021). Digitalne vještine kao perspektiva razvoja gospodarstva i važan čimbenik digitalne transformacije. *Ekonomski pregled*, 72(1), 59-87, <https://doi.org/10.32910/ep.72.1.3>
- Baltar, F. & Brunet, I. (2012). Social research 2.0: virtual snowball sampling method using Facebook, *Internet Research*. 22(1), 1-18, <https://doi.org/10.1108/10662241211199960>
- Barnes, R. & Anna Potter, A. (2021). Sharenting and parents' digital literacy: an agenda for future research, *Communication Research and Practice*, 7(1), 6 – 20, <https://doi.org/10.1080/22041451.2020.1847819>
- Burroughs, B. (2017). YouTube Kids: The App Economy and Mobile Parenting. *Social Media + Society*. <https://doi.org/10.1177/2056305117707189>
- Buzzi, M. (2012). What Are Your Children Watching on YouTube? In: F. Cipolla-Ficarra, K. Veltman, D. Verber, M. Cipolla-Ficarra & F. Kammüller (eds.) *Advances in New Technologies, Interactive Interfaces and Communicability (Second International Conference, ADNTIIC 2011)* (pp.243 – 252). Berlin Hedelberg: Springer Verlag.
- Correa, T. (2014). Bottom-up Technology Transmission Within Families: Exploring How Youths Influence Their Parents' Digital Media Use With Dyadic Data, *Journal of Communication*, 64(1), 103–124, <https://doi.org/10.1111/jcom.12067>
- Digital 2021 April Global Statshot Report (2021). Retrieved from: <https://datareportal.com/reports/digital-2021-april-global-statshot> (1/5/2022)
- Elias, N. & Sulkin, I. (2017). YouTube viewers in diapers: An exploration of factors associated with amount of toddlers' online viewing. *Cyberpsychology: Journal of Psychosocial Research on Cyberspace*, 11(3), 14-30.
- Evans, C. & Robertson, W. (2020). The four phases of the digital natives debate. *Human Behavior and Emerging Technologies*, 2(3), 269-277, <https://doi.org/10.1002/hbe2.196>
- Goodman, L. A. (1961). Snowball sampling. *The annals of mathematical statistics*, 148-170.
- Hercigonja, Z. (2019). *Prostor kritičkog mišljenja u digitalnim medijima kao dionicima procesa formiranja osobnosti djeteta*. Varaždin: Fronta Impres.
- Ilišin, V. (2005). Roditelji kao medijski odgovornici: komunikacija djece i roditelja o medijskim sadržajima. In: N. Zgrabljic Rotar (Ed.). *Medijska pismenost i civilno društvo* (pp. 131-152). Sarajevo: Mediacentar.
- Jindal, R. & Kanozia, R. (2019). Do youtube based children channels impact parenting? An exploratory study, *Journal for All Subjects: www.lbp.world*, 8(8), 1-11.

- Lozano-Blasco, R., Quilez-Robres, A., Delgado-Bujedo, D., & Latorre-Martínez, M. P. (2021). YouTube's growth in use among children 0-5 during COVID19: The Occidental European case. *Technology in society*, 66, 101648. <https://doi.org/10.1016/j.techsoc.2021.101648>
- Kuppens, S. & Ceulemans, E. (2019). Parenting Styles: A Closer Look at a Well-Known Concept. *Journal of Child and Family Studies*, 28(1), 168–181. DOI: <https://doi.org/10.1007/s10826-018-1242-x>
- Marić, I., Borovac, T. & Dobi Barišić, K. (2022). Mobile devices and preschool children: do their parents know how much they know? In L. Gómez Chova, A. López Martínez, I. Candel Torres (eds.) *INTED2022 Proceedings* (pp. 7621-7630). IATED Academy.
- Marsh, J. (2016). The digital literacy skills and competences of children of pre-school age. *Media Education*, 7(2), 178 – 195.
- Neumann, M.M. & Herodotou, C. (2020). Evaluating YouTube videos for young children. *Education and Information Technologies*, 25, 4459-4475.
- Ofcom (2021). Children and parents: media use and attitudes report 2020/21. Retrieved from: <https://www.ofcom.org.uk/research-and-data/media-literacy-research/childrens/children-and-parents-media-use-and-attitudes-report-2021> (12/2/2021)
- Oliemat, E., Ihmeideh, F., Alkhaldeh, M. (2018). The use of touch-screen tablets in early childhood: children's knowledge, skills, and attitudes towards tablet technology *Child. Youth Serv. Rev.*, 88 , 591-597
- Papadamou, K., Papasavva, A., Zannettou, S., Blackburn, J., Kourtellis, N., Leontiadis, I., ... & Sirivianos, M. (2020). Disturbed YouTube for kids: Characterizing and detecting inappropriate videos targeting young children. *The Proceedings of the International AAAI Conference on Web and Social Media*, 14(1), 522–533.
- Parker, C., Scott, S. & Geddes, A. (2019). *Snowball sampling*. SAGE Research Methods Foundations. DOI: <http://dx.doi.org/10.4135/> Retrieved from: <https://methods.sagepub.com/foundations/snowball-sampling> (2/12/2021)
- Peran, S. & Raguž, A. (2019). Odnos i značenje medijskog odgoja u dječjim vrtićima: pravila i medijski izazovi. *Communication Management Review*, 4(1), 216-231. DOI: <https://doi.org/10.22522/cmr20190148>
- Prensky, M. (2001). Digital natives, digital immigrants part 1. *On the Horizon*, 9(5), 1– 6. <https://doi.org/10.1108/10748120110424816>
- Radesky, J. S., Schaller, A., Yeo, S. L., Weeks, H. M., & Robb, M.B. (2020). *Young kids and YouTube: How ads, toys, and games dominate viewing*. San Francisco, CA: Common Sense Media.
- Rideout, V., & Robb, M. B. (2020). *The Common Sense census: Media use by kids age zero to eight*. San Francisco, CA: Common Sense Media.
- Sharma, G. (2017). Pros and cons of different sampling techniques. *International Journal of Applied Research*, 3(7), 749-752.

- Sindik, J. (2012). Kako roditelji percipiraju utjecaj medija na predškolsku djecu? *Medijska istraživanja*, 18(1), 5-33.
- Smetana, J. (2017). Current research on parenting styles, dimensions, and beliefs. *Current Opinion in Psychology*, 15(1), 19-25. DOI: <https://doi.org/10.1016/j.copsyc.2017.02.012>
- Tan, L., Ng, S. H., Omar, A., & Karupaiah, T. (2018). What's on YouTube? A case study on food and beverage advertising in videos targeted at children on social media. *Childhood Obesity*, 14(5), 280-290.
- Varga, R. (2011). Nove pismenosti u kurikulumu suvremene osnovne škole. *Školski vjesnik*, 60(3), 283-294.
- Van Kessel, P., Toor, S., & Smith, A. (2019). A week in the life of popular YouTube channels. Pew Research Center. Retrived from: <https://www.pewresearch.org/internet/2019/07/25/a-week-in-the-life-of-popular-youtube-channels/> (12/10/2021)
- Vrkić Dimić, J. (2014). Suvremeni oblici pismenosti. *Školski vjesnik*, 63(3), 381-394.
- World Bank Report. (2022). Retrieved from: <https://data.worldbank.org/indicator/IT.NET.USER.ZS?locations=HR> (1/5/2022)
- YouTube statistics (2022). Retrieved from: <https://socialblade.com/youtube/> (1/7/2022)

Differences in early and preschool children when using mobile devices in relation to their age

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Abstract

We live in a time when mobile devices and the internet have become a part of our everyday lives, not just for individuals, but for entire families. Mobile devices and the internet are making their way into children's lives from a young age and sometimes it seems that children are extremely adept at using them. This study aimed to examine the knowledge and habits related to mobile device use among children of early and preschool age from the point of view of the children and their parents. Special attention was paid to the differences related to the age of the children. The child sample consisted of two groups of respondents attending public kindergartens. One group consisted of 3–4-year-old children, and the other group consisted of 5–6-year-old children. A total of 30 children and their parents participated in the study, 15 children in both groups. Data were collected in writing from parents through a set of questions about their family's habits of using mobile devices, while data on children, their knowledge, and their habits were collected through interviews. The research findings suggest differences between the age groups in mobile device ownership, ability to use a mobile device outside the home, knowledge of commonly used applications, downloads, and understanding of control over downloading applications, content, and search methods on YouTube.

Keywords: mobile devices, early and preschool children, parents, online security

Introduction

Modern society is hard to imagine without digital technologies and the internet, which have become an integral part of our lives and the lives of today's children. Pavlović Breneselović (2012) states that digital technologies have become an integral part of children's family environment and the world they live in, the immediate and wider context of growing up,

whether they use them themselves or are merely observers and witnesses of how others use them. Intense changes in the process of digitizing society have initiated the digital transformation of education, but also changes in family dynamics, creating thus numerous challenges for children, parents, teachers, and education policymakers.

The rapid development and growth of the popularity of mobile devices, especially smartphones and tablets, has facilitated access to information, people, services, and goods, while simultaneously becoming a source of entertainment for young children. According to the Central Bureau of Statistics, 86% of households in the Republic of Croatia had access to the internet in 2021. Moreover, 69% of people in Croatia use mobile devices to access the internet (Eurostat, 2022). Borovac (2019) notes that the age limit for the first internet access has dropped down across Europe. According to Livingston et al. (2011), the average age of the first internet access in some countries is seven, but most research and studies over the past decade have involved children over 7 (e.g., EU kids online) years of age. Nevertheless, the number of studies involving younger children has increased in recent years, but due to the specifics of the research, the number is still unsatisfactory and such research is mostly qualitative (Plowman et al. 2010, Brito 2016, Dias et al. 2016, Marić, Borovac, and Dobi Barišić 2021).

Very often we see smartphones in the hands of young children. The parents use them to calm children down, entertain them, etc. Therefore, it should not come as a surprise that children as young as 5 or 6 can easily browse YouTube, buy games in an app store, or take a selfie. The OFCOM report (2013) indicates that tablet use is rapidly increasing among children between the ages of five and seven. The children most often watch videos, play games, and surf the internet.

Kılıç, et al. (2019) conducted a study on cell phone exposure in children aged 1 to 60 months, involving 422 parents of children of that age. This study shows a high prevalence of exposure to mobile devices in young children. The frequency of tablet use and possession was inversely related to mothers' education level and household income. According to the UNESCO report (2015), children and young people are considered a particularly vulnerable group because they are often unaware of the dangers they face when accessing the internet. Naturally, the use of these devices and applications requires internet access.

Dias et al. (2016) conducted a qualitative study in four European countries involving families with children between the age of 6 and 7. They found that there is a discrepancy between what children really know and how they use digital technologies and what parents believe their children know and do. Dias et al. (2016) concluded that most parents felt that their children were protected at that moment, mainly because they were younger children who were

not yet literate and not yet interested in social networks, which parents considered “particularly dangerous”, and also found that children knew device passwords or could download apps without their parents’ knowledge. Chaudron (2015) points out that there are numerous cases of parents being unaware of their children’s activities and digital skills, especially concerning early and preschool children.

Plowman et al. (2010) observed that children begin to interact with technology by watching parents and older siblings. They soon become autonomous in their use and only turn to parents for help when they cannot complete a level of a game or have other difficulties. Also, older siblings show them new activities and digital games. Once the child has learned and mastered the basic settings of the device, owing to today’s increasingly intuitive operating systems, they gradually explore all the available application and device options without fear of damaging the device. As they try out all the options, they also remember the actions they performed, creating a sort of “mental map” of their own. The next time they use the application, they already know what action is associated with each “key” or option.

The importance of digital literacy has been recognized in numerous European strategic and education policy documents, such as the European Strategy for a Better Internet for Children (2012), the European Union (EU) Agenda for the Rights of the Child (2011), the Digital Education Action Plan (2020), and in Croatian documents (National Curriculum for Early Childhood and Preschool Education, 2015), but also by parents. Many parents consider the development of digital competencies important and beneficial for their children’s future, but there are also some fears about the harmful consequences of excessive use (Dias et al. 2016).

Methodology

The research aim was to investigate the knowledge and frequency of using mobile devices of children of early and preschool age from the point of view of children and their parents. This paper is based on data collected for the purpose of writing the graduation thesis (Marić,2021). As part of the research, the following research questions were highlighted:

- What differences were noted in the use of mobile devices in relation to the age of the respondents?
- How do parents care about the safety of their children when using mobile devices and the Internet?

Instrument

For this study, a *Questionnaire for parents on the use of mobile devices by their children of early and preschool age* and an *Interview protocol for children of early and preschool age* were designed.

The *Questionnaire for parents on the use of mobile devices by their children of early and preschool age* contains a total of 20 questions. The first part of the questionnaire refers to the sociodemographic characteristics of the parents (gender and age, education, and employment status). The second part of the questionnaire contains 16 questions, the first of which relates to parents' use of mobile devices and the others to their children's use of mobile devices (access to mobile devices and frequency of use, internet access and access to applications, parents' knowledge of applications used by their children, supervision of children when using mobile devices).

The *Interview protocol for children of early and preschool age* contains a total of 21 questions. The first two items are related to the child's age and gender, and the other items are related to mobile device use (which mobile device the child uses, frequency of use, knowledge and use of mobile applications, ability to use a mobile device). During the interview, the Huawei P20 Lite Android phone was used by the children to demonstrate their knowledge.

The items in the questionnaire for parents and the interview protocol with children are similar in content to facilitate later comparison and analysis.

Participants

Children from the kindergarten Vukovar I (Croatia) participated in the study. Thus, it is a convenience sample of 30 early and preschool-aged children and their parents. The children who participated in the study were between 4 and 7 years old, 14 of them were girls (47%) and 16 were boys (53%). In addition to the children, their parents also participated in the study, one parent per child, i.e., 26 mothers (87%) and 4 fathers (13%).

Research ethics and process of data collection

Parents who participated in the study signed an informed consent form to participate in the study for both the child and themselves. The introductory section of the consent form clarified that the data collected would be used solely to write the graduate thesis and scientific papers and that only cumulative data would be used. The interview with the children was conducted in accordance with the Code of Ethics for Research with Children.

The *Interview protocol* was constructed prior to the interview with the children. The interview was conducted in the children’s kindergarten group, in a familiar setting.

A previously prepared interview protocol was used for the interview with the children, and the interview was conducted in the children’s kindergarten group, in a familiar setting. The interviews were recorded with an audio device to facilitate later analysis of the children’s responses. A *Questionnaire for parents on the use of mobile devices by their children of early and preschool age* was distributed to the parents, who completed and returned it to the researcher. The *Interview protocol* of each child is linked to the parents’ responses to the questionnaire. Based on the obtained data, statistical data processing was performed, and final conclusions were drawn for the research.

Data processing method

The collected data were processed through quantitative analysis, which included data consolidation and coding through a logical analysis process. The statistically processed data are presented in tables with the corresponding descriptive analysis.

Results

The use of mobile devices and applications

Access to mobile devices and the internet outside of the home

Table 1 shows the frequency and relative frequency for all categories of the variable *Age group* in terms of having a cell phone, using a cell phone outside the home, and mobile data usage.

Table 1

Owning a cell phone, using a cell phone outside the home, and mobile data usage

Age group	Having a cell phone		Using a cell phone outside the home		Mobile data usage		
	Has a cell phone	Does not have a cell phone	Allowed	Not allowed	Allowed	Not allowed	
Younger age group	N	5	10	8	7	5	10
	%	33%	67%	53%	47%	33%	67%
Older age group	N	11	4	11	4	2	13
	%	73%	27%	73%	27%	13%	87%
Total	N	16	14	19	11	7	23
	%	53%	47%	63%	37%	23%	77%

Older and younger age groups differ statistically significantly when it comes to possessing a mobile device ($\chi^2(1) = 4.82, p = 0.028$), but do not differ statistically significantly in terms of cell phone use outside the home ($\chi^2(1) = 11.29, p = 0.256$) and using mobile data ($\chi^2(1) = 1.68, p = 0.195$).

Recognizing applications

Table 2 shows children's recognition of certain applications concerning their age.

A statistically significant difference in the knowledge of the observed applications was recorded for YouTube ($\chi^2(1) = 4.62, p = 0.032$), TikTok ($\chi^2(1) = 4.82, p = 0.028$), Viber ($\chi^2(1) = 6.00, p = 0.014$), Play Store ($\chi^2(1) = 3.97, p = 0.046$), and Snapchat ($\chi^2(1) = 4.62, p = 0.032$).

Table 2

Knowledge of certain applications

Application		Age group				Total	
		Younger age group		Older age group		N	%
		N	%	N	%		
Facebook	<i>Familiar</i>	0	0%	1	7%	1	3%
	<i>Not familiar</i>	15	100%	14	93%	29	97%
Messenger	<i>Familiar</i>	0	0%	1	7%	1	3%
	<i>Not familiar</i>	15	100%	14	93%	29	97%
Viber	<i>Familiar</i>	0	0%	5	33%	5	17%
	<i>Not familiar</i>	15	100%	10	67%	25	83%
WhatsApp	<i>Familiar</i>	0	0%	1	7%	1	3%
	<i>Not familiar</i>	15	100%	14	93%	29	97%
Instagram	<i>Familiar</i>	0	0%	2	13%	2	7%
	<i>Not familiar</i>	15	100%	13	87%	28	93%
Phone	<i>Familiar</i>	5	33%	6	40%	11	37%
	<i>Not familiar</i>	10	67%	9	60%	19	63%
Messages	<i>Familiar</i>	0	0%	1	7%	1	3%
	<i>Not familiar</i>	15	100%	14	93%	29	97%
Camera	<i>Familiar</i>	8	53%	6	40%	14	47%
	<i>Not familiar</i>	7	47%	9	60%	16	53%
YouTube	<i>Familiar</i>	11	73%	15	100%	26	87%
	<i>Not familiar</i>	4	27%	0	0%	4	13%
Google Chrome	<i>Familiar</i>	0	0%	1	7%	1	3%
	<i>Not familiar</i>	15	100%	14	93%	29	97%
Gmail	<i>Familiar</i>	0	0%	0	0%	0	0%
	<i>Not familiar</i>	15	100%	15	100%	30	100%
Play Store	<i>Familiar</i>	2	13%	7	47%	9	30%
	<i>Not familiar</i>	13	87%	8	53%	21	70%
TikTok	<i>Familiar</i>	5	33%	11	73%	16	53%
	<i>Not familiar</i>	10	67%	4	27%	14	47%

Snapchat	<i>Familiar</i>	0	0%	4	27%	4	13%
	<i>Not familiar</i>	15	100%	11	73%	26	87%

No statistically significant difference was observed between age groups for the following applications: Camera ($\chi^2(1) = 0.54$, $p = 0.464$), Facebook ($\chi^2(1) = 1.03$, $p = 0.309$), Messenger ($\chi^2(1) = 1.03$, $p = 0.309$), WhatsApp ($\chi^2(1) = 1.03$, $p = 0.309$), Instagram ($\chi^2(1) = 2.14$, $p = 0.143$), Phone ($\chi^2(1) = 0.14$, $p = 0.705$), Messages ($\chi^2(1) = 1.03$, $p = 0.309$), Google Chrome ($\chi^2(1) = 1.03$, $p = 0.309$).

Security

Downloading applications and control over downloading

Table 3 shows the frequency and relative frequency of the variable Age group regarding knowledge about downloading applications, control over downloading applications from the point of view of children, and control over downloading applications from the point of view of parents.

Table 3

Knowledge about downloading applications, control over downloading applications from the children's point of view, and control over downloading applications from the parents' point of view

Age group	Downloading application		Control over downloading applications from the children's point of view		Control over downloading applications from the parents' point of view	
	Familiar	Not familiar	Password required	Password not required	Parental control	No parental control
Younger age group	N 3	12	2	13	14	1
	% 20%	80%	13%	87%	93%	7%
Older age group	N 8	7	8	7	12	3
	% 53%	47%	53%	47%	80%	20%
Total	N 11	19	10	20	26	4
	% 37%	63%	33%	67%	87%	13%

Older and younger age groups did not differ statistically significantly in knowledge about downloading games from the Play Store ($\chi^2(1) = 3.59$, $p = 0.058$). The difference in control over downloading applications was statistically significant from the children's point of view ($\chi^2(1) = 5.40$, $p = 0.02$), but not from the parents' point of view ($\chi^2(1) = 1.15$, $p = 0.283$).

The type of parental control over downloading applications from the Play Store

The type of parental control over downloading applications from the Play Store regarding age is presented in Table 4. No statistically significant difference was found between the younger and older age groups regarding the type of control over downloading applications via the Play Store ($\chi^2(3) = 1.67, p = 0.644$).

Table 4

Type of parental control over downloading applications

Age group	The type of parental control over downloading applications					TOTAL
	Password required	No password required	Parental control application	Other		
Younger age group	N	5	1	4	5	15
	%	33%	7%	27%	33%	100%
Older age group	N	5	3	2	5	15
	%	33%	20%	13%	33%	100%
TOTAL	N	10	4	6	10	30
	%	33,3%	13,3%	20%	33,3%	100%

Content monitoring and parental control applications

The extent to which parents monitor the content that children access on mobile devices, as well as parents' awareness of the parental control applications and their use concerning the variable Age group, are presented in Table 5.

There is no statistically significant difference between the younger and older age groups on the observed safety aspects: monitoring of the content accessed by children ($\chi^2(1) = 0.37, p = 0.543$), awareness of parental control applications ($\chi^2(1) = 0.16, p = 0.69$), and use of parental control application ($\chi^2(1) = 0.16, p = 0.69$).

Table 5

Parental monitoring of the content accessed by children, parental awareness of the parental control applications, and parental use of the applications themselves

Age group	Monitoring the content accessed by children			Awareness of parental control applications		The use of parental control application		
	Complete monitoring	Partial monitoring	No monitoring	Familiar	Not familiar	Yes	No	
Younger age group	N	14	1	0	10	5	5	10
	%	93%	7%	0%	67%	33%	33%	67%
Older age group	N	13	2	0	11	4	4	11
	%	87%	13%	0%	73%	27%	27%	73%
TOTAL	N	27	3	0	21	9	9	21
	%	90%	10%	0%	70%	30%	30%	70%

Discussion and conclusion

The first research question about differences in relation to age group showed that significant differences were noted in relation to age group: owning mobile devices, knowledge of YouTube, TikTok, Viber, PlayStore and SnapChat applications, difference in control over downloading applications from the children's point of view.

Plowman et al. (2010) found that children's technological competencies were directly related to several factors: their age, maturity, time spent using the device, personality, and gender. This study found that as children get older, the number of children with their own cell phones and the opportunity to use cell phones outside the home increases which confirms the results of the OFCOM report (2013).

Of all the observed applications, children are most frequently familiar with YouTube in both age groups, which is in line with the OFCOM report (2013) that mobile devices use is rapidly increasing among children between five and seven, and that they most often watch videos. Also, this indicates that all children from the older age group and at least 73% of children from the younger age group have access to the Internet, which is in line with Eurostat (2022) and the Central Bureau of Statistics, even for kindergarten children. Also, the fact that 73% of children from the younger age group recognize YouTube and thus have access to the Internet, confirms the statements of Borovac (2019) that the age limit for the first internet access has dropped down across Europe.

It is interesting to note that a greater number of children in the younger age group recognized the application for taking photos than the children in the older age group. However, recognition of TikTok applications showed the greatest difference in the number of children who are familiar with it concerning the age group. In line with the conclusions of Plowman's research (2010) that children's technological competencies were directly related to their age and maturity as same as in our results (recognition of TikTok app), but there were differences between our result and Plowman's research(2010) about application for taking photos. Further research could focus on identifying elements that influence the choice of applications by children in relation to age.

The results show that as children get older, their knowledge about downloading applications from the Play Store changes, which is to be expected according to Plowman (2010). In terms of restrictions on downloading applications, the results show that parents of older children have more control over what applications their children download, thus showing that they recognize the allegations of the UNESCO report (2015) that children and young people are a vulnerable group when accessing the internet.

When we talk about the safety of their children when using mobile devices and the Internet, it is necessary to point out that all parents, in some way, control the content their children access via cell phone. When observing the content monitoring and parental control applications, there is no significant difference between the younger and older age groups. This research showed that a larger number of parents, compared to their children, stated that a password is required to download applications, similar as Chaudron (2015), which is especially pronounced in the younger age group, which confirms Dias et al. (2016) conclusions that parents of younger children felt that their children were protected at that moment because of their age and inexperience.

About 70% of parents in both age groups are familiar with parental control applications, but only about 30% use them. In further research, it would be interesting to explore the reasons for the low use of such applications, especially given that almost 90% of parents, regardless of age, report that they fully control the content their children access via cell phone.

There is a lack of research in Croatia about usage of mobile devices in early and preschool age, therefore, future studies should be more oriented in this field to clarify crucial factors affecting children's mobile devices usage in everyday life, in order to collect various variables to explain further the differences in mobile usage strategies and adoption among parents and children.

References

- Borovac, T. (2019). Pregled istraživanja o informacijskoj sigurnosti. In T. Velki & K. Šolić (eds.), *Izazovi digitalnog svijeta* (pp. 15-37). Accessed 11/9/2021 at: <https://repositorij.foozoz.hr/islandora/object/foozoz:988>
- Brito, R. (2016). Who taught you how to play?», «I did!»: digital practices and skills of children under 6. *MEDIA EDUCATION* Vol. 7, n. 2, pp. 281-302 doi: 10.14605/MED721607
- Chaudron, S. et al. (2015). Young children (0–8) and digital technology: A qualitative exploratory study across seven countries. *JRC 93239/EUR 27052*.
- Eurostat (2021). Individuals – devices used to access the internet. Accessed 10/4/2022 at: https://ec.europa.eu/eurostat/databrowser/view/ISOC_CI_IN_H/default/table?lang=en&category=isoc.isoc_i.isoc_ici
- Dias, P. et al. (2016) The role of parents in the engagement of young children with digital technologies: Exploring tensions between rights of access and protection, from 'Gatekeepers' to 'Scaffolders'. *Global Studies of Childhood*. Vol. 6(4) 414–427.

- Smahel, D., Machackova, H., Mascheroni, G., Dedkova, L., Staksrud, E., Ólafsson, K., Livingstone, S., and Hasebrink, U. (2020). EU Kids Online 2020: Survey results from 19 countries. EU Kids Online. <https://doi.org/10.21953/lse.47fdeqj01ofo>
- Livingstone, S., Haddon, L., Görzig, A., & Ólafsson, K. (2011). EU kids online: final report. London: EU Kids Online, London School of Economics & Political Science. Open.
- Livingstone S, Cagiltay K. and Olafsson K. (2015). EU Kids Online II Dataset: A cross-national study of children's use of the Internet and its associated opportunities and risks. *British Journal of Educational Technology* 46(5): 988–992.
- Kılıç, A.O. et al. (2019). Exposure to and use of mobile devices in children aged 1–60 months. *European Journal of Pediatrics* (2019) 178:221–227
- Marić, I. (2021). The use of mobile devices in children of early and preschool age (Graduation thesis). Faculty of Education, University of Osijek. <https://urn.nsk.hr/urn:nbn:hr:141:411048>
- Marić, I., Borovac, T., Dobi Barišić, K. (2021). Mobile devices and preschool children: do their parents know how much they know? In: L. Gómez Chova, A. López Martínez, I. Candel Torres (eds.) 16th International Technology, Education and Development Conference. March 7th-8th, 2022. Proceedings of INTED2022 Conference 7621- 7630
- OFCOM (2013). Children and Parents: Media Use and Attitudes Report. Retrieved from: <http://stakeholders.ofcom.org.uk/binaries/research/media-literacy/october-2013/research07Oct2013.pdf>
- Pavlović Breneselović, D. (2012). (Ne)postojeći digitalni sustav u predškolskom vaspitanju. In: I. Milićević (ed.), *Zbornik radova naučno-stručnog skupa sa međunarodnim učešćem Tehnika i informatika u obrazovanju – TIO 2014* (str.319-325). Čačak: Fakultet tehničkih nauka u Čačku.
- Plowman L, Stephen C., McPake, J. (2010). Supporting young children's learning with technology at home and in preschool. *Research Papers in Education* 25 (1) 93-113
- Vekić-Kljajić, V. (2016). Stavovi roditelja predškolske djece o ključnim kompetencijama važnima za budući uspjeh djeteta. *Školski vjesnik*, 65 (3), 379-401. Accessed 2/8/2021 at: <https://hrcak.srce.hr/178098>

Adolescents' online motivation and social influences on their online behavior

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Abstract

The aim of this research was to examine adolescents' online motivation and social influences on their online behavior. 146 female and 45 male (N= 191) secondary school students participated in this research. Results showed that adolescents engage in online activities ((1) online gaming, (2) watching clips on YouTube, (3) browsing the Internet and (4) social networking) primarily because they are bored and have too much free time and rarely for the academic and informational purposes. Most often adolescents are online alone, 67% of adolescents share at least one online activity with a peer, while only 14% of them share online activity with a parent. Parents help promoting online safety more than peers do, but peers are more likely to help adolescents when they encounter a problem or something that bothers them online. Parents and peers influence girls more than boys when it comes to online safety.

Keywords: secondary school students, online motivation, social mediation

Online risks for adolescents

Socializing in the virtual world can represent a distance from the real world, an escape to an idyllic, no-responsibility world that offers enticing opportunities as well as risky situations. The combination of impulsiveness, tendency to overestimate their digital skills and poorly developed decision-making abilities makes adolescents the population that is most exposed to online risks (Steijn et al, 2016; Velki et al., 2017). Research has shown that adolescents have the lowest security awareness and are exposed to the greatest online security risks; secondary school students, compared to adults, more often disclose their e-mail address and passwords, disclose or borrow personal data, and consider certain risky online activities safe (Steijn et al., 2016; Velki et al., 2017). According to Livingstone & Stoilova (2021) online risks arise when an adolescent engages with and/or is exposed to potentially harmful *content*; experiences and/or is targeted by potentially harmful *contact*; witnesses, participates in and/or is a victim of potentially harmful *conduct*; and is exploited by potentially harmful *contract*. Their classification also distinguishes between *aggressive*, *sexual* and *value* risk. *Content risk*

includes pro-anorexia, self-harm, suicide and race hatred content. *Contact risk* includes *sexting* or online communication with potentially harmful adult strangers. *Conduct risk* happens when a child is engaged in online bullying, harassment etc. *Contract risk* implies being tricked into buying fake or illegal goods and having credit card or personal information hacked (Livingstone & Stoilova, 2021).

Characteristics of adolescents' online activity

Study by Vejmelka et al. (2017) found that adolescents use the Internet primarily for socializing, communication and entertainment and less often for informational purposes and self-actualization (reading news, books, learning new skills, acquiring new knowledge etc.). There is also evidence that female and male adolescents differ in their online motivation. Girls spend more time online than boys on social networks, listening to music, messaging, in online shopping and browsing the Internet for homework and medical information. Boys spend significantly more time than girls in riskier activities, playing online games, searching for adult content and in online gambling (Livingstone et al., 2011).

Most research suggests that the amount of time spent online is increasing (Buljan Flander et al, 2020; Ciboci et al., 2020). According to one national study, around 73% of secondary school students contact their peers several times a day using the Internet and 17% of secondary school students spend more than 5 hours a day online (Đuranović & Klasnić, 2016). Unfortunately, almost 30% of children aged 11 to 16 report one or more experiences related to excessive Internet use (neglecting school responsibilities, insomnia, etc.). Compared to girls, boys spend more time online (Ciboci et al., 2020). Large number of research concluded that risky online behaviors, for example cyberviolence, personal data disclosure and risky online communication are associated with higher amount of time spent online (e.g. Carević et al., 2014; Livingstone et al., 2011). When reviewing the literature, it is possible to observe that there is a lack of research on adolescents' motivation to use certain applications or engage in certain online activities, as well as data on how adolescents spend time online - whether they are involved in certain activities alone or in the company of their parents and peers.

Predictors of safe online behavior – digital skills and risk awareness

It seems that most prevention programs aimed at adopting safe digital skills among young people unfortunately do not show success (Chibnall et al., 2006). Moreover, previous research on adolescents' risky online behavior indicates that adolescents with better digital skills face more online risks and /adopt a riskier online behavior (Livingstone et al., 2011; Velki et al., 2017). It seems that those who spend more time online have better digital skills, engage in various online activities and encounter riskier situations. In addition, various risky online

behavior such as communication with strangers, disclosure of personal information and passwords are interrelated (Livingstone et al., 2017; Meter & Bauman, 2015). Research of the relationship between online risk awareness and risky online behavior are inconclusive (Teimouri et al., 2018; Velki et al., 2017). Some results suggest that greater risk awareness is associated with safer, and some with riskier online behavior. The problem is the fact that there is no consensus on the operationalization of concepts such as *online risk awareness*, *privacy concerns*, *security awareness*, etc. among different researchers and these concepts more or less overlap, depending on the research. In addition, certain personality traits such as extraversion, neuroticism, impulsivity, as well as parental mediation of adolescents' online activity appear to be more related to adolescents' online risk behavior than risk awareness (Nikken, 2017; McCormac et al., 2016). Some research suggests that online risky behaviors are often unintentional and unplanned (Acquisti & Gross, 2006; Acquisti et al., 2015). Our behavior is influenced by cognitive components such as risk awareness but also by social factors and emotions, especially in adolescence (Ouytsel et al., 2020). Risky behavior such as disclosing personal data online is not always exclusively risky but also has certain benefits for adolescents; increased self-esteem, closeness to peers, etc. Before engaging in an activity online, individuals do a costbenefit analysis and then decide should they engage in a particular behavior or not. It seems that adolescents tend to share personal information online and communicate with strangers, which can be one of the ways to attract social attention and gain popularity among peers (Brstilo et al., 2014; Steijn, et al., 2016).

Social influences on adolescents' online behavior

Parents represent an important factor in influencing children's online behavior through their supervision of children's online activities. When it comes to parental mediation of online activity, it is possible to distinguish positive or active parental regulation, which includes encouraging certain activities and talking about online content with a child, and negative or restrictive parental regulation of a child's online activity, which includes prohibiting certain content and disabling certain online activities (Livingstone et al., 2017). Research conducted by Livingstone et al. (2017) showed that positive parental regulation leads to a significant increase in opportunities for learning skills, gaining social capital etc. when restrictions are low, while restrictions lead to a significant reduction in risk when positive regulation is pronounced. It seems that there is no combination of parental regulation strategies that will simultaneously reduce online risks and increase online opportunities for a child (Livingstone et al., 2017). As children get older parents are less involved in promoting their risk awareness and think that children are in less risk than they really are (Livingstone et al., 2011). Risks that adolescents

are facing grow with their age and various research shows that they are most vulnerable in middle and late adolescence (Brstilo et al., 2014; Livingstone et al., 2011). Research suggests that parental mediation can be successful in promoting safe online behavior among adolescents of any age (Livingstone et al., 2017; Nikken, 2017).

Aim of the research

The aim of this research was to examine some adolescents' online activities and motivation for those activities. This is important because previous research showed that boredom and excess leisure time are associated with greater exposure to online risks (e.g. Livingstone et al., 2011; Vejmelka et al., 2017). It is also interesting to investigate whether adolescents feel they are involved in certain activities because they want to be like their peers or because they feel addicted to certain activities. Adolescents' risky online behavior is specific because adolescents often engage in risky activities without real intention - under the influence of social factors (Acquisti et al., 2015; Brstilo et al., 2014), so the aim was to also examine which online activities adolescents share with their parents and peers, as well as how they influence their online risk awareness.

Methodology

Instrument

The *Online motivation and parents' and peers' mediation questionnaire* was designed for the purpose of this research, in accordance with some previous research (Livingstone et al., 2017; Livingstone et al., 2011). The first part of the questionnaire consisted of four general questions – students wrote their age, gender, the number of their (real life) friends and the number of their Facebook friends. The second part consisted of five items regarding online motives. The third part of the questionnaire consisted of eight items regarding parents' and peers' influence on adolescent's online activity.

Participants

Vocational and grammar school students (146 female and 45 male ($N= 191$)), from first to fourth grade (15 to 18 years old) participated in this research.

Procedure

The research was conducted in January 2020. The principals of the schools gave their consent for participation in the research. The participation was voluntary and anonymous. The purpose of the research was explained to the participants. Since participants were older than 14 years, they gave their informed consent for participation and their parents were informed that

they will be a part of the research. Students filled out the questionnaire during school hours. They were all given the same instructions. The procedure lasted approximately 15 minutes.

Results

Adolescents' online activities

The first question in the questionnaire referred to adolescents' online activities. Participants could choose several responses to that question - the activities they were most engaged in. Results showed that the most popular online activities among adolescents are social networking; 93.2% of adolescents use Internet mainly for social networking, listening to music and browsing the Internet for interesting information, such as sports match results, celebrity gossip etc. Only 54.5% of them say they use the Internet mostly for informational purposes - because they seek necessary information regarding weather forecast, timetable, bus information etc., and 49.2% of them use the Internet mostly for schoolwork or homework. It seems that there are some differences in online motivation regarding gender. Girls use the Internet for academic and informational purposes more than boys – 80% of girls stated they use the Internet primarily for school, and 63% of them primarily for informational purposes; yet only 24% of boys stated they use the Internet primarily for school, and 35% of them for informational purposes. Boys use the Internet for online gaming more than girls do – 50% of boys claimed their main reason for using the Internet is online gaming, yet only 16% of girls stated the same.

Adolescents' motivation for different online activities

Adolescents' motivation for four online activities – (1) online gaming, (2) watching YouTube videos, (3) browsing the Internet and (4) social networking was examined.

Online gaming

Results showed that 74.3% of adolescents play online games (Table 1). The main reasons for online gaming are boredom and excess of free time. Only 3.7% of adolescents think they are addicted to online games.

Table 1

Online gaming motives

	f	f (%)
boredom	89	46.6
excess of free time	37	19.4
relaxation	8	4.1
addiction	7	3.7
to be like everybody else	1	.5
I do not play online games	49	25.7

YouTube

All of the adolescents from the examined sample visit YouTube (Table 2). Most of them do it for relaxation, because they are bored and have extra free time, but 14.7% of them think they are addicted to YouTube. Only 4.7% of adolescents visit YouTube to learn something new.

Table 2

YouTube motivation

	f	f (%)
boredom	56	23
excess of free time	32	16.8
relaxation	66	36
addiction	28	14.7
to learn something new	9	4.7
to be like everybody else	0	0

Browsing the Internet

Results showed that 33% of adolescents browse the Internet mainly for schoolwork, homework or some necessary information and 67% of them mainly for fun.

Social networking (Facebook and Instagram)

On average students have 578 Facebook friends ($SD=252.31$), but most of them (67.5%) from 2 to 5 ($M=3.8$, $SD=2.71$) close friends in real life (Table 3). More than 50% of students from the sample have more than 400 Facebook friends and 95.8% of students use social networks (Facebook and Instagram) to stay in touch with their real life friends. Almost 25% of them communicate with strangers online on a regular basis. Only 1% of them do not use social networks.

Table 3

Number of real life and Facebook friends

Number of real-life friends	f (%)	Number of Facebook friends	f (%)
0-1	12.3	0-200	27.2
2-3	37.7	201-400	20.4
4-5	29.8	401- 800	26.2
6-8	20.4	800 +	26.2

Shared online activities

Most adolescents play online games with their peers (Table 4). They browse the Internet with a peer or when they are alone. They visit YouTube when they are alone or with a peer and

usually use social networks when they are alone. Most often adolescents are alone online, sometimes with a peer; 67% students share at least one online activity with a peer) and very rarely with parents; 86% do not share any activity with a parent. Girls share more online activities with parents than boys do ($t_{(189)}=2.142, p<.01$).

Table 4

Shared online activities

		f (%)
Online gaming	alone	7
	with a parent	22
	with a friend	71
Browsing the Internet	alone	32
	with a parent	9
	with a friend	59
YouTube	alone	77
	with a parent	2
	with a friend	21
Social networking	alone	88
	with a parent	1
	with a friend	11

Parents' and peers' influences on adolescents' online activity

The data showed that according to students, 66% of parents talked about online threats with their child, 49.7% of parents advised a child about online safety and 54.4% parents helped when a child encountered an online problem (Table 5). Parents help promoting online safety more than peers do, but peers are more likely to help them when they encounter a problem or something that bothers them online. Parents and peers influence girls more than boys when it comes to online safety ($t_{(189)}=4.873; p<.01; t_{(189)}=3.705; p<.01$). However, results suggest that 67.5% of parents never set any rule about online behavior to their child (Table 6). The most common rule they set is not to give too much personal information online; 24.6% of parents set that rule. Only 4.2% parents limited their child's time online and 3.7% of them banned visiting certain web pages.

Table 5

Parents' and peers' online mediation of adolescents' online activity

		parents (%)	peers (%)
talk to me about online threats	yes	66.0	45.4
	no	34.0	54.5

advise me on how to use the Internet more safely	yes	49.7	29.3
	no	50.3	70.7
help me when I come across a problem or something that bothers me online	yes	54.5	70.7
	no	45.5	29.3

Table 6

Parents' rules about online activity

	f	f (%)
time limit	8	4.2
banned personal information disclosure	47	24.6
banned visiting certain web pages	7	3.7

Discussion

This research showed that adolescents use the Internet mainly because they are bored and have too much free time. Results are consistent with previous research (Ciboci et al, 2020; Đuranović & Klasnić, 2016) that concluded that a large part of adolescents' free time is spent online and those who spend excessive time online are exposed to high amount of online risks. In future research it would be interesting to examine how much adolescents, who spend a lot of time online, are involved in certain extracurricular activities and whether involving adolescents in quality offline activities can reduce their exposure to risky online content. Although adolescents spend a lot of time online, the question of their digital literacy arises – as this research shows, they use the Internet mainly for entertainment – social networks, listening to music and browsing for interesting information and less often for informational and educational purposes. There are not many opportunities to learn something new during these activities that interest adolescents the most. Although YouTube offers a variety of content and opportunities to learn new information, it is interesting that only 4.7% of adolescents visit YouTube to learn something new. In accordance with previous research (Livingstone et al., 2011; Vejmelka et al., 2017) this research showed that girls use the Internet for informational and academic purposes more than boys do and that boys engage in online gaming more than girls do.

The Internet can be a place to socialize, connect with peers and it can affect adolescents' well-being and self-esteem, but it is worrying that a certain percentage of adolescents in this research feel that they are addicted to certain online content – YouTube and online gaming. In addition, adolescents state that they do not play online games and do not visit YouTube to be like others, but the question is whether they are truly aware of the influence others have on their own behavior.

Even though majority of adolescents from the examined sample say that they use social networks to maintain existing friendships, there is a big discrepancy between the number of Facebook friends and the number of their real life friends - it seems that although adolescents have many online friends, very often more than 800 Facebook friends, most of these connections are not considered to be close friendships. It is questionable whether they are aware of Facebook privacy settings and if they think about the personal information they share with their Facebook friends who are actually strangers to them. The information they share is often private and a lot of people can see it. Almost all adolescents from the sample use social networks, and the fact that almost a quarter of them communicate with strangers via social networks is worrying.

The results of this research also showed that more than two-thirds of adolescents share at least one online activity with a peer - most often playing online games together or browsing the Internet, while only 14% of them share an online activity with a parent, usually playing online games together. When using social networks adolescents are usually alone. This research suggests that more than half of parents talked about online safety and advised their child how to behave online. Very rarely parents set time limit on adolescents' online activity or ban visiting certain websites. Nearly one quarter of parents advised a child not to give too much personal information online. According to data collected in this research it can be concluded that parents rarely use negative or restrictive parental regulation (prohibiting and disabling certain activities) for adolescents. It seems that parents help promoting online safety more than peers do, but peers are more likely to help them when they encounter a problem or something that bothers them on the Internet.

Furthermore, parents and peers have greater influence on girls than on boys when it comes to online safety and parents set more rules regarding online activities to girls than to boys.

In future research it would be useful to examine adolescents' motivation for engaging in other online activities –social networks such as TikTok, online forums etc., and develop a validated measure of adolescents' online motivation. Adolescents participate in certain online activities together with peers, so it would be interesting to examine how peers influence each other during these shared online activities. It would be useful to examine whether the coronavirus pandemic made changes in adolescents' online activities and also conduct a research on a larger sample that will include approximately the same number of boys and girls as well as younger children so that results can be generalized to a larger population.

Conclusion

Adolescents use the Internet primarily because they are bored and have too much free time. They show signs of risky online behavior; some adolescents think they are addicted to online gaming and YouTube, and almost one quarter of them communicate with strangers via social networks on a regular basis. Adolescents often share online activities with a peer and probably influence each other's behavior during these shared activities. Parents help promoting online safety more than peers do, but peers are more likely to help them when they encounter online problem.

References

- Acquisti, A., & Gross, R. (2006). Imagined Communities: Awareness, Information Sharing, and Privacy on the Facebook, in: Danezis G., & Golle P. (eds.), *Privacy Enhancing Technologies. Lecture Notes in Computer Science* (pp. 36-58). Springer, Berlin, Heidelberg. https://doi.org/10.1007/11957454_3
- Acquisti, A., Brandimarte, L., & Loewenstein, G. (2015). Privacy and human behavior in the age of information. *Science*, 347(6221), 509-514. <https://doi.org/10.1126/science.aaa1465>
- Brstilo, I., Batinić, L., & Grgić, S. (2014). Navike djece i mladih kod objavljivanja osobnih podataka na društvenim mrežama. *Sociološka luča*, 8(2), 105-121.
- Buljan Flander, G., Selak Bagarić, E., Prijatelj, K., & Čagalj Farkaš, M. (2020). Ispitivanje aktualnih trendova u korištenju društvenim mrežama kod učenika prvog i trećeg razreda srednjih škola u Hrvatskoj. *Kriminologija i socijalna integracija*, 28 (2), 277–294. <https://doi.org/10.31299/ksi.28.2.6>
- Carević, N., Mihalić, M., & Sklepić, M. (2013). Ovisnost o internetu među srednjoškolcima. *Socijalna politika i socijalni rad*, 2(1), 64-81.
- Chibnall, S., Wallace, M., Leicht, C., & Lunghofer, L. (2006). *I-safe evaluation. Final report*, Faiffax: Caliber Assotiation.
- Ciboci, L., Ćosić Predrag, I., Kanižaj, I., Potočnik, D., & Vinković, D. (2020). *Nacionalno istraživanje o sigurnosti djece na internetu: HR Kids Online*. Društvo za komunikacijsku i medijsku kulturu. Retrieved January 9, 2022, from <http://hrkids.online/prez/EUKidsOnlineHRfinal.pdf>
- Đuranović, M., & Klasnić, I. (2016). Povezanost školskog uspjeha i rizičnih ponašanja srednjoškolaca na internetu. *Napredak*, 157(3), 263 – 281.
- Livingstone, S., Haddon, L., Görzig, A., & Olafsson, K. (2011). *Risks and safety on the internet: the perspective of European children: full findings and policy implications from the EU Kids Online survey of 9-16 year olds and their parents in 25 countries*. EU Kids Online, Deliverable D4. London, UK: EU Kids Online Network.

- Livingstone, S., Olafsson, K., Helsper, E.J., Lupianez-Villanueva, F., Veltri, G.A., & Folkvord, F. (2017). Maximizing Opportunities and Minimizing Risks for Children Online: The Role of Digital Skills in Emerging Strategies of Parental Mediation. *Journal of Communication*, 67(1), 82-105. <https://doi.org/10.1111/jcom.12277>
- Livingstone, S., & Stoilova, M. (2021). *The 4Cs: Classifying Online Risk to Children (CO:RE Short Report Series on Key Topics)*. Hamburg: Leibniz-Institut für Medienforschung, Hans-Bredow-Institut (HBI), CO:RE - Children Online: Research and Evidence. <https://doi.org/10.21241/ssoar.71817>
- McCormac, A., Zwaans, T., Parsons, K., Calic, D., Butavicius, M., & Pattinson, M. (2016). Individual differences and Information Security Awareness. *Computer in Human Behavior*, 69, 151–156.
- Meter, D., & Bauman, S. (2015). When Sharing Is a Bad Idea: The Effects of Online Social Network Engagement and Sharing Passwords with Friends on Cyberbullying Involvement. *Cyberpsychology, Behavior, and Social Networking*, 18(8), 437 – 442. <https://doi.org/10.1089/cyber.2015.0081>
- Nikken, P. (2017). Implications of low or high media use among parents for young children’s media use. *Cyberpsychology: Journal of Psychosocial Research on Cyberspace*, 11(3). <https://doi.org/10.5817/CP2017-3-1>
- Ouytsel, J.V., Walrave, M., Ojeda, M., & Del Rey, R. (2020). Adolescents’ Sexy Self-Presentation on Instagram: An Investigation of Their Posting Behavior Using a Prototype Willingness Model Perspective. *International Journal of Environmental Research and Public Health*, 17(21), 1-15. <https://doi.10.3390/ijerph17218106>
- Steijn, W. M. P., Schouten, A. P., & Vedder, A. H. (2016). Why concern regarding privacy differs: The influence of age and (non-)participation on Facebook. *Cyberpsychology: Journal of Psychosocial Research on Cyberspace*, 10(1), 3. <https://doi.org/10.5817/CP2016-1-3>
- Teimouri, M., Benrazavi, S.R. Griffiths, M. D., & Hassan, S. (2018). A Model of Online Protection to Reduce Children’s Online Risk Exposure: Empirical Evidence From Asia, *Sexuality & Culture*, 22 (4), 1205–1229. <http://doi.org/10.1007/s12119-018-9522-6>
- Vejmelka, L., Strabić, N., & Jazvo, M. (2017). Online aktivnosti i rizična ponašanja adolescenata u virtualnom okruženju. *Društvena istraživanja*, 26(1), 59-78.
- Velki, T., Šolić, K., Gorjanac, V., & Nenadić, K. (2017). Empirical study on the risky behavior and security awareness among secondary school- validation and preliminary results. in: P. Biljanovi (ed.), 40th *International Convention on Information and Communication Technology, Electronics and Microelectronics* (pp. 1496-1500). Opatija, MIPRO.

The influence of online teaching on the social status of the children protected by SOS Children's Villages in Croatia

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Abstract

SOS Children's Village accepts a challenging and praiseworthy task of returning balance to the lives of abandoned, impoverished, and physically and spiritually traumatized children. Among the most critical places and factors of social integration of the children protected by SOS Children's Villages are schools whose functioning and inclusive culture they nurture represent the backbone of their social status and their sense of belonging to the community of peers. As a vulnerable and socially marked group, children protected by SOS Children's Villages are at constant risk of rejection and isolation from peers.

The COVID-19 pandemic at the global level has led to a significant shift in understanding and maintaining the teaching process. It has undoubtedly accelerated changes in teaching and the use of ICT in teaching. Today's online teaching model as a separate concept coexists with traditional ideas of classroom/non-classroom teaching, project teaching, field teaching, etc. For the past two and a half years, online teaching has served to a greater or lesser extent as a substitute for traditional teaching in school. The question arises as to what extent such a teaching model affects the social status of primary school pupils protected by SOS Children's Villages in Croatia. In this research, the focus group method was used to explore attitudes and observations of SOS Mothers of school children from SOS Children's Village Ladimirevci on changes in social contacts between their proteges and other children from the local community.

Keywords: online teaching, pupils, social status, SOS Children's Village

Introduction

Self-evaluation and self-knowledge develop as you grow up and are influenced by cognitive and social skills and variables (Ruble et al., 1990, according Vasta, Haith & Miller, 2005, p. 499.; Velki, Cakić & Oblačić, 2015). Maslow, in his *A Theory of Human Motivation*

(1943), at the fourth level puts *the esteem needs*, of which one group represents “the desire for reputation or prestige (defining it as respect or esteem from other people), recognition, attention, importance or appreciation.” (Maslow, 1943, p. 381) As the children get older, the time that they spend and interact with their peers increases, as well as the need for acceptance by peers. Difficulties that can occur in social experiences such as popularity and friendship can cause anxiety and social isolation (Ladd, 1989; Kolak, 2010). Socially accepted pupils who show prosocial, cooperative and responsible school behavior most frequently achieve higher results. On the other side, socially excluded pupils frequently achieve lower school results and represent a risk group for delinquency, school absences, and dropping out of the school system altogether (Krnjajić, 2002; Kolak, 2010). According to Kingery, Erdely and Marshall (2011), relationships with peers predict self-esteem, school achievement, loneliness, and inclusion in school activities. Hintsanen et al. (2010) have found a high positive correlation between self-esteem and teachers’ assessment of their peer’s acceptance. Earlier, Ladd (1989) constated that peer acceptance and rejection in kindergarten could forecast their styles of interacting in preschool (Ladd, 1989, p. 284).

SOS Children’s Village’s Social Background as a Predictor of Pupils’ Social Status

A child who is temporarily or permanently deprived of a family environment or for its protection cannot be allowed to remain in its family environment is entitled to special protection and assistance from the State. Such care can include, among other things, foster placement, adoption, or, if necessary, placement in suitable childcare institutions (Convention on the Rights of the Child, 1989, Art. 20). Forms of alternative care include setting the child with relatives, in children’s care homes, family-type children’s homes, or foster families (Đuranović, Klasnić & Klasnić, 2017). Life in SOS Children's Villages represents alternative (family-type) care for children who can no longer live with their parents or biological families. There are currently 559 SOS Children’s Villages and 713 youth programs worldwide*. At the moment, SOS Children’s Village Croatia† takes care of 240 children and young people situated in two SOS Villages in Lekenik and Ladimirevci and four SOS Youth Communities in Osijek, Zagreb, and Velika Gorica. Every SOS Family has one person – the SOS Mother who is obliged to take care of her children and lives with them in the same house (Miljević-Riđički & Pavin-Ivanec, 2009). SOS Villages today support the concept of SOS Parent. The role is gender-neutral, although the

* <https://www.sos-childrensvillages.org/where-we-help>

† <https://sos-dsh.hr/sto-radimo/opcenito/>

practice usually recognizes the role of the SOS Mother. Therefore, SOS Mother must be a qualified, professional person who works with a team of professionals (pedagogue, psychologist, social worker). The main reasons for placing children in SOS Children's Villages are neglect, abuse, and/or death of both parents. They are usually in a hygienically and behavioral neglected state during admittance (Daniel & Martinović, 2005, according to Miljević-Riđički & Pavin-Ivanec, 2009). Once admitted, every child and young individual, a protegee of SOS Children's Village, gets a chance to find their own, very personal path, heal wounds, and develop their potential.

Due to rigorous privacy and protection policy, complex ethical issues, and research restrictions on the social status of children protegees of SOS Children's Villages, there aren't many scientific data that provides information on that subject, so research conducted on sensitive groups of children with similar upbringing backgrounds should be considered. Trout et al. (2008) show that growing up in institutionalized surroundings leads to children's school underachievement (Miljević-Riđički & Pavin-Ivanec, 2009). In research conducted by Quinton, Rutter, and Liddle (1984), girls in institutional care, similar to SOS care, according to Miljević-Riđički and Pavin-Ivanec (2009), have had more significant difficulties in psychosocial adjustment. As risk factors for social exclusion of children, literature most frequently points out poverty, psychic illnesses and unstable parental/caregivers relations, migrations, neglect, and child abuse, as well as premature birth of a child (Sabates & Dex, 2013; Bouillet & Domović, 2021), where a more significant number of risk factors increases the probability of social exclusion of children. Romera et al. (2020) point out deficient levels of social preference, perceived popularity, and friendship received by chronic victims of bullying, which are especially alarming as these levels are far below those obtained by sporadic and variable victims.

Online teaching - a risk factor for social exclusion

Even though online teaching isn't a novel concept, before the COVID-19 pandemics, no one would've thought that such a quick change in worldwide mindset and teaching method would be possible. If anything is to be learned from this, teaching practices have evolved to a new online era much faster than anyone could have predicted only three years ago. In normal circumstances, designing an online course follows a systematic instructional design process with careful consideration of the unique characteristics of target learner groups and the chosen instructional medium (Reiser, 2001; Lee et al., 2021).

In March 2021, the UN released *General Comment No. 25* on children's rights about the digital environment: "The digital environment is becoming increasingly important across most aspects of children's lives, including during times of crisis, as societal functions, including education, government services and commerce, progressively come to rely upon digital technologies. It affords new opportunities for the realization of children's rights, but also poses the risks of their violation or abuse." (General Comment No. 25, 2021)

This paper does not argue the online teaching model through its properties and possibilities but as a risk factor of additional social exclusion for a vulnerable and socially marked group of pupils, Children of SOS Children's Village Ladimirevci.

Research Methodology

This research is a part of a larger research project that deals with teachers' inclusive social-pedagogical competencies necessary for children's education from SOS Children's Villages. The research goal was to collect qualitative data as a base for future quantitative analysis focusing on the article subject *The influence of online teaching on the social status of the children protected by SOS Children's Villages in Croatia*. According to the above mentioned, this research is based on the following two hypotheses:

H1: COVID-19 pandemics have a negative impact on the social status of a sensitive group of pupils coming from SOS Children's Village.

H2: Online teaching negatively impacts the social status of a sensitive group of pupils coming from SOS Children's Village.

Considering the nature of the problem, the research is conducted deductively, starting from the hypotheses mentioned above. The primary method used to achieve the research goal is the focus group method. This qualitative research technique combines the advanced form of a group interview with participating observation (Vinković, 2021). Collected data have been analyzed using the qualitative approach for studying subjects (Halmi, 2004, p. 195) and will be used to develop a questionnaire for further examination on the subject.

An occasional group of seven SOS Mothers from SOS Children's Village Ladimirevci was selected from a targeted one of two SOS Children's Villages in Croatia. Applied criteria were proximity and availability of respondents. The interview was done by online video call via the Microsoft Teams platform and was recorded for more accurate later transcription. Respondents have been informed of the problem and the study's goal. Some descriptive data gathered is presented in Table 1, using pseudonyms to preserve SOS Mothers' anonymity.

Table 1*SOS Mothers - descriptive data*

Qualitative data collected about SOS Mothers

Pseudonym	Age (years)	Work experience as SOS Mother (years)	Current number of children	Number of children included in online classes
M1	55	27	4	4
M2	56	10	5	4
M3	59	5	5	2
M4	61	13	5	4
M5	59	10	6	5
M6	57	27	5	5
M7	60	13	7	4
Average	58,14	15	5,29	4

SOS Children's Village Ladimirevci gives home to 80 children living in 16 houses[‡]. All of them at some point go to Primary School Ladimirevci, which consists of three divisions: one Main (8 grades school) situated in village Ladimirevci, one branched (8 classes school) located in the village Ivanovci and one branched (4 grades, multi-grades school) school located in the village Harkanovci. In further text, *Main School Ladimirevci* will be referred to when describing the social status of SOS children because it is the school unit these pupils go to. Table 2 shows the number of pupils in the Main School Ladimirevci for the past three school years compared to the number and the share of SOS children in the school population.

Table 2*Main School Ladimirevci - number of pupils for the past three school years*

Numbers and share of SOS Children in Main School Ladimirevci

		Number of pupils	Number of SOS children	Percentage of SOS children in the school population
School year 2019/2020	1st to 4th grade	76	26	34%
	5th to 8th grade	81	27	33%
	IN TOTAL	157	53	34%
School year 2020/2021	1st to 4th grade	67	21	31%
	5th to 8th grade	85	25	29%
	IN TOTAL	152	46	30%
School year 2021/2022	1st to 4th grade	67	20	30%

[‡] <https://sos-dsh.hr/ladimirevci/>

5th to 8th grade	77	23	30%
IN TOTAL	144	43	30%

During the group interview, the following research questions were asked:

1. What is their children's social status and acceptance in the local school community?
2. What are the consequences of the COVID-19 pandemic measures on their children's functioning and schooling?
3. Is there a change in socializing with other children from school comparing moving to online classes to a prior and traditional classroom schooling model?

Results and discussion

It has been gathered around 60 minutes of the interview video recording. Thematic analysis of the collected material identified three main themes listed from A to C and discussed in the next subchapters.

A. Socializing with local school community children before COVID-19 pandemics

All the SOS Mothers agreed that their children generally have sporadic social contact with the local community children outside the school. Some report children's experiences of one or maybe, two long-term friendships they nurture. They've reached a consensus on this subject, explaining that children who come to their care have often suffered significant trauma before being set with them, so they have difficulties adapting to such a form of socializing. They must consider every case differently because their socialization mostly depends on their background story, which correlates with earlier mentioned findings (Sabates & Dex, 2013; Bouillet & Domović, 2021). M4 reports: "Children come here with painful pasts and have adjustment difficulties." M6 explains: "If children come younger and less traumatized, they have better chances of socializing and having friends outside the SOS community." Kirkøen et al. (2021), examining the academic struggles among children with home-based support from child welfare services, showed that children with externalizing difficulties show behaviors that disrupt their ability to learn, which causes academic problems. The authors also state that it is possible that experiencing academic difficulties causes increased externalizing difficulties, perhaps due to rejection and negative feedback from peers and teachers. SOS Mothers commend the local school and the local community for not having prejudices toward their children. Eventual problems come from complicated cases of traumatized or neglected children whose issues are addressed square on every occasion. SOS Mothers have also agreed that while

younger, children want to have peers as friends and call them and go to birthday parties, etc., but as they become older, they reduce it to internal SOS socializing. They explain it with changes they experience during puberty and stringent restriction measures imposed by SOS Organization. The majority of the children lose interest in socializing when they need official approval for every contact they want to make with their peers, such as “taking a stroll to nearby river Karašica with their peers” or “going to movies” (M2), etc. Such strict policy also confuses other parents because SOS Mothers sometimes must have their agreement to take their children in writing. M1 says: “If I want to take their child to the movies with mine, they have to write me agreement on it, or they have to write down that they’ll take care of my child if vice-versa. They get scared.”

These findings agree with the earlier theoretical discussion on how children with difficult upbringing have significant problems with socialization with peers and how it can negatively reflect on their mental health and academic achievement. According to these findings, SOS Children’s Village represents a specific social background that needs to be considered in further studies.

B. Changes in school functioning and local community due to COVID-19 pandemics

This topic was brought to a unanimous conclusion. Pandemic measures were so strict at the beginning of the COVID-19 crisis. The school was closed. SOS Children’s Village was under the most restrictive measures for about six months. During that first period, children weren’t allowed outside their courtyard. Covid-19 measures were relaxed. However, the impact on socializing continued to be significant. In schools, children still aren’t allowed to interact without protective masks during class breaks with pupils from other grades. Not so long ago, they weren’t allowed to interact at all. It led to numerous changes in children’s behavior. Most of their school children have become distant, alienated, antisocial even. They all agree that actual consequences are yet to be seen because a significant part of their childhood has been taken away, and they don’t know what will derive from it. Ristić Dedić and Jokić (2021), showed that the pandemic had the greatest negative impact on the respondents' mental health, extracurricular activities, hobbies, and playing sports. Before pandemics, children were offered different types of free time activities in Ladimirevci, such as chess club, soccer club for boys and girls, folklore society, and church chorus, which no longer exists. It is a small community, and it was too big of a strike on volunteer organizations that gathered local children together. Rajić (2020), states that children's socialization has changed due to quarantine because children no longer have the opportunity to play and socialize with their friends. According to these respondents, the first hypothesis (H1) is considered confirmed.

There are significant indicators that SOS Children carry a certain stigma and are isolated from their school peers, willingly or forced upon them. It is reasonable to suppose that other such schools are suffering from similar problems of having a sizeable sensitive group, in this case of around 30% of the total number of their students, being isolated or at massive risk of isolation from peer community due to their social background. In that case, teachers need to be adequately educated on dealing with the problem, especially in times of crisis, and answers should be found in an academic community.

C. Changes in the SOS Children's behavior due to implementation of the online teaching model

SOS Mothers agree that social contacts with peers in school and other children from the SOS community have changed. Most of the children have school tablets, or if they don't, they use mobile phones and computers to communicate with each other. According to respondents, the Microsoft Teams platform, which local school uses for online classes, has become one of the most popular social networks. They use it to contact relatives connected through the schools' systems and contact friends from schools they've come from. M6 says: "We've experienced online bullying, but it doesn't differ from usual school bullying in puberty. As I see it, pandemics have changed children's behavior, not the online classes." M5 thinks that teachers do not encourage children to do group work in online classes, but that doesn't mean that it changes children's socialization status compared to prior status. They all agree that children's knowledge through online classes can't reach the quality children get in real-life classes. Mothers agree that the quality of online schooling should improve, but there are some benefits also. Ristić Dedić and Jokić (2021) state that organizational changes and restrictions caused by the pandemic had the most negative impact on motivation to learn, while most students rated their impact on the development of digital skills as positive. Mothers also see changes in children's behavior caused by too much time spent in the virtual world. M4 called her preadolescents "zombies alike". M6 thinks children have been alienated from everybody, mostly themselves. The conclusion was that online teaching negatively affects the quality of children's lives, mostly their mental health, but they don't think that it changed their children's social status. So, the second hypothesis (H2) is not confirmed for this focus group.

Nevertheless, the impact of the online teaching model and the pandemics circumstances on this sensitive group of children should be explored more thoroughly. Jokić Begić et al. (2020) displayed that the child's mental health is related to many characteristics of the child and the environment in which they live. In their extensive research dealing with the overall mental health consequences of the COVID-19 pandemics, children's mental health indicators are

correlated to their assessments of changes in free time and spending time with family members and friends. Children who reported increased free time and time spent with family members or friends performed better in times of crisis.

Conclusion

The main research goal of gathering qualitative data for further investigation focusing on this research question has been achieved.

Hypothesis, *H1: COVID-19 pandemics have a negative impact on the social status of a sensitive group of pupils coming from SOS Children's Village*, was accepted and expected considering the observed population's specifics, gathered theoretical data, and the extent of the crisis caused by COVID-19 pandemics.

Initially set hypothesis, *H2: Online teaching negatively impacts the social status of a sensitive group of pupils coming from SOS Children's Village*, was rejected, which was unexpected and proved the value of the focus group method as a means of gathering initial data for further quantitative studies exploring the same phenomenon.

Besides testing hypotheses, the focus group method provided much valuable data. Even though results cannot be generalized outside this group of respondents, qualitative results indicate more complex and more profound problems of social isolation of SOS Children than was initially considered.

This research has not only opened new questions but has also provided enough data to encourage broader and more severe studies on the problem of the social status of this specific population of children, within online teaching, and within the school system in general. The next step is to extend the research to the entire Croatian SOS population to understand the problem better. Given the large number of SOS Children's Villages worldwide, this and similar populations of children coming from alternative care must be considered in future teacher education programs. Specific scientific data must be gathered and taken into account to do so.

References

- Bouillet, D., Domović, V. (2021). Socijalna isključenost djece rane i predškolske dobi: konceptualizacija, rizici i model intervencija. *Ljetopis socijalnog rada*, 28 (1), 71-96. <https://doi.org/10.3935/ljsr.v28i1.388>
- Convention on the Rights of the Child (1989). General Assembly Resolution 44/25. https://downloads.unicef.org.uk/wp-content/uploads/2010/05/UNCRC_united_nations_convention_on_the_rights_of_the_child.pdf

- Convention on the Rights of the Child (2021). General comment No. 25 (2021) on children's rights in relation to the digital environment. Committee on the Rights of the Child. <https://childrens-rights.digital/assets/includes/sendtext.cfm?aus=4211&key=1661>
- Duranovic, M., Klasnić, I., Klasnić, D. (2017). SOS Children's Village Lekenik – A positive example of alternative care for children and youth. *New Trends and Issues Proceedings on Humanities and Social Sciences*, 4(6), 11-16. www.prosoc.eu
- Halmi, A. (2004). *Strategije kvalitativnih istraživanja u primijenjenim društvenim znanostima*. Jastrebarsko: Naklada Slap.
- Hintsanen, M., Alatupa, S., Pullmann, H., Hirstiö-Snellman, P., Keltikangas-Järvinen, L. (2010). Associations of self-esteem and temperament traits to self-and teacher-reported social status among classmates. *Scandinavian Journal of Psychology*, 51(6), 488–494. doi:10.1111/j.1467-9450.2010.00820.x
- Jokić Begić, N., Hromatko, I., Jurin, T., Kamenov, Ž., Keresteš, G., Kuterovac Jagodić, G. ... Sangster Jokić, C. (2020). Kako smo svi mi? Rezultati istraživanja psihičkog zdravlja za vrijeme pandemije COVID-19 u Hrvatskoj. U: A. Bogdan, (Ur.), *Koronavirus i mentalno zdravlje: psihološki aspekti, savjeti i preporuke* (str. 415-460). Zagreb: Hrvatska psihološka komora. <https://urn.nsk.hr/urn:nbn:hr:131:293364>
- Kirkøen, B., Engell, T., Follestad, I.B., Holen, S., Amlund Hagen, K. (2021). Early academic struggles among children with home-based support from child welfare services. *Children and Youth Services Review*, 131, 1-14. <https://doi.org/10.1016/j.childyouth.2021.106268>
- Kolak, A. (2010). Sociometrijski status učenika u razrednom odjelu i školskoj hijerarhiji. *Pedagoški istraživanja*, 7 (2), 243-252. <https://hrcak.srce.hr/118087>
- Krnjajić, S. (2002). Peer relationships and academic achievement. *Belgrade: Education Research Institute*, 34, 213–235. <https://doi.org/10.2298/ZIPI0204213K>
- Ladd, G. W. (1989). Children's Social Competence and Social Supports: Precursors of Early School Adjustment? *Social Competence in Developmental Perspective*, 277–291. doi:10.1007/978-94-009-2442-0_17
- Lee, K., Fanguyhttps, M., Blighhttps, B., Luhttps, X. S. (2021). Adoption of online teaching during the COVID-19 Pandemic: a systematic analysis of changes in university teaching activity. *Educational Review*, 1-24. <https://doi.org/10.1080/00131911.2021.1978401>
- Maslow, A.H. (1943). A Theory of Human Motivation. *Psychological Review*, 50, 370-396. doi:10.1037/h0054346
- Miljević-Ridički, R., Pavin Ivanec, T. (2009). Važnost socijalnog konteksta za kognitivni razvoj predškolske djece – usporedba kognitivne uspješnosti djece koja odrastaju u različitom obiteljskom i institucionalnom okruženju. *Suvremena psihologija*, 12 (2), 309-322. <https://hrcak.srce.hr/82956>

- Rajić, V. (2020) Međuvršnjački odnosi učenika osnovne škole: prijateljstvo u doba pandemije COVID-19 bolesti. U: Strugar, V., Kolak, A. & Markić, I. (Ur.) Školovanje kod kuće i nastava na daljinu u vrijeme HR-COVID-19. Zagreb, HPD; HAZU; ELEMENT, 147-166.
- Reiser, R. A. (2001). A history of instructional design and technology: Part I: A history of instructional media. *Educational Technology Research and Development*, 49(1), 53.
- Ristić Dedić, Z., Jokić, B. (2021). Croatian Pupils' Perspectives on Remote Teaching and Learning during the COVID-19 Pandemic. *Društvena istraživanja*, 30 (2), 227-247. <https://doi.org/10.5559/di.30.2.03>
- Romera, E. M., Jiménez, C., Bravo, A., Ortega-Ruiz, R. (2021). Social status and friendship in peer victimization trajectories. *International Journal of Clinical and Health Psychology*, 21 (1), 1-8. <https://doi.org/10.1016/j.ijchp.2020.07.003>
- Sabates, R., Dex, S. (2013). The impact of multiple risk factors on young children's cognitive and behavioral development. *Children & Society*, 29 (2), 95-108. <https://doi.org/10.1111/chso.12024>.
- Trout, A. L., Hagaman, J., Casey, K., Reid, R., & Epstein, M. H. (2008). The academic status of children and youth in out-of-home care: A review of the literature. *Children and Youth Services Review*, 30(9), 979–994. doi:10.1016/j.childyouth.2007.11.019
- Quinton, D., Rutter, M., Liddle, C. (1984). Institutional rearing, Parenting Difficulties and Marital Support. *Psychological Medicine*, 14, 107-124. doi:10.1017/s0033291700003111
- Vasta, R., Haith, M.M., Miller, S.A. (2005). Dječja psihologija: Moderna znanost. Jastrebarsko: Naklada Slap
- Velki, T., Cakić, L., Oblačić, I. (2015). Odnos samopoštovanja i socijalnog statusa kod učenika nižih razreda osnovne škole. *Školski vjesnik*, 64 (1), 153-172. <https://hrcak.srce.hr/143873>
- Vinković, D. (2021). Inkluzivne socijalno-pedagoške kompetencije učitelja u osnovnoj školi (Disertacija). <https://urn.nsk.hr/urn:nbn:hr:142:550134>
- No child should grow up alone - SOS Children's Villages International. <https://www.sos-childrensvillages.org/>
- SOS Dječje selo Hrvatska. <https://sos-dsh.hr/>

Physical activity and health-related mobile applications

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Abstract

Physical activity nowadays involves the use of various health- and exercise-related applications on smartphones and smartwatches. This study aimed to examine the relationship between the levels of physical activity and the usage frequency of smartphone and smartwatch health-related applications. A total of 128 kinesiology and physiotherapy students filled out The International Physical Activity Questionnaire – Short Form (IPAQ-SF) and answered questions about the frequency of using health-related applications. Based on the IPAQ-SF, the domains of physical activity were calculated: physical activity of vigorous-intensity, physical activity of moderate-intensity, and walking. It has been found that a total of 79.7% of participants use health-oriented applications and functions on their smartphones. They mostly use smartphones to track the type and amount of physical activity – 40.6% of them is using this function more than five days a week. Vigorous physical activity is positively related to smartphone applications for exercising (timers, exercise programs), a stopwatch, and programs for running. Participants engaged in moderate physical activity, and those who walk more use the stopwatch on their smartphones for exercise more often. Just over half of the students use a smartwatch (53.1%). They use them for tracking the type and amount of physical activity (33.6%) and heart rate monitoring (26.6%) more than five days a week. Positive correlations were found between vigorous physical activity and using the smartwatch for monitoring sleep quality and hydration, and using it as a stopwatch while exercising. Results indicate that students use more often applications on their smartphones than on smartwatches, and for slightly different reasons.

Keywords: physical activity, health-related applications, exercising, mental health

Introduction

The benefits of physical activity (PA) are widely recognized nowadays. Any bodily movements of skeletal muscles that require energy expenditure during leisure, transport from one to another place, and work refer to PA (World Health Organization, 2020). The frequency, duration and intensity are the important aspects of PA. The intensity level is expressed as a

metabolic cost of PA in rest (MET – the rate of energy expenditure). To determine the intensity of various activities, there are MET values (Miles, 2007). Physically active individuals have higher levels of well-being and health (Oliver et al., 2020).

However, lack of PA is still a major problem in many countries around the world, and the inactivity of people is still too high. It is consistently confirmed that physical inactivity leads to increased risk for health and a shorter lifespan. Advances in technology reduced the amount of physical labour and have led to a sedentary lifestyle that requires less energy consumption. Consequently, there has been an increase in people's body weight and obesity. The same confirms the finding that insufficient activity increased by 5% in high-income countries (to 36.8%) (World Health Organization, 2020). However, technology can also help people maintain a healthy lifestyle.

An important aspect of life makes leisure, which affects the quality of life, especially for students who can spend it in physical and sports activities. There are many benefits from physical exercise for students – health and academic improvement, reduction of internalized and externalized problems (Hudziak & Tiemeier, 2017), and better mental and physical health (Hossen et al., 2020). Information communication technologies (ICT) are useful in motivating youth to exercise (Zach et al., 2016). Likewise, there are many ways in which smartphones and smartwatches monitor our PA and health factors, such as pedometers, heart rate, energy expenditure, and intensity levels of PA. Applications on smartphones can contribute to the increase in useful leisure and influence people's behaviours and habits (Carden & Wood, 2018). Thematic analysis shows that students are interested in using exercise, health and nutrition-oriented applications, which consequently improve health (Luo & He, 2021). There are many ways technology can be applied in promoting PA which may be used for preventive purposes and to develop healthy habits in young people.

Since the most appropriate way to increase PA is still unknown, the effectiveness of various methods needs to be further explored. Therefore, the main goal of this research is to examine the relation between various health-related applications and functions on smartphones and smartwatches and levels of PA in student population.

Method

Participants

A total of 128 kinesiology and physiotherapy students participated in this study. There were 61.7% kinesiology students and 38.3% physiotherapy students. The sample is evenly

distributed according to gender. The average students' age was 22 ($M=22.08$, $SD=2.84$). Students' characteristics regarding PA are presented in Table 1.

Table 1
Participants' characteristics regarding physical activity

	Total				Kinesiology students				Physiotherapy students			
	<i>Min</i>	<i>Max</i>	<i>M</i>	<i>SD</i>	<i>Min</i>	<i>Max</i>	<i>M</i>	<i>SD</i>	<i>Min</i>	<i>Max</i>	<i>M</i>	<i>SD</i>
Vigorous-intensity PA (MET-min/week)	0	10080	2415.00	2233.53	0	10080	2603.54	2216.20	0	8640	2111.02	2250.56
Moderate-intensity PA (MET-min/week)	0	5040	1478.59	1461.81	0	5040	1676.20	1534.33	0	5040	1160.00	1288.59
Walking (MET-min/week)	0	4158	1792.05	1440.67	0	4158	1735.84	1450.59	0	4158	1882.68	1434.78
Total PA (MET-min/week)	0	17838	5685.69	3721.71	339	17838	6015.63	3661.15	0	15012	5153.73	3794.50

Note: Min/Max – minimal and maximal score; PA - physical activity; MET - metabolic equivalent

Instruments

Sociodemographic characteristics regarding age, gender, type of study, height, and weight were gathered. Data about various health-related applications have been collected through a set of questions. The first part referred to the use of health-oriented smartphone applications and functions. Participants were asked if they use various applications and functions to track the type and amount of PA (e.g. pedometer), caloric intake and consumption (nutrition plans), exercise (timers for HIIT, programs for exercise, menstrual cycle, a stopwatch for exercise, running, hydration, mental training, meditation and relaxation. Also, data about using a smartwatch and for what purposes were collected (heart rate monitoring, exercise monitoring, quality of sleep, level of stress, a stopwatch for exercise, hydration monitoring). Information regarding the use and frequency were collected (whether they use and how many days a week).

The International Physical Activity Questionnaire – Short Form (IPAQ-SF) (Craig et al., 2017) has been applied to obtain internationally comparable results on PA. It has acceptable measurement characteristics and is used in various settings and languages. IPAQ has good stability and high reliability (0.80). The existing Croatian version was applied. The IPAQ short

form encompasses specific types of activity – vigorous intensity, moderate-intensity activities, and walking. For each type of activity frequency in days per week and duration per day are measured. Data were expressed according to the official guidelines. PA is presented as MET-minutes per week, which signify multiples of metabolic rate while sitting. MET score was derived as the product of MET value and duration in minutes of each activity. The recommended values of PA were used in the analysis – 3.3 METs for walking, 4.0 METs for moderate PA, and 8.0 METs for vigorous PA.

Procedure

The research was conducted in January 2021. All participants filled out an online questionnaire via Google form. Participation in the study was entirely anonymous and voluntarily. Before conducting research, the participants were introduced to the aim and purpose of the study.

Results

Results of the frequency of using smartphones and smartwatch health-related applications and functions are shown in Figures 1 and 2. There are differences in the habits of use of smartphones and smartwatch health-related applications of kinesiology and physiotherapy students.

Figure 1

Mean values of the frequency of use of smartphone health-related applications and functions

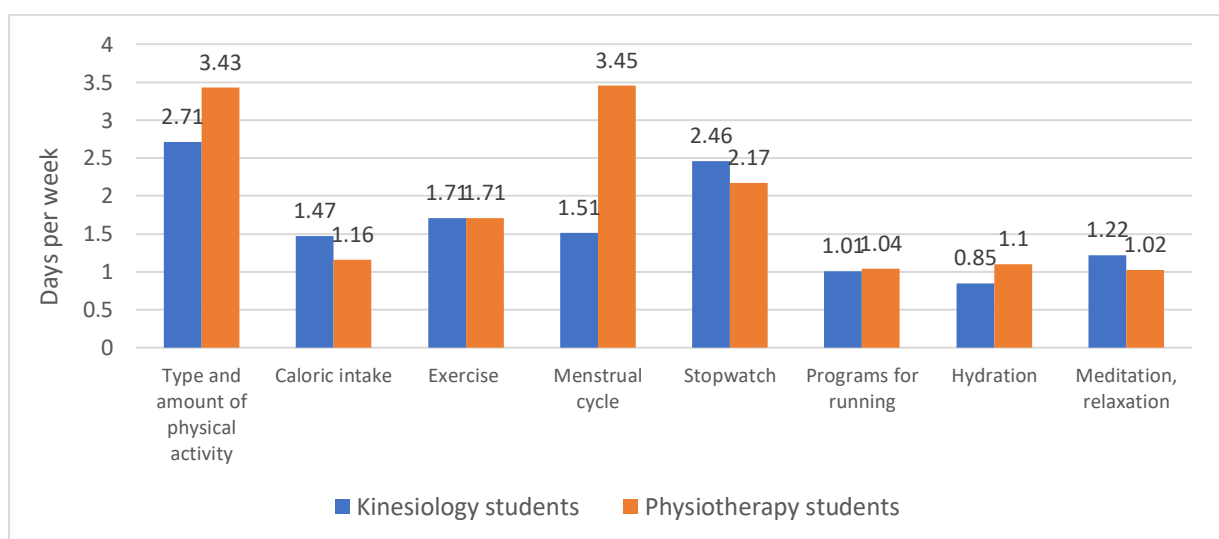
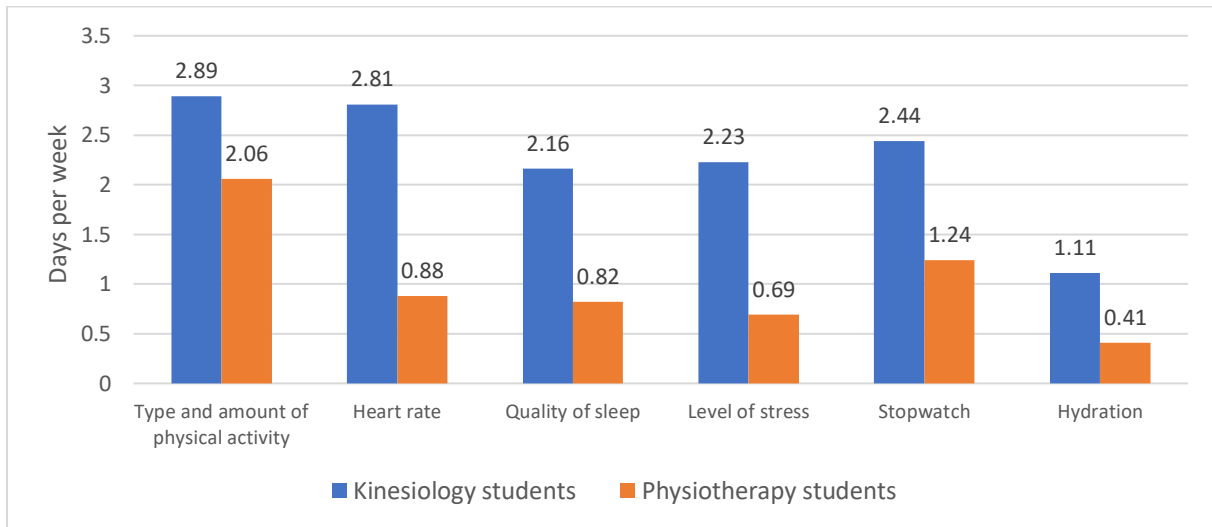


Figure 2

Mean values of the frequency of use of smartwatch health-related applications



Physiotherapy students (85.7%) use health-related applications on smartphones more frequently than kinesiology students (75.9%), and kinesiology students (62.2%) use much more health-related applications on smartwatches than physiotherapy students (38.8%). Students have similar habits of using health-related applications on smartphones. Kinesiology students use significantly more smartwatch health-related applications ($t=2.61$, $p<.01$, *Cohen's d* = 0.47). On average, they use smartwatch health-related applications three days a week ($M=3.27$, $SD=3.38$), and physiotherapy students on average one day a week ($M=0.96$, $SD=2.28$; $t=4.22$, $p<.01$, *Cohen's d*=0.77). Physiotherapy students monitor their type and amount of PA more often using smartphones, but kinesiology students prefer monitor it using smartwatches. However, kinesiology students significantly often monitor their heart rate ($t=3.86$, $p<.01$, *Cohen's d*=0.70), quality of sleep ($t=2.82$, $p<.01$, *Cohen's d*=0.51), level of stress ($t=3.20$, $p<.01$, *Cohen's d*=0.58), and use a stopwatch more for exercise ($t=2.54$, $p<.05$, *Cohen's d*=0.46) on smartwatches than physiotherapy students. The effect size of differences varies from medium to large.

To examine the relationship between the levels of PA and health-related applications on smartphones and smartwatches correlations coefficients were calculated and presented in Table 2 and Table 3.

Table 2

Correlations coefficients between physical activity and health-related applications on smartphones

	Vigorous PA	Moderate PA	Walk	Total PA
Type and amount of PA	.06	.03	.10	.08
Caloric intake	.10	.07	.09	.13
Exercise	.30**	.12	.13	.28**
Menstrual cycle	-.09	-.06	.18*	-.01
Stopwatch	.36**	.26**	.21*	.39**
Programs for running	.27**	.09	.15	.25**
Hydration	.28**	.12	.15	.28**
Meditation, relaxation	.18*	.21*	.15	.25**

Note. PA – physical activity; * $p < 0.05$; ** $p < 0.01$

Students in the category of vigorous exercise use health-related smartphone applications more often for exercise (e.g. timers for HIIT, programs for exercise) ($r=0.30$, $p < .01$). In addition, these students more often use programs for running ($r=0.27$, $p < .01$), hydration ($r=0.28$, $p < .01$) and mental training ($r=0.18$, $p < .05$) on smartphones. Obtained results show that all levels of PA are positively related to the use of the stopwatch on smartphones. The higher level of PA is, the correlation coefficients are stronger (for walking $r=0.21$, for moderate PA $r=0.26$, for vigorous PA $r=0.36$). Students involved in moderate PA more often use smartphone applications for meditation and relaxation ($r=0.21$, $p < .05$).

Table 3

Correlations coefficients between physical activity and health-related applications on smartwatches

	Vigorous PA	Moderate PA	Walk	Total PA
Type and amount of PA	.15	.07	.06	.14
Heart rate	.11	.06	.05	.11
Quality of sleep	.20*	.09	.01	.16
Level of stress	.16	.01	.05	.12
Stopwatch	.24**	.19*	.11	.26**
Hydration	.21*	.03	.07	.16

Note. PA – physical activity; * $p < 0.05$; ** $p < 0.01$

Students who exercise vigorously ($r=0.24$, $p < .01$) and moderate ($r=0.19$, $p < .05$) more often use a stopwatch for exercise on their smartwatches. Those in the category of vigorous PA

more often use the smartwatch for monitoring the quality of sleep ($r=0.2$, $p<.05$) and hydration ($r=0.21$, $p<.05$).

Discussion

The purpose of this study was to investigate the relationship between the levels of PA and the frequency of use of smartphone and smartwatch health-related applications in a convenience sample of kinesiology and physiotherapy students. Furthermore, the secondary purpose was to examine if there are differences between these two groups of students regarding their use of health-related mobile applications and whether there are associations between their level of PA and total PA with the use of these applications on their smartphones and smartwatches, respectively. To the best of our knowledge, there are no previous studies conducted on the sample of physiotherapy and kinesiology university students regarding their use of health-related mobile applications with respect to the level of PA. In general, there is a lack of evidence regarding the association between health-related application use and actual levels of PA, which makes a comparison of our study with other studies difficult.

Most of our participants actively use health-related mobile applications on their smartphones, mostly to track the type and amount of PA. Other frequently used types of health-related smartphone applications among our sample involve those for tracking of menstrual cycle and stopwatch. Heart rate monitoring smartwatch applications are also very frequently used among kinesiology students. Students of kinesiology and physiotherapy are expected to have more knowledge and awareness regarding the benefits of PA and the importance of maintaining a healthy lifestyle. A substantial part of their curriculum represents education on human physiology, health promotion and active lifestyle as well as the effects of PA and sedentary behaviour on health and prevention of disease. Kinesiology students also, in general, tend to lead a very active lifestyle and most of them are involved in regular sports activities because it is the requirement of their curriculum.

Smartphones became an indispensable part of modern life, especially among the student population. The use of smartwatches is also on the rise and their functions are extending and becoming more sophisticated with every new generation of devices. Advances in technology enabled the emergence of smartphones and smartwatches with powerful functions, which support the development of different health-related applications and sensors, as well as wireless connectivity with other devices (Bender et al., 2013). Health-related applications, which work in combination with wearable biometric sensors in smartwatches became common and most of

the smartphones entering the market have already preinstalled some of the health-related applications and options for wireless connectivity with wearable devices.

We found numerous positive correlations between using exercise-related and hydration-related smartphone applications and being in the group of those with vigorous-intensity levels of PA. Likewise, students with higher levels of total PA tended to use exercise-related and hydration-related smartphone applications more frequently. Furthermore, those with vigorous levels of PA tended to use smartwatch applications for quality of sleep and hydration, as well as stopwatch functions more often. In general, smartphone applications are used somewhat more frequently than smartwatch applications, and kinesiology students tend to use smartphone and smartwatch health-related applications more often than physiotherapy students.

A similar study carried out by McFadden and Li (2019) reported that there is a connection between wearable exercise tracking devices and frequency, intensity and duration of exercise among university students. Out of the 70 students, which met exercise recommendations in that study, nearly half of them also regularly used wearable technology for tracking exercise. Likewise, of 90 students which were identified as regular users of wearable technology, 31 met all three recommendations for exercise (adequate frequency, intensity and time), and 53 met two of these recommendations (frequency and time). Of 112 regular exercisers who met two of three recommendations for exercise, nearly half used wearable technology.

Honary et al. (2019) reported that mobile fitness applications could have a positive role in the promotion of healthy living among young people. Zach et al. (2016) conducted a study with the purpose to investigate the effects of information communication technology on the motivation of young people regarding exercise, particularly running, during leisure time. They examined the effect of a 12-week intervention program on motivational climate in physical education lessons. Programs for enhancing motivation for PA during physical education lessons using the Internet and self-reporting using smartphone applications both showed improvement in motivational climate and physical fitness measures among participants.

Rapid developments in technology, especially wearable technology, made it easier to play an active role in self-monitoring of PA and physiologic functions of the body. There are thousands of smartphone and smartwatch health-related applications available on the market, which are designed to monitor the physiological functions and PA of the user (McKay et al., 2019). However, the effectiveness of these applications and their impact on health behaviours and outcomes is still not completely established. A recent systematic review performed by Milne-Ives et al. (2020) evaluated the effectiveness of mobile health applications. They reported

little significant evidence, which supports the effectiveness of mobile health applications. On the opposite, a recent meta-analysis reported that smartphone-based interventions represent a promising strategy to increase total PA and steps in children and adolescents (He et al., 2021).

Another recent systematic review focused on the effects that certain mobile phone application techniques have on PA with the goal to establish what techniques are more or less effective (Hosseinpour & Terlutter, 2019). Nurturing PA behaviour using applications, feedback, goal setting, competition, and social sharing with familiar users in segregated and social network groups seem to stimulate PA behaviour, whereas social sharing with strangers and rewards are less effective in improving PA. A similar older study reported that application users generally positively welcome real-time feedback, social networking, expert counselling, and goal setting (Kirwan et al., 2013). Still, manufacturers of sports applications should make significant efforts to personalize the application to develop its full potential (Janssen et al., 2017). Sports applications have an important entertainment aspect that can help their users to overcome difficulties (Sun & Zhang, 2006) and this can contribute to the increase of mobile PA applications.

The current study has some limitations. First, our sample was small and consisted of only physiotherapy and kinesiology students, which makes it difficult to generalize our results to the whole university student's population. We did not research their motivation for use of different types of applications. Furthermore, we did not use our participants' actual PA levels generated by the applications which measure the type and amount of PA, which would give more accurate data regarding the association between PA levels and usage of applications in comparison to the data, obtained from IPAQ questionnaire. Future studies should consider a larger population, which will include students of other academic disciplines, detailed analysis regarding the motivation of using specific types of applications and use actual data stored by mobile applications regarding the type and amount of PA when establishing associations between the level of PA and usage of health-related mobile applications.

Conclusion

This study adds useful information to the body of evidence regarding students' habits of using health-related smartphone and smartwatch applications and the relationship between the actual level of PA and the use of these applications. The majority of students of both disciplines use some type of health-related applications, however, those studying the academic discipline of kinesiology tend to use them more frequently. The use of health-related applications is positively associated with higher levels of PA. The results of this study could

assist in the development of more tailor-made and personalized health-related applications. Further studies are needed to clarify the preferences and motives for the usage of health-related mobile applications, and the relationship between their usage and lifestyle habits in university students of different academic disciplines.

References

- Bender, J. L., Yue, R. Y. K., To, M. J., Deacken, L., & Jadad, A. R. (2013). A lot of action, but not in the right direction: Systematic review and content analysis of smartphone applications for the prevention, detection, and management of cancer. *Journal of Medical Internet Research*, *15*(12), e287. <https://doi.org/10.2196/jmir.2661>
- Carden, L., & Wood, W. (2018). Habit formation and change. *Current Opinion in Behavioral Sciences*, *20*, 117-122. <https://doi.org/10.1016/j.cobeha.2017.12.009>
- Craig, C., Marshall, A., Sjoström, M., Bauman, A., Lee, P., Macfarlane, D., Lam, T., & Stewart, S. (2017). International physical activity questionnaire-short form. *Journal of American College Health*, *65*(7), 492-501. <https://youthrex.com/wp-content/uploads/2019/10/IPAQ-TM.pdf>
- He, Z., Wu, H., Yu, F., Fu, J., Sun, S., Huang, T., Wang, R., Chen, D., Zhao, G., & Quan, M. (2021). Effects of smartphone-based interventions on physical activity in children and adolescents: Systematic review and meta-analysis. *JMIR mHealth and uHealth*, *9*(2), e22601. <https://doi.org/10.2196/22601>
- Honary, M., Bell, B. T., Clinch, S., Wild, S., & McNaney, R. (2019). Understanding the role of healthy eating and fitness mobile apps in the formation of maladaptive eating and exercise behaviors in young people. *JMIR mHealth and uHealth*, *7*(6), e14239. <https://doi.org/10.2196/14239>
- Hosseinpour, M., & Terlutter, R. (2019). Your personal motivator is with you: A systematic review of mobile phone applications aiming at increasing physical activity. *Sports Medicine*, *49*(9), 1425-1447. <https://doi.org/10.1007/s40279-019-01128-3>
- Hossen, M. S., Karmakar, P., Das, A., Rahman, A., & Chakma, M. (2020). Association of Sport and Exercise with Health Condition and Academic Performance: A Cross Sectional Study Among University Students in Bangladesh. *Turkish Journal of Sports Medicine*, *55*(4), 290-299. <https://doi.org/10.5152/tjism.2020.187>
- Hudziak, J. J., & Tiemeier, G. L. (2017). Neuroscience-inspired, behavioral change program for university students. *Child and Adolescent Psychiatric Clinics*, *26*(2), 381-394. <https://doi.org/10.1016/j.chc.2016.12.016>
- Janssen, M., Scheerder, J., Thibaut, E., Brombacher, A., & Vos, S. (2017). Who uses running apps and sports watches? Determinants and consumer profiles of event runners' usage of running-related smartphone applications and sports watches. *PLoS One*, *12*(7), e0181167. <https://doi.org/10.1371/journal.pone.0181167>

- Kirwan, M., Duncan, M. J., Vandelanotte, C., & Mummery, W. K. (2013). Design, development, and formative evaluation of a smartphone application for recording and monitoring physical activity levels: The 10,000 Steps “iStepLog”. *Health Education & Behavior, 40*(2), 140-151. <https://doi.org/10.1177/1090198112449460>
- Luo, W., & He, Y. (2021). Influence of sports applications on college students' exercise behaviors and habits: A thematic analysis. *Alexandria Engineering Journal, 60*(6), 5095-5104. <https://doi.org/10.1016/j.aej.2021.03.059>
- McFadden, C., & Li, Q. (2019). Motivational readiness to change exercise behaviors: An analysis of the differences in exercise, wearable exercise tracking technology, and exercise frequency, intensity, and time (FIT) values and BMI scores in university students. *American Journal of Health Education, 50*(2), 67-79. <https://doi.org/10.1080/19325037.2019.1571960>
- McKay, F. H., Wright, A., Shill, J., Stephens, H., & Uccellini, M. (2019). Using health and well-being apps for behavior change: A systematic search and rating of apps. *JMIR mHealth and uHealth, 7*(7), e11926. <https://doi.org/10.2196/11926>
- Miles, L. (2007). Physical activity and health. *Nutrition Bulletin, 32*(4), 314-363. <https://doi.org/10.1111/j.1467-3010.2007.00668.x>
- Milne-Ives, M., Lam, C., De Cock, C., Van Velthoven, M. H., & Meinert, E. (2020). Mobile apps for health behavior change in physical activity, diet, drug and alcohol use, and mental health: Systematic review. *JMIR mHealth and uHealth, 8*(3), e17046. <https://doi.org/10.2196/17046>
- Oliver, M. D., Morton, A. L., Baldwin, D. R., & Datta, S. (2020). A pilot study exploring the relationship between wellness and physical fitness: an examination into autonomic health. *Journal of American College Health, 68*(7), 712-719. <https://doi.org/10.1080/07448481.2019.1596919>
- Sun, H., & Zhang, P. (2006). The role of moderating factors in user technology acceptance. *International Journal of Human-computer Studies, 64*(2), 53-78. <https://doi.org/10.1016/j.ijhcs.2005.04.013>
- World Health Organization. (2020). *Physical activity*. <https://www.who.int/news-room/fact-sheets/detail/physical-activity>
- Zach, S., Raviv, T., & Meckel, Y. (2016). Using information communication technologies (ICTs) for motivating female adolescents to exercise/run in their leisure time. *Computers in Human Behavior, 60*, 593-602. <https://doi.org/10.1016/j.chb.2016.02.096>

ICT and Croatian Justice System

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Abstract

The author examines the current level of development and usage of ICT technology in the Croatian legal environment and legal system. It is inevitable that the usage of ICT technology in the judicial system and public administration will increase in future because Croatian National Recovery and Resilience Plan for the period 2021-2026, like most of the plans examined and approved by the European Commission, largely supports further digitalization of all spheres of government. However, it is in question whether future IT solutions will lead to a more effective and capable justice system, this because efficiency, simplicity, and capability of the justice system to a very great degree depends on the sincere political commitment to improvements and reforms.

Keywords: ICT, law, justice system, judicial system, courts, reforms

Digital transformation, judicial reform, and fast-changing legal business

Digital transformation in the field of law is not a new development. Richard Susskind who was in his books deliberating about the future of the legal profession and courts of law has one central claim and that is that the entire legal world is changing, much faster than ever before.* Although the implementation and the wider use of technology are not the only forces that boost the change, there is little doubt that the usage of advanced computer systems and IT technologies is at the forefront of the trend. And what is also important to acknowledge is that digitalization and ICT relate not only to the law of cybersecurity, digital privacy, or the process of exchange of documents in the justice sector, but to virtually all legal fields including those relating to the legal industry as a business.†

* See the preface of the second edition of Richard Susskind's book titled *Tomorrow's Lawyers. An Introduction to Your Future*, Oxford, 2017.

† One interesting document about future challenges of legal business is certainly Prognos AG and DeutscherAnwaltVerein study on the future of the legal profession in Germany titled "The Legal Services Market 2030", document available at:

For instance, filling in the online forms for bringing money claims is now operational in some EU jurisdictions and on the EU level there is a simplified written procedure for small claims under 5000€ which is usually conducted on the basis of standard forms.[‡] According to the Report delivered by the World Bank although no regional patterns can be discerned, it is known that some countries offer comprehensive packages of information and legal services online including how to start a small claims procedure, obtain information on related legislation and rights, share evidence and supporting documents etc. While some countries offer full online availability of services relating to small claims procedures, others offer only some kind of electronic services like checking the status of a case or similar.[§]

One other issue is that nowadays there is a huge quantity of legal data available online. Finding legal information has never been easier. Then again it is often in question whether discovered information is accurate and up to date. Legal rules are changing all the time both on national and international level and keeping them up to date may be difficult because updating legal information requires a large number of lawyers, legal experts and computer experts. That is why paid legal information services and websites normally provide better information and much better search options. One good example of the paid legal information provider which had monopolized legal cyberspace in Croatia, Slovenia and Turkey is online legal portal Ius-Info operated by Lexpera SA.^{**}

We should not disregard the fact that besides legal information websites, legal document automatic platforms also exist for some time now. Essentially these are cloud-based platforms that allow automatic generation of different legal documents, both for business and personal use.^{††}

Things have changed a lot when it comes to provisioning and finding adequate legal aid and services, especially for people who have not had legal troubles before (this problem is often

<https://anwaltverein.de/de/anwaltspraxis/dav-zukunftsstudie?file=files/anwaltverein.de/downloads/service/DAV-Zukunftsstudie/2013-06-12-Studie-engl-final.pdf&cid=3536>.

[‡] This procedure is based on the Regulation (EC) No 861/2007 of the European Parliament and of the Council of 11 July 2007 establishing a European Small Claims Procedure.

[§] See Harley, Georgia; Said, Agnes. 2017. Fast-Tracking the Resolution of Minor Disputes : Experience from EU Member States. World Bank, Washington, DC. © World Bank, p. 24-25. The Report is available at: <https://openknowledge.worldbank.org/handle/10986/26100>. Countries that score 100% for online availability of small claims procedures are Estonia, Lithuania, Malta and Portugal.

^{**} The fact that IUS-INFO now stands as the best provider of legal information in aforementioned countries does not mean, in any way, that IUS-INFO is without flaws and limitations.

^{††} One of the first such platforms named RocketLawyer (<https://www.rocketlawyer.com/>) came to existence 13 years ago. Comparison of different automatic platforms for legal documents see at: <https://www.rallylegal.com/best-legal-document-automation-software>.

perceived as the problem of information asymmetry^{††}). Namely, it is obvious that due to the massive use of computers and the internet, finding a lawyer has never been easier. In many countries, one could find online marketplaces for legal services.^{§§} For instance, in Germany where the legal profession has been liberalized over the last several decades one can now find different online markets for legal services.^{***} Even here in Croatia where legal advertising remains under strict control of the Croatian Bar Association, it is evident that all kinds of practices exist - typing “lawyer” in Google search engine will deliver a list of local lawyers with their addresses and indication of their experience.^{†††} The IT advertising and marketing has obviously permeated all businesses and legal business is not exempted.^{†††}

Altogether, in many countries different IT technologies have become deeply rooted in justice systems and in legal business. Efficient management of legal jobs is impossible without the use of computers and different kinds of software, good and fast search tools for case law texts, secure databases and secure transmission of legal data and, of course, all around internet service which must be fast and stable. It is envisaged that the usage of artificial intelligence in legal business and the administration of justice will probably develop further because, as observed by Susskind, we should not understate the probable influence of technology on law in the very long term because machines and systems are becoming increasingly capable and over time they will take on more and more legal tasks such as legal question answering, document automation, document analysis, machine prediction and similar, i.e. the tasks that have been historically regarded as the unique preserve of legal practitioners.^{§§§}

^{††} The problem of information asymmetry in contract theory and economics was firstly researched by George Akerlof. See, for instance, Akerlof, G. A., *The Market for Lemons: Quality Uncertainty and the Market Mechanism*, *The Quarterly Journal of Economics*, Vol. 84:3 (1970), p. 488-500.

^{§§} The advertising of legal services has been and still is a big issue worldwide. In the USA where legal advertising is omnipresent, the Supreme Court has ruled more than 40 years ago that attorney advertising is a form of commercial speech protected by the US Constitution. More about the case see at *The First Amendment Encyclopedia* at: <https://www.mtsu.edu/first-amendment/article/72/bates-v-state-bar-of-arizona>. The full-text case is available at: <https://supreme.justia.com/cases/federal/us/433/350/>.

^{***} Regarding the current status, role and function, education and training of German lawyers see Murray, P.L.; Stürmer, R., *German Civil Justice*, Carolina Academic Press, 2004., p. 88 etc.

^{†††} It is obvious that the results are the product of Google Ads services.

^{†††} In one of his movies, Woody Allen has placed lawyers who advertise on television in a very deep layer of hell. See https://en.wikipedia.org/wiki/Deconstructing_Harry.

^{§§§} See Susskind, op. cit. (r. no. 2), p. 185.

Digitalization for a better justice system

Statista reveals that between 2007 and 2020 the share of households with internet access in Croatia increased dramatically, from 41 to 85 %.^{****} Another data collected by the national statistical office tells us that 77% of Croatian households have a personal computer.^{††††}

Given *supra* mentioned data, It is reasonable to expect that in future there will be only a few households without internet access and computers. Under such circumstances, it is reasonable to believe that keeping up with the transition towards digitalization will be of utmost importance for the Croatian justice system, the system of public administration as well as for the legal business.

The driving forces for the transition toward digitalization in justice sector have two origins. One is purely internal. We live in a world in which people often firstly search for answers online. Thus, the internal societal demand is to have more and more digital information and digital legal services for distant problem solving. This demand was significantly boosted during the pandemic and especially the lockdown period when practically all communications transferred online.

The other driving force for digitalization and wide use of IT services within the justice system and legal business is external. Various organizations such as the EU, CEPEJ (European Commission for the Efficiency of Justice) and some others now support and campaign for further transition towards digitalization of the justice sector. For instance, it is perceived by CEPEJ that digitalization of judicial systems contributes not only to the efficiency of the justice system, but also transparency of justice, collaborative justice, people-centered justice, and informed justice orientation. It is also held that the growing digitalization could be well in line with European standards and Article 6 of the European Convention of Human Rights which stands for the central procedural guarantee and principle to the fair enforcement and vindication of both civil and criminal justice administration and the rule of law.^{††††} One short, but rather comprehensive list of orientations that should be used as a guide in the process of digital transformation of the justice system we find in one of the newest documents of CEPEJ titled

^{****} According to Statista in 2020, the overall share of households in Croatia with internet access was six percent lower than the average of the European Union (EU-27). See <https://www.statista.com/statistics/377714/household-internet-access-in-croatia/>.

^{††††} See <https://www.croatiaweek.com/85-of-croatian-households-have-internet-access-77-a-pc/>.

^{††††} See 2022-2025 CEPEJ Action plan “Digitalization for a better justice”, adopted at the 37th CEPEJ plenary meeting held in Strasbourg, 8 and 9 December 2021. (CEPEJ(2021)12Final), document available at: <https://rm.coe.int/cepej-2021-12-en-cepej-action-plan-2022-2025-digitalisation-justice/1680a4cf2c>.

2022-2025 CEPEJ Action plan “Digitalization for a better justice”. There it has been explicitly said that:

- a) The transition from paper to digital court files is ongoing and necessary and that the administration of justice must use IT to optimize its operations,
- b) The digitalization of procedures must improve the efficiency of courts, but also the quality of the work to be carried out by judges, prosecutors, and lawyers,
- c) That new technologies must provide users with better knowledge of procedures, judicial institutions, and the respective roles of each of the justice professionals,
- d) Each court must have dashboards enabling it to monitor and manage its case flow to make it possible to identify and limit potential backlogs,
- e) Efficient, easy to use and compatible communication tools must be introduced,
- f) The digitalization of justice should make justice more efficient but must never seek to replace the judge as a public official who must remain at the center of the procedure etc.^{§§§§}

Above-mentioned preferences present a very good starting point for a brief examination of the current level of digitalization of the Croatian justice system. Is the Croatian judicial system now fully computerized and interconnected? Are court files digitalized? How easy is it to access and search the case law of higher and especially the highest court(s)? Is the quality of information about the most common procedures and adjudicative institutions available online satisfactory? Finally, the question is whether the Croatian judicial system is more efficient now when different ICTs are available than before, when everything relied on paperwork, physical archiving, printing, and copying machines?

Answers to all these questions could be straightforward, pure Yes and Noes, but this kind of answers would certainly not depict all the peculiarities that exist now within the system itself.

ICT and Croatian justice system

In its latest 2021 Rule of Law Report on Croatia the European Commission has stated that the use of electronic communication tools in courts is gradually increasing.^{*****} The findings from

^{§§§§} Ibid.

^{*****} See 2021 Rule of Law Report, Country Chapter on the rule of law situation in Croatia (SWD/2021/713 final), p. 7. The document is available at: <https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:52021SC0713&from=EN>.

another important EU document, the 2021 EU Justice Scoreboard in Croatia tell us that the ICT for case management and the electronic communication between courts and parties remain among the least developed in the EU.^{††††} A short explanation of the current situation in the 2021 Rule of Law Report reads as follows (the footnotes are omitted): “As regards the use of ICT in case management, the introduction of the “e-File” system for the last remaining courts is underway, to be operational by the end of 2021. As regards the electronic communication tools, the “e-Communication” system, which allows exchanging documents with court electronically, has been introduced to Commercial, County and Municipal courts, the High Commercial Court, and the Supreme Court (only for civil cases). Currently, the main users of this system are lawyers, public notaries, court experts, appraisers and interpreters, and insolvency practitioners. The use of the e-Communication system increased during 2020, after the law prescribed electronic communication as mandatory for legal persons (citizens still have a choice to use paper). However, room for improvement remains, particularly in criminal cases: while technical conditions for electronic communication between the state attorneys and courts exist, amendments to the Criminal Procedure Code, envisaged for 2022, will be necessary.”^{*****}

Indeed, the usage of ICT in the judicial system has increased during the pandemic. It could be also said that the ICT became rediscovered because until the Covid-19 outbreak it existed mostly on paper.^{§§§§} Fortunately, aside from technical conditions that have been met before, the laws that regulate procedure have all been amended and these amendments have foreseen the possibility of distant adjudication. For instance, the amendments of the Civil Procedure Act from 2019. allow courts to decide that the hearing will be held remotely with the use of appropriate ICT devices.^{*****} Identical provision has been inserted into the Act on Administrative Disputes.^{†††††} The Criminal Procedure Act also contains provisions that regulate some form of distant presentation of evidence.^{*****} Unfortunately, having the technical conditions and the legislative basis does not mean that remote hearings are common and widespread. There is evidence that so far only a small number of judges have taken advantage of the procedural rules and available hardware and software even though distant communication

^{†††††} Ibid.

^{§§§§§} Ibid.

^{§§§§§} See Uzelac, A., *Croatian Civil Justice v. COVID-19, Civil Courts Coping with Covid-19* (Krans, B., Nylund, A., edis.), Eleven, 2021.,p. 50.

^{*****} See art. 115/3 of the Civil Procedure Act (OG no. 53/91., 91/92., 112/99., 129/00., 88/01., 117/03., 88/05., 2/07., 96/08., 84/08., 123/08., 57/11., 148/11., 25/13., 89/14., 70/19.).

^{†††††} See art. 37/2 of the Administrative Disputes Act (OG. no. 20/10., 143/12., 152/14., 94/16., 29/17., 110/21.).

^{*****} See art. 192/1 of the Criminal Procedure Act (OG. 152/08., 76/09., 80/11., 121/11., 91/12., 143/12., 56/13., 145/13., 152/14., 70/17., 126/19., 126/19.).

has proven vital for overcoming the problems caused by the pandemic. Apparently, having the stimulative normative framework in place does not mean that the implementation of the ICT goes quickly and smoothly. In Croatia acting later than required or planned is an old story when it comes to laws and their subsequent implementation. For instance, the provision which has allowed audio recording in court hearings came into effect in 2011., but it has not been put in use ever since.^{§§§§§§} It is now expected that the new amendments of the Civil Procedure Act, which were recently discussed and put into legislative procedure, will finally introduce mandatory recording of court hearings, more than ten years after that procedural guidance came to normative existence.

While the biggest improvement in civil court proceedings has been made with the delivery and exchange of documents, the same could not be said regarding case law databases. Visiting websites of county courts reveals that case law databases or, if nothing else, links to the central web page of all so far published cases of all Croatian courts are nonexistent, and if there is a link it will take the visitor to the web portal of case law developed by the Supreme Court of the Republic of Croatia. The latter is free for use, but it is very inefficient and murky. Moreover, it is evident that judicial decisions are published in a selective manner, i.e., not all courts are publishing their decisions, which makes a search for a relevant judgment and legal standpoint, both in criminal and civil legal sphere often difficult, sometimes futile.

The problem with the case law is that in every modern legal system in which the consistency of the case law serves as the prerequisite to legal certainty and without access to all court made decisions it is impossible to achieve the ideal of a clear and foreseeable legal system.^{*****}

Compared to state institutions, private firms are much more adaptable and efficacious, so it is not surprising that private firm(s) have developed a much better system of tracing the case law and email notification options, but that comes at no small price.^{††††††}

When it comes to the efficiency of case management, it is evident that Croatia scores poorly because estimated time needed to resolve litigious cases at most court instances is among the longest in the EU and the number of unresolved cases is high.^{‡‡‡‡‡‡} Partly the reason for such

^{§§§§§§} See art. 5 of the 2011 Amendments to the Civil Procedure Act (OG no. 57/2011).

^{*****} See Engstad, N., Consistency of the case law as a prerequisite to legal certainty: European and national perspectives, speech delivered in Athens on 29 September 2017. during the introduction at the High-Level Conference on the Harmonization of Case Law and Judicial Practice.

^{††††††} This is the case with IUS-INFO website and engine which was mentioned supra.

^{‡‡‡‡‡‡} The data about the problem of the length of proceedings as well as other important indicators is available in the EU Justice Scoreboard which is a comparative information tools with the purpose to assist the EU and Member States to improve the capacity of their national justice systems, especially with respect to efficiency, quality and independence of justice systems.

a slow tempo of clearing the court dockets lies with the poor case management, but case management is certainly not the only reason why Croatian judicial system performs poorly. §§§§§§

For instance, in Slovenia documentary payment orders are processed electronically and there is rather clear evidence that the system is highly functional, ***** while in Croatia these procedures have been outsourced to public notaries although introduction of automation for documentary payment orders would enable courts to handle tens of thousands of these cases efficiently.

The truth is also that the state itself has not done as much as possible to improve the availability of online court filing and online litigation support for ordinary citizens and legal entities. For example, when googling typical legal issues, one will be directed to governmental websites (gov.hr) containing different general legal information about, for instance, the provisions relating to free legal aid, personal bankruptcy, divorce, court fees and some other, in essence very common legal issues. Unfortunately, this information is usually insufficient for creating a complete picture about the rights and obligations relating to a particular case as well as the best way to handle the legal matter in question.

In the legal world, it is well known that the true revolution lies with electronic filing, legal forms, and broad availability of online case access. The access to the system for exchange of documents should be available not only to licensed lawyers, public notaries, and other legal professionals but to all parties to the court proceedings. The system of online filing is nonfunctional to the extent that even the simplest web forms tend to malfunction. One of the latest absurdities, which was revealed by the media, was that the web form of the State Attorney's Office of the Republic of Croatia for submitting criminal information was not available, although the anti-crime and anti-corruption strategies and action plans present one of the major political policies. ††††††††

All EU Justice Scoreboard are available at: https://ec.europa.eu/info/policies/justice-and-fundamental-rights/upholding-rule-law/eu-justice-scoreboard_en#scoreboards.

§§§§§§ Daily newspaper "Jutarnji list" has recently published information according to which 41% percent of all judges in Croatia have not undertaken any kind of procedural activity in cases they were given during the last six months. See <https://www.jutarnji.hr/vijesti/hrvatska/porazne-brojke-cak-41-sudaca-dulje-od-sest-mjeseci-nije-ni-taknulo-predmet-15183388>.

***** See Bratković, M., Reorganization of enforcement on the basis of a trustworthy document in Slovenia, Zbornik Pravnog fakulteta Sveučilišta u Rijeci, Vol. 36:2(2015), p. 1025-1050.

†††††††† See <https://hr.n1info.com/vijesti/petek-hrvatska-zemlja-u-kojoj-ne-radi-link-za-prijavu-korupcije/>.

Conclusion

Although the entire legal profession has been historically perceived as the profession that had required human presence and rational thinking, it would be completely wrong to disregard the fact that we live in the digital age and that computer programs and hardware can easily outperform humans. Digital processing of payment orders established by Slovenia is one good example of how powerful and efficient digital solutions can be in justice sector.

It is inevitable that justice systems will increasingly shift towards digital e-justice systems and that process will certainly affect the entire justice system as well as the legal service market. To put it simply, in the 21st century, no one is immune from the all-around digitalization of working processes.

In Croatia, information and communications technology is slowly penetrating into the justice system.

The starting point of all future justice system reforms in Croatia should be that ICT solutions cannot always outperform work of lawyers, but that in certain cases and legal proceedings ICT can contribute the efficiency of proceedings and help courts, parties to the proceedings and lawyers to better handle paperwork and have instant overview of the case progress. Besides, personal appearance in court hearings should not be viewed as a necessity in a world that had adopted video telephony and meetings as a perfectly normal way of distant communication.

We can only hope that money that Croatia will receive from the EU on the basis of approved National Recovery and Resilience Plan for the period 2021-2026 will be smartly used to support the digital transformation of the entire justice system. Also, the determination of the politics to carry out reforms and transition of the justice system will be of crucial importance. It has been proved so many times by now that pure changing of laws and regulations together with proclamations of political readiness to undertake justice sector reforms can hardly result with true changes within the system. The bottom line is that without modern, digitalized and effective justice system in place Croatia cannot become business and investment friendly state and environment.

References

2021 Rule of Law Report, Country Chapter on the rule of law situation in Croatia (SWD/2021/713 final), p. 7. The document is available at: <https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:52021SC0713&from=EN>.

- 2022-2025 CEPEJ Action plan “Digitalization for a better justice”, adopted at the 37th CEPEJ plenary meeting held in Strasbourg, 8 and 9 December 2021. (CEPEJ(2021)12Final), document available at: <https://rm.coe.int/cepej-2021-12-en-cepej-action-plan-2022-2025-digitalisation-justice/1680a4cf2c>.
- Akerlof, G. A., The Market for Lemons: Quality Uncertainty and the Market Mechanism, *The Quarterly Journal of Economics*, Vol. 84:3 (1970), p. 488-500.
- Bratković, M., Reorganization of enforcement on the basis of a trustworthy document in Slovenia, *Zbornik Pravnog fakulteta Sveučilišta u Rijeci*, Vol. 36:2(2015), p. 1025-1050.
- Engstad, N., Consistency of the case law as a prerequisite to legal certainty: European and national perspectives, speech delivered in Athens on 29 September 2017. during the introduction at the High-Level Conference on the Harmonization of Case Law and Judicial Practice.
- Harley, Georgia; Said, Agnes. 2017. *Fast-Tracking the Resolution of Minor Disputes : Experience from EU Member States*. World Bank, Washington, DC. © World Bank,. The Report is available at: <https://openknowledge.worldbank.org/handle/10986/26100>.
- Hartung, M., “Thoughts on Legal Tech and Digitalisation”, Hartung, M., et. al. (eds.), “Legal Tech. How Technology is Changing the Legal World. A Practitioner’s Guide”, Beck/Hart/Nomos, 2018.
- Jelinić, Z., Digital technologies, resolving civil and consumer disputes and rendering legal assistance, *Glasnik Advokatske komore Vojvodine - Časopis za pravnu teoriju i praksu*, God. XCI, knjiga 79., br. 2., Novi Sad, 2019., str. 189-213.
- Jelinić, Z., The EU reports and other soft-governance tools on rule of law, independence, quality and efficiency of justice systems – Are they right about the current state of justice system in Croatia?, *EU and comparative law issues and challenges series (ECLIC)*, Vol. 4/2020.,
- Murray, P.L.; Stürner, R., *German Civil Justice*, Carolina Academic Press, 2004.
- Prognos AG and DeutscherAnwaltVerein study on the future of the legal profession in Germany titled “The Legal Services Market 2030”, document available at: <https://anwaltverein.de/de/anwaltspraxis/dav-zukunftsstudie?file=files/anwaltverein.de/downloads/service/DAV-Zukunftsstudie/2013-06-12-Studie-engl-final.pdf&cid=3536>.
- Susskind, R., *Tomorrow’s Lawyers. An Introduction to Your Future*, Oxford, 2017.
- Uzelac, A., *Croatian Civil Justice v. COVID-19, Civil Courts Coping with Covid-19* (Krans, B., Nylund, A., edis.), Eleven, 2021.
- Other materials such as the laws, regulations and cases

History teaching in Croatia in the jaws of the Internet

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Abstract

The reflections of digitalization are increasingly visible in all areas of human activity. Science is intensively using and researching digitalization while education lags in this field. This paper discusses the influences and challenges of digitalization on history as a science and as a school subject. It is mainly dedicated to analyzing the preparation of future history teachers and their training in the use of ICT in history teaching. By researching examples of education of future teachers and their training, several proposals were offered that could be applied in Croatia.

Keywords: digital learning, digital historiography, ICT in education, teaching history

The information (r)evolution

According to Koren (2014), modern historiography and modern history teaching emerged in the second half of the 19th century. Interpretive and ideological frameworks have changed since then, but students still have a requirement to reproduce knowledge society considers worth remembering. In those nearly two hundred years, the availability of sources in the past has changed significantly. For a long time, the teacher was the one who passed on the historical story to students who had no alternative sources of information about the past. The availability and proliferation of the Internet in the 21st century poses an abundance of possible sources to interested students. Questions are raised about how this resource availability affects historiography and the teaching of history, the preparation for the future, and the training of current history teachers. In the search for answers to these questions, the paper presents the development of information transfer from ancient times to the present day and problematizes the impact of digitalization on the work of historians. Particular emphasis was placed on the impact of digitalization on teacher preparation with an analysis of future teacher education,

opportunities for the implementation of ICT in teaching, and successful models already in place.

Evolution implies gradual and layered development, while revolution implies rapid changes. The evolution of the human species has been going on for millions of years. Within long-term evolution, several revolutionary milestones occurred, ranging from using tools, upright two-legged walking, and the discovery of fire. Harari (2011) mentions three revolutions: cognitive, agricultural and scientific. The cognitive revolution enabled communication and imagination. The agricultural revolution, i.e., domesticating animals and crops, enabled population growth and created larger communities and states. The scientific revolution has been going on for the last 500 years and is based on the development of scientific methods of research and proof. In his opinion, it has enabled man to develop and at the same time, can lead him to ruin.

Human development is inevitably associated with the transmission and exchange of information. Information has a higher value than a raw material because a person would not know how a specific raw material is used or what it is used for without the knowledge. Whether the Egyptians first used hieroglyphs or the Sumerian cuneiform, humanity has been literate for more than 5,500 years. Before literacy, information was passed on in direct contact and from generation to generation. The invention of pictorial and then phonetic writing enabled the indirect exchange of information, the transmission of information to the next generation, and a greater geographical distance. For example, the Korean invention of metal plate printing in the 13th century and Gutenberg's movable type printing press in the 15th century enabled the democratization of literacy and learning. What had hitherto been reserved for the rare or elite became widely available and cheap. The introduction of compulsory education, especially in the 19th and 20th centuries, significantly accelerated the development of science.

The discovery of the writing is such a crucial event that historians from 3500 BC begin to count the old age. For the generation that Marc Prensky called digital natives, such an important event is likely to be the launch of the Google search engine.⁴⁰ Google Search was officially launched under this name on September 4, 1998.⁴¹ The most visited website globally today is Google.⁴² The Irish company StatCounter Global Stats estimates that the share of Google Search in the Internet search engine market in March 2022 was 91.56%.⁴³ Given the daily frequency of using Google services, perhaps new generations will call the historical era

⁴⁰ Prensky, M. (2001). Digital Natives, Digital Immigrants Part 1. *On the Horizon*, 9(5), 1–6. <https://doi.org/10.1108/10748120110424816>

⁴¹ Google Search. (2022). In Wikipedia. https://en.wikipedia.org/w/index.php?title=Google_Search&oldid=1081957631

⁴² Alexa—Top sites. <https://www.alexa.com/topsites>

⁴³ Search Engine Market Share Worldwide. StatCounter Global Stats. <https://gs.statcounter.com/search-engine-market-share>

before its emergence "before Google", as historians have chosen an era after the approximate year of the birth of the Jewish prophet Yeshua.

Today, the fastest way to get information is to "surf the web". With the spread of the concept of the Internet of Things, our daily lives are becoming more and more networked. From 2017 to 2021, television news is still the most popular news source in Croatia, although the COVID-19 pandemic has affected the increased use of digital media (Vozab and Peruško, 2021). Younger users gather information through social networks and applications such as TikTok. Influencers of a similar age group as users or celebrities play an important role. Celebrities have been recognized on social networks as a major source of misinformation (Newman et al., 2021).

Digitization and/or democratization of research

Historians are researching the past looking for sources. The sources are analyzed and their interpretations are made. Historical sources are all remnants or traces of the past from which historians draw their knowledge of the past and can be anything a man has ever said or written, made or come into contact with (Nikolić Jakus, 2008, p. 11). Modern historiography has been given a new opportunity for a better collection, analysis and interpretation of the past. By digitizing archives, museums and other heritage institutions, historical sources become available to a broader circle of researchers who come to new conclusions and perspectives about historical events, processes, and the people who participated. In nearly six thousand years of literacy, humanity has made the most significant leap in disseminating knowledge within the last century. Computer technology and a digitally networked society have accelerated scientific collaboration and production. In addition to an optimistic view of the research, the amount of information clutter that can cause scientists to feel lost is also noticeable (Čonč, 2014).

Historiography has opened up to the interested public, which has become a significant co-creator of historical narratives. The opportunity for new scientific achievements faces an increase in the accidental and intentional production of false historical sources and an upgrade of historical myths. Oral history is an essential source for historical research, but it also poses a significant risk to objective historical narratives. For example, the Internet allows for the emergence of multiple personal memories that are often difficult to determine as a source of actual participation or observation of past events. This democratization of historiography can enrich it but also complicate research conclusions. Another novelty is the digital humanities,

which use computer methods and other modern information tools to inaugurate a new approach to humanistic research (Čonč, 2014). The last two decades have seen a tremendous increase in the number of websites that write about the past in various ways. In addition to numerous good (professional and scientific) contributions, many websites have been deliberately produced to misinform, falsify, or even fabricate historical events. In addition, the popularity of social networks based on video production has spread to these places. The skill of authenticating website content and digital materials, whether used by children, the public, or professionals, needs to be applied. (Čonč, 2014; Hajdarović, 2010).

The digitization of historical heritage and its availability has influenced the emergence of new textual and pictorial sources in history textbooks and the use of archival videos in digital educational materials. Some of the new Croatian textbooks created in the past three years confirm this, but no detailed analyses of these novelties exist.

Digitization of History Teaching

In the autumn of 2021, the story of the thoughts and work of the Polish pedagogue Janusz Korczak spread through the Croatian space of the social network Facebook. He was killed during the Holocaust with a group of orphans he was caring for. The text was accompanied by a photo of an older man holding a frightened girl in his arms. Although the story of his work is true, the photograph shows actor Wojciech Pszoniak and a scene from the film *Korczak* (1990). Scenes from movies or pictures of the recreation of historical events are often used as illustrations of historical events. With the help of visual effects or subsequent software modification, such materials are tough to distinguish from the original (primary) image sources. Unfortunately, such materials are also taken over by history teachers who use them in their work with students without additional analysis or verification.

Scientific research on history teaching using digital media and tools is rare (Demantowsky & Pallaske, 2015, p. 3). The situation has not changed significantly in recent years, despite a new history curriculum being published in Croatia in 2019, which should include significant digitization, which is understood in the education system. The History curriculum actually goes nowhere on using digital media and tools. Only the section entitled "Materials and resources" for learning mentions that in addition to the usual materials, digital resources can also be used (websites, journals, tools, archives, collections, knowledge repositories) (Kurikulum nastavnog predmeta povijest za osnovne škole i gimnazije u Republici Hrvatskoj, 2019). It can only be assumed that the authors of the history curriculum relied on the fact that students should acquire part of the skills of using ICT according to

educational expectations Cross-curricular topic "Use of information and communication technology."

The adoption of the subject curriculum was accompanied by a public debate in which the social element of fear for jobs appeared, i.e., how digitalization will also affect the schedule of history teachers. Fears turn out to be unjustified. It is not technology that will replace the teacher, it is the teacher who can make technology relevant to the learning process, to engage students (Dubovicki et al., 2022, p. 158). For example, the Croatian project "School for Life" gave primary school students the use of tablets. With a free internet connection, these tablets are becoming a teaching tool and a medium for distributing teaching materials. There is no research or report on the use of tablets, but in communication through teacher groups on social networks, it can be concluded that they are mostly not used or are not used adequately. If such a device, application, or content does not put students in a position to research and give feedback, then such tools are not ideal and often not adequate (Hajdarović et al., 2021, p. 113).

Generation naming became popular at the turn of the 20th and 21st centuries, and names and time ranges often differ (Raphelson, 2014). Recently, the naming of the latest generations according to the Greek alphabet letters has been frequent, with a range of 15 years (McCrinkle, 2020). Thus, the alpha generation began to be born in 2010 and includes all those born by 2024, followed by a beta generation. "Alphas" may be the first real generation of "digital natives" who "speak the original language of digital technology," as Dubovicki, Jukić, and Topolovčan (2022, p. 159) write. The generation of "baby boomers still defines decisions and policies of education" or, at best, generation X. Generations X and Y (so-called millennials) are currently actively involved in education and face digitalization with greater or lesser shocks. Today's teachers are a generation that mostly did not receive lessons on the quality use of ICT during their education and is mainly faced with the reality of independent and continuous improvement. Through the application of various technologies, they discover which teaching aids and methods work to achieve educational outcomes. The question is what new generations of future history teachers can learn about the use of ICT. What can teachers learn during formal education at colleges and later by reading professional periodicals or participating in training.

The TPACK (Technological Pedagogical Content Knowledge) framework is designed to link educational content, pedagogical knowledge, and the use of technology (Mishra & Koehler, 2006). During their teacher studies, students regularly acquired an understanding of the achievements of particular sciences and prepared for work in education by applying the knowledge of educational sciences. In the 21st century, this must be complemented by a quality understanding of the use of ICT. The framework is widely accepted today and is used in many

universities to educate future teachers (Divjak, 2017; Miralles-Martínez et al., 2019). History methodology is taught at eight faculties in Croatia. The course's syllabi were analyzed in search of literature that would contain sections in which students can learn about the use of the Internet and ICT.⁴⁴ The most significant number of spotted titles was published in the 20th century, and a good part even before the advent of the world wide web.⁴⁵ Half of the analyzed bibliographies mention Stradling (2003), who dedicates the chapter to the use of websites and gives specific instructions related to the then-current concept of Web 2.0. A particular exception is the Faculty of Croatian Studies literature, which has only one title on the list. In it, Pranjić (2013) problematizes ICT as a teaching medium and teaching aids in several places. Nevertheless, even that title does not detail the concepts or methods of digital teaching.

There is only one scientific journal on teaching history in Croatia. The Society for Croatian History has been publishing "History Teaching" since 2003, and 32 issues have been published to date. An analysis of all issues found only five articles related to the Internet or ICT. The authors in the articles mostly write about the Internet in general and give examples of various websites that are thematically at least roughly related to the past (Čonč, 2014; Lukačić, 2008; Tomorad, 2005, 2013; Vukosavljević, 2021). Of these articles, only the articles by Čonč and Vukosavljević relate more specifically to contemporary history teaching and research.

Continuous teacher training in the organization of state institutions takes place at the national and county level. At the gatherings of the national level in the last ten years, maximum attention has been paid to the contents at the expense of didactics and the subject's methodology. The use of ICT is entirely on the sidelines or just as an illustration of how certain content can be conveniently presented using some applications. With the introduction of the new subject curriculum, the Ministry of Science and Education maintained the MOOC. MOOC through the Loomen service included learning about the curriculum, teaching about new teaching methods and tools, student evaluation, and examples of ICT use. Despite many expressions of teacher outrage on social media, the MOOC has attracted a significant portion of the professional population of history teachers. More precise analyzes of the number of users

⁴⁴ Links to syllabuses (as of April 9, 2022): 1. Filozofski fakultet Zagreb - <http://www.ffzg.unizg.hr/pov/pov2/files/4knjiznica/Knjizpov/dokumenti/Metodika,Koren.pdf>; 2. Fakultet hrvatskih studija - https://www.hrstud.unizg.hr/predmet/mnp_a; 3. Hrvatsko katoličko sveučilište - <https://unicath.hr/izvedbeni-planovi-19-20/detaljni-izvedbeni-plan/2019-2020-izborni/metodika-nastave-povijesti-2/>; Filozofski fakultet u Puli - <https://ffpu.unipu.hr/ffpu/predmet/mnp1>; 5. Filozofski fakultet u Splitu - <https://www.ffst.unist.hr/predmet/mnp1>; 6. Filozofski fakultet Osijek - <https://sokrat.ffos.hr/ff-info/kolegiji.php?action=show&id=1990>; 7. Filozofski fakultet u Rijeci - https://www.ffri.uniri.hr/files/studijskiprogrami/2021-2022/POV-program_dipl_nast-2021_2022.pdf; 8. Odjel za povijest Sveučilišta u Zadru - https://povijest.unizd.hr/Portals/3/Uglesic%20-%20Metodika%20n%20p%2C-IIzvedbeni%20plan%20-%20obrazac%202021_-2022_%20%281%29.docx.

⁴⁵ The oldest edition from the bibliography was published in 1968. Author mentions the computer as a novelty that could be useful for word processing. Vrbetić, M. (1968). *Nastava povijesti u teoriji i praksi*. Školska knjiga.

and their experiences do not yet exist. Still, it is worth noting that many teachers did not participate in the MOOC. Teachers and publishing houses have launched several groups on the social network Facebook to encourage the exchange of experiences and teaching materials. There are usually no discussions about the content or application of shared materials, and teachers mostly follow them by using likes. Criticism of the material is not viewed favorably, which is not conducive to skills development. Some teachers publish their works and examples from practice in digital journals or repositories. Several unsystematic attempts have been made to organize history teaching using the learning management system (LMS) Moodle (or a localized version called Loomen).⁴⁶

Functional capabilities of digital media require students to be active, research, communicate, collaborate, solve problems, and create new content and products (Dubovicki et al., 2022, p. 166). A suitable method that combines computer work and the idea of developing skills following the technical concepts of teaching history in the curriculum is Computer Supported Collaborative Learning (CSCL) (Hernández-Sellés et al., 2020; Vakaloudi & Dagdilelis, 2016). The CSCL method successfully links the distribution of roles and responsibilities of students in group work (project work) with the emphasis on the use of digital media and devices. Most digital tools are not specialized, i.e., they do not go into the specifics of particular school subjects. This is a logical business decision because specialization in a narrow area reduces the possibility of selling the service and return on investment. This leads history teachers to use more digital services and applications to cover a wide range of subject requirements. History teachers most commonly use presentation tools, timelines, storytelling apps, and gamification tools. This is a problem for teachers and students - they have to master the use and functions of the application. This can make things even more difficult for students. In addition to learning history, they have to adapt to using more applications, multiplied by the number of subjects they listen to.

From 2014 to 2017, EuroClio (European Association of History Educators) implemented the Innovating History Education for All (IHEA) project. The project aimed to develop specialized digital tools for teaching history and to promote historical and critical thinking skills. Based on the research on the needs of history teachers and the experience of the

⁴⁶ The oldest examples are the attempts of teachers Josip Šarčević from the Matija Antun Reljković High School in Vinkovci and Miljenko Hajdarović from the Petar Zrinski Šenkovec Elementary School during the 2006/2007 school year. At the end of 2007, teachers from the mentioned primary school founded the Association for the Application of the Internet in Education "Sponge". They used Moodle experimentally to teach history and music culture. From 2012 to 2018, the same LMS was used at the Čakovec High School in the teaching of history, sociology and civic education. The report on the use of LMS was presented at the user conference of the Croatian Academic and Research Network Carnet in 2014. Available at: https://radovi2014.cuc.carnet.hr/modules/request.php?module=oc_proceedings&action=view.php&a=Accept&id=63&type=2

international expert group, five tools were created (Jasik et al., 2016).⁴⁷ The tools Text, Question, Embed, Sorting, and Prioritising are combined into an e-activity builder on the Historiana website.⁴⁸ They allow teachers to create source analysis activities and get feedback from students. When creating activities, user can upload their materials or use the Europeana archive.⁴⁹

Findings

The availability of digitized primary and secondary sources, scientific papers, and monographs increases, and scientists and practitioners in education are collecting them in large quantities. This collection turns users into a kind of "digital hamsters," and the question arises as to whether these materials are used or take up space on computer disks and cloud storage. Textbooks accompanied by digital educational content are still a challenge that has not been sufficiently exploited, and there is insufficient knowledge on how to design and use them in teaching meaningfully. Digital technology is still used ad hoc, by trial and error, without much research and application of this knowledge.

The honeymoon of utopian and dystopian expectations related to digitalization is over, and the two-year pandemic isolation has contributed to that. There is an apparent discrepancy between expectations from the digitization of education and visible results. However, this raises the question of whether digital technology is bad, whether it has been misused as a teaching tool, whether we do not have developed teaching methods or whether teachers are simply not ready enough to use ICT. There seems to be an abyss between digital technology and the existing technology and the education system that is still looking at these opportunities from the opposite shore. In the coming years, we can expect reorganizations of teacher education that will have to include the issue of digitalization more seriously. We are already late for the alpha generation - we need to rapidly change for the beta generation and plan for the gamma generation.

References

Čonč, T. (2014). Elektronički izvori znanstvenih informacija za povjesničare i uloga knjižnica u podršci znanstvenome radu. *Povijest u Nastavi*, 12(23), 1–22.

⁴⁷ The members of the expert group were Súsanna Margrét Gestsdóttir (Iceland), Richard Kennett (Great Britain), Pascal Tak (Netherlands), Natia Pirtskhalava (Georgia) and Miljenko Hajdarović (Croatia).

⁴⁸ Available at <https://historiana.eu/builder>.

⁴⁹ Europeana is a web portal created by the European Union containing digitised cultural heritage collections from heritage institutions across Europe. Available at <https://www.europeana.eu/en>.

- Demantowsky, M., & Pallaske, C. (Eds.). (2015). *Geschichte lernen im digitalen Wandel*. De Gruyter Oldenbourg.
- Divjak, B. (2017). *Preporuke za razvoj e-kompetencija (digitalnih kompetencija) budućih nastavnika* (p. 29). Fakultet organizacije i informatike.
http://higherdecision.foi.hr/sites/default/files/D6.2.%20Preporuke%20za%20razvoj%20e-kompetencija%20budu%C4%87ih%20nastavnika_0.pdf
- Dubovicki, S., Jukić, R., & Topolovčan, T. (2022). Izazovi nastavnčkog poziva u budućnosti. In *Ogledi o nastavničkoj profesiji* (pp. 158–178). Sveučilište u Zadru.
- Harari, Y. N. (2011). *Sapiens: A Brief History of Humankind*. Harper Collins.
- Hajdarović, M. (2010). Vrijednovanje internet stranica povijesne tematike. *Historijski Zbornik*, 63(2), 561–569.
- Hajdarović, M., Glučina, M., & Turk-Presečki, V. (2021). *Metodički paket za poučavanje povijesti* (2nd ed.). Profil Klett. <https://bit.ly/3jWHrN5>
- Hernández-Sellés, N., Muñoz-Carril, P.-C., & González-Sanmamed, M. (2020). Interaction in computer supported collaborative learning: An analysis of the implementation phase. *International Journal of Educational Technology in Higher Education*, 17(1), 23.
<https://doi.org/10.1186/s41239-020-00202-5>
- Koren, S. (2014). *Čemu nas uči povijest? Nastava povijesti, ideje o učenju/poučavanju i ishodi učenja*. Profil Klett.
- Kurikulum nastavnog predmeta Povijest za osnovne škole i gimnazije u Republici Hrvatskoj, (2019) (bill by Ministarstvo znanosti i obrazovanja). https://narodne-novine.nn.hr/clanci/sluzbeni/full/2019_03_27_557.html
- Jasik, K., Lorenc, J., Mrozowski, K., Staniszewski, J., & Walczak, A. (2016). *Innovating History Education for All—Needs Assessment*. Educational Research Institute.
- Lukačić, P. (2008). Primjena Web 2.0 servisa u nastavi povijesti. *Povijest u Nastavi*, 6(12), 205–219.
- McCrinkle, M. (2020). *Understanding Generation Alpha*. McCrinkle Research Pty Ltd.
- Miralles-Martínez, P., Gómez-Carrasco, C. J., Arias, V. B., & Fontal-Merillas, O. (2019). Digital Resources and Didactic Methodology in the Initial Training of History Teachers. *Comunicar: Media Education Research Journal*, 27(61), 41–51.
- Mishra, P., & Koehler, M. J. (2006). *Technological Pedagogical Content Knowledge: A Framework for Teacher Knowledge*. *Teachers College Record*, 108(6), 1017–1054.
- Nikolić Jakus, Z. (2008). *Uvod u studij povijesti: Historiografski praktikum*. Leykam international.
- Newman et al. (2021). *Reuters institute digital news report 2021*. Reuters Institute.
- Pranjić, M. (2013). *Nastavna metodika u riječi i slici*. Hrvatski studiji Sveučilišta u Zagrebu.
- Raphelson, S. (2014, October 6). From GIs To Gen Z (Or Is It iGen?): *How Generations Get Nicknames*. NPR. <https://www.npr.org/2014/10/06/349316543/don-t-label-me-origins-of-generational-names-and-why-we-use-them>

- Stradling, R. (2003). *Nastava europske povijesti 20. stoljeća*. Srednja Europa.
- Tomorad, M. (2005). Web stranice s povijesnim sadržajima i njihova primjena u nastavi povijesti. *Povijest u nastavi*, 3(1).
- Tomorad, M. (2013). Web stranice i baze za istraživanje i nastavu kultura i civilizacija starog vijeka. *Povijest u nastavi*, 22(2), 117–136.
- Vakaloudi, A. D., & Dagdilelis, V. (2016). The Transformation of History Teaching Methods in Secondary Education Through the use of Information and Communication Technology (ICT). *History Education Research Journal*, 13(2), 150–174. <https://doi.org/10.18546/HERJ.13.2.15>
- Vozab, D., Peruško, Z. (2021). *Digitalne publike vijesti u Hrvatskoj 2017.-2021.*. Centar za istraživanje medija i komunikacije. Fakultet političkih znanosti. Sveučilište u Zagrebu.
- Vukosavljević, J. (2021). Vrednovanje rada učenika u online okruženju. *Povijest u nastavi*, 32(1), 45–51.

Selection of an educational mathematical computer game using the AHP method

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Abstract

This paper explains and describes the AHP method and its advantages and disadvantages, describes the selection of mathematical computer games by group using the AHP method, explains the criteria and alternatives for choosing a mathematical computer game, describes AHP decision making and group decision making results.

For the needs of the research, didactically prepared computer games in the field of mathematics were selected. The basic criteria for selecting the game were: compatibility with the chronological age of children and compliance with pedagogical criteria. Only one game was needed for the research, and it was selected using the AHP method, which was also used to create a model of pedagogically and methodically acceptable computer game for use in teaching. This game, for the research, was important to choose so that the mathematical computer game matched the objectives of the research. The research itself determined the differences in motivation and content acquisition in students with regard to the approach to teaching. It was determined which approach gives the best results. The students of the 4th grade of primary school were divided into three subgroups of 30 students: the one who processed the curriculum in the classical way, the one who processed the curriculum only by playing games and the one who combined the previous two models. As there is a great availability of games that students could play, choosing an educational math computer game was extremely important. Therefore, this paper deals with just that: group decision making AHP method.

Keywords: AHP method, math, education, computer games

Introduction*

This paper explains and describes the AHP method and its advantages and disadvantages, describes the selection of mathematical computer games by group decision-making using the AHP method, explains the criteria and alternatives for choosing a mathematical computer game, describes in detail the criteria and mathematical computer

* This study was part of doctoral dissertation.

games, and participants AHP decision making and group decision making results. Conclusions were drawn based on group decision making given the importance of criteria for a good mathematical computer game.

For the needs of the research, didactically prepared computer games in the field of mathematics were selected. The basic criteria for selecting the game were: compatibility with the chronological age of the children, compliance with pedagogical criteria (understanding of the content by the child and whether the games have social, cultural and educational potential in accordance with existing educational frameworks). Only one game was needed for the research, and it was selected using the AHP method, which was also used to create a model of pedagogically and methodically acceptable computer game for use in teaching. This game, for the research that followed, was important to choose so that the mathematical computer game fit the objectives of the research. The research itself determined the differences in motivation and content acquisition in students with regard to the approach to teaching. It was determined which approach gives the best results. The students of the 4th grade of primary school were divided into three subgroups of 30 students each: the one who processed the curriculum in the classical way, the one who processed the curriculum only by playing games and the one who combined the previous two models. As there is a great availability of games that students could play, choosing an educational math computer game was extremely important. Therefore, this paper deals with just that. Group decision making AHP method.

Analytical hierarchically process (AHP method)

Every day, in different areas of life, we encounter the problem of decision-making, i.e., the procedures by which we choose one of several possible alternatives (variants) of decision-making. Methods that make it easier to compare and rank alternatives in decision-making can help us in this, and are based on determining the advantages that an alternative has over others and comparing these advantages with its disadvantages. The mentioned methods are based on certain mathematical assumptions according to Begičević (2008).

The most well-known methods for comparing and ranking alternatives in decision-making are: analytical hierarchical process (AHP method), ELECTRE (there are several variations) and PROMETHEE. Using the ELECTRE and PROMETHEE methods, the set of alternatives is determined on the basis of estimates of differences in their criterion values, while the AHP method is based on the comparison of alternatives in pairs. AHP method (Saaty, 1980) is one of the best known and, in recent years, most widely used methods for multi-criteria

decision-making in solving real problems. It is applied in various areas of life such as industry, engineering, politics and education in decision making, planning and development and evaluation. Its popularity is primarily based on the fact that it is very close to the way an individual intuitively solves complex problems by breaking them down into simpler ones. Another reason for its popularity is the quality software tool Expert Choice that supports the AHP method. Solving complex decision-making problems using this method is based on breaking them down into components: goal, criteria (sub-criteria) and alternatives. These elements are then combined into a multi-level model (hierarchical structure) with the goal at the top and the main criteria at the first lower level. Criteria can be broken down into sub-criteria, and at the lowest level there are alternatives (variants). The complexity of the problem grows with the number of criteria and the number of alternatives. It has been proven that the ability of the human mind to distinguish between a large number of alternatives and criteria is limited, and when forming a hierarchy, no more than $25 \pm$ elements at the same level are recommended. At the same time, the analysis of complex problems into simpler ones and their grouping according to their similarity is the way in which the human mind works according to Begičević (2008).

The AHP method is used when the decision-making process, i.e., the selection of one of the available alternatives or their ranking, is based on several criteria that have different importance and which are expressed using different scales. Namely, decision-making implies the choice of some of the alternatives that solve a given problem. In decision-making, according to Begičević (2008), there are goals to be achieved, criteria for measuring the achievement of these goals, the weight of these criteria, which reflects their importance, and alternative solutions to problems.

The term decision-making means the process of choosing one of the possible alternatives (variants) of the decision. The main elements of the decision-making problem are the goals to be achieved by the decision, the alternatives to choose from and the criteria used in the election. The goal means the state of the system that we want to achieve with the decision. In some cases, this goal can be described more precisely, and sometimes it is not quantified. Criteria are attributes that describe alternatives and their purpose is to directly or indirectly provide information on the extent to which a particular alternative achieves the desired goal. In a particular decision-making problem, usually not all criteria are equally important, and the relative importance of the criteria stems from the decision-maker himself. Which criterion he will give preference to depends on his value system and his psychological characteristics. In

addition to the above, other characteristics of the decision-maker determine his choice of criteria and their importance. If more than one person uses some common criteria in making decisions, it is very likely that they will not give equal importance to the same criteria.

Criteria and alternatives for the problem of using computer games in teaching

There are different problem-solving strategies, and their purpose is to obtain as many problem-solving proposals as possible that seek to encourage divergent thinking (Guilford, 1959) of either individuals or groups. Individuals are advised to write down everything that comes to their mind when solving a problem. Thus, after some time, many different ideas are collected, some of which can prove to be the ideal solution to a given problem. More people have more ideas, so the solution to the problem can be sought in groups. Each member of the problem-solving group presents an idea or proposal or simply refers to a solution that he sees as the way out of a particular problem. At this stage of group divergent thinking, all ideas are considered acceptable. Such a group search for a way out of the problem acts as a stimulus to other members of the group, so they also try to come up with as many suggestions as possible (whether they may seem, at first glance, funny or unrelated). In this way, a good atmosphere was created for the work of the group, so the ideas began to "rain" like rain, and a phenomenon called American *brainstorm* occurred, and the process by which this phenomenon causes *brainstorming* (Furlan, 1984).

According to Dennis and Valacich (1993), *brainstorming* is an excellent way of creating ideas. In this, primarily, creative process, there is no place to criticize other people's ideas. Namely, through *brainstorming*, all members of the work team, without hesitation, express all their thoughts and ideas. If only one person or individual participates in *brainstorming*, the advantage is manifested in its unhindered creation of many ideas, and the disadvantage is less efficiency in their further development. If a group of people participates in *brainstorming*, they will come up with fewer ideas, but they will elaborate on each individual idea in much more detail. In group *brainstorming*, it is necessary to follow some basic rules in order to avoid conflicts between members. For successful *brainstorming*, according to Rickards (1999), the following rules should be followed: clearly define the problem to be solved (ask one specific question) and determine the criteria to be followed, throw a question or just one word and ask participants to say all the associations that come to mind, keep the meeting focused on the problem, make sure no one criticizes or values other people's ideas during the brainstorming itself. Encourage them to come up with as many ideas as possible (from very practical to the

most complicated), make sure that one thought does not linger too long, encourage individuals to build on each other (develop other people's ideas or develop new ones based on other people's ideas), instruct one person to write down every idea that comes up during brainstorming.

Six assistants and teachers from the field of Information Sciences and Mathematics participated in the *brainstorming* process. The *brainstorming* process started in a relaxed atmosphere and a problem was raised with a specific question - what criteria should a mathematical computer game meet in order to be called a good educational game. The key words were: math, game, computer, education. The participants in the process very quickly, based on their own associations with regard to keywords and in response to the question asked, offered their ideas, i.e., criteria that were written down in order. Each participant presented their ideas without hindrance. Some of the criteria began to be repeated after some time through different names for the same term, to which the participants of the *brainstorming* process were warned in time. Ultimately, the *brainstorming* process offered the following criteria: interactivity - it is stated that the existence of feedback is very important when it comes to educational games, graphical interface, multimedia, attractiveness - with an explanation emphasizing that if the game does not look good, no one will not keep playing long enough to learn something, the goals of the game - clearly define goals and achievements, the ability to model and solve problems, make a good decision about how to use the game (in game design), the game must have clear instructions and additional information depending on who it is intended for, and which is especially important for younger ages, other elements of the game: objects, setting, difficulty of the game, reaching goals (there must be a goal and completion), decisions (player should be able to choose from several options), balance (matching the difficulty of the game with the goals and rewards), rewards (points, additional tools in the game after the player wins a goal, level), the course of the game (logical you game echo that contains all the previous elements systematically and intuitively complex), multimedia elements (motivational elements that support the course of the game: animations, music, special effects), time limit because most math games come down to calculating or grouping elements, and it makes no sense if there is no time limit, the rules of the game should be clear and understandable after one reading, clear instructions, intuitive user interface, care should be taken of the children and that they must be able to cope with the menus in the game, visual appearance is very important - a lot of colors and interesting details, which still varies from person to person, competitive spirit, understandable content.

Studying the literature, it is evident that many have dealt with the issues of creating a good mathematical computer game. According to Demirbilek and Tamer (2010) in mathematics education, technology and computer games are very important for transforming abstract mathematical concepts into concrete mathematical concepts, eliminating or at least reducing the fear of mathematics. Abrams (2008) mentioned computer games as powerful motivating tools for mathematics teaching. Likewise, Ke (2008) found that games are more motivating than pencil and paper math learning activities. According to Roach (2003) an important criterion of a good mathematical computer game is the understandable content of the game that is in line with the existing educational framework. At the same time, mathematical computer game must be age-appropriate (Gee, 2003). Hurd and Jennings (2009) point out how important it is for a mathematical computer game to be created in a way that is stimulating for the child and to have very clear goals. A good mathematical computer game must encourage a sense of competition in students (Malone & Lepper, 1987), and good multimedia content is also important (Gee, 2003). Klawe (1998) points out that mathematical computer games should include: content that students need to learn, activities to learn, ways and concepts of presenting concepts, interfaces for manipulating concepts and objects, navigation structures and sequences of activities, feedback and reward systems, entertainment elements (graphics, sound, story, characters and humor).

After merging the criteria obtained by brainstorming and studying the literature, the following criteria for good mathematical computer games emerged as the most important: understandable age-appropriate game content, compliance of the game with the existing educational framework, clear goals and rules of the game, support for the development of a competitive spirit, user-friendly user interface, good multimedia content and interactivity.

Thus, each of the above criteria was selected through a brainstorming process and a study of the literature and examples of good practice.

Selection of mathematical computer games

Based on the previously selected criteria, at the very beginning it was necessary to choose among the multitude of mathematical computer games those that would meet these criteria. Among the large number of offered mathematical computer games, the already mentioned group from the field of Information Science and Mathematics, chose three games (alternatives), respecting the criteria obtained by brainstorming and studying the literature, and thus prepared them for the selection process using AHP.

The chosen (from www.cyberkidzgames.com/cyberkidz) alternatives for the 4th grade were : game A - Math Puzzle, game description: Different numbers are offered in 4 fields and 4 columns, and next to them the symbols of 4 arithmetic operations (addition, subtraction, multiplication and division). The student is given a number that he must get by choosing the correct numbers and the correct symbol of the arithmetic operation from the offered fields. The selected game belongs to the didactic games with rules for one player. By playing this mathematical computer game, students practice addition, subtraction, multiplication and division by heart, which are some of the critical points in education, based on student achievement prescribed in the national mathematics curriculum for 4th grade elementary school students.; game B - Mathmix, game description: Didactic game for one player (with rules) in which different numbers are offered in one line that the player needs to use to get the given number. The arithmetic operation used is multiplication.; game C - Sowing Grass, game description: Students must calculate the marked area (squares) that represents the surface of the ground. They plant flowers with the correct answers on that surface, i.e., the soil. Didactic game with rules for one player.

After the criteria and mathematical computer games were selected, it was necessary to select the participants in the decision-making process by the AHP method. In group decision-making groups of people make decisions that are structured according to different criteria. The characteristics of the decision-making groups are seen in the common interest of the group, the mutual communication of the group members and the division of roles among the group members in order to achieve the common goals of the group. The advantage of group decision-making, according to Dennis and Valacich (1993) and Begičević (2008), lies in the fact that the responsibility for the decision is distributed to all members of the group. Individuals, and thus members of the group, make easier decisions knowing that they do not take responsibility for the possible negative consequences of the decision. It depends on the knowledge (whether the knowledge is complementary, competitive or similar) and the abilities of the group members what the group decision-making process will be like. The best results in group decision-making are most often achieved if the knowledge of the members of the decision-making group is complementary, and the worst results when the knowledge of the group members is competitive, i.e., identical.

Considering the fact that they are mathematical computer games and their application in the educational process, a decision-making group was selected according to the following key: three teachers, two students and one computer scientist. The teachers were primary school

teachers and primary school mathematics teachers. Students were selected from the group of advanced 4th grade math students. Also, computer scientist has been a teacher of mathematics and informatics for many years, with experience in primary and secondary school.

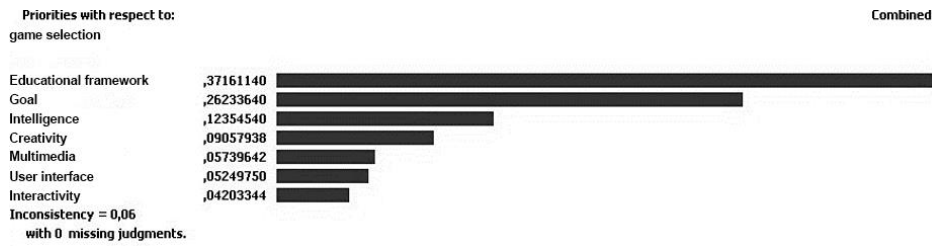
In the group decision-making that followed, during which each person has the opportunity to enter their own assessments, the possibility of the so-called "Collective opinion" - the unanimous opinion of all members of the group that occurs due to pressure on participants who have a different opinion. Namely, each member participated in a joint discussion and, individually, entering their assessment. In this way, in the final selection, the members of the group have more confidence in the chosen alternative. All participants received age-appropriate computer games and pre-selected according to criteria and played them for several days. After that, they were given instructions for completing the questionnaire and questionnaires. Instructions for completing the questionnaire were further clarified to all participants, with special care taken to ensure that the children who participated in the selection process understood the differences between the criteria as clearly as possible. During the completion of the questionnaire, the criteria were further clarified. All participants in the process successfully completed the questionnaires. After data collection, data entry into the *Expert Choice software package* was started.

Results of group decision-making - choosing a game for the 4th grade of primary school

The results of the group decision-making of teachers showed the importance of the criteria for a good mathematical computer game (*see Figure 1*). According to teachers, the most important criteria is that the computer game is in line with the existing educational framework. The next criterion in importance is that the game must have clear goals and rules of the game. After that, it is important for them that the game supports the development of cognitive abilities and intelligence, and then the development of creativity. Teachers attach somewhat less importance to multimedia content in the computer game, as well as to the user-friendly interface and interactivity.

Figure 1

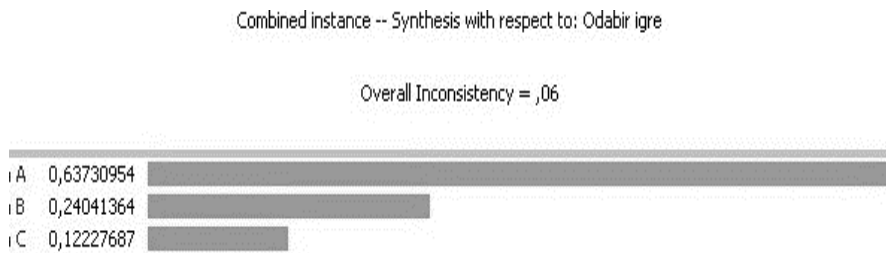
Implementation and results of numerical comparison by AHP method at the level of criteria - selection of teachers



According to the given criteria, the teachers chose game A by group decision-making (see Figure 2).

Figure 2

Results of group decision making by AHP method - priorities of alternatives - selection of teachers



After the entry of the remaining participants in the decision - making process, two students and computer scientists, the following results were obtained for the importance of the criteria (Figure 3).

Figure 3

Implementation and results of numerical comparison by AHP method at the level of criteria - final results (after all participants)



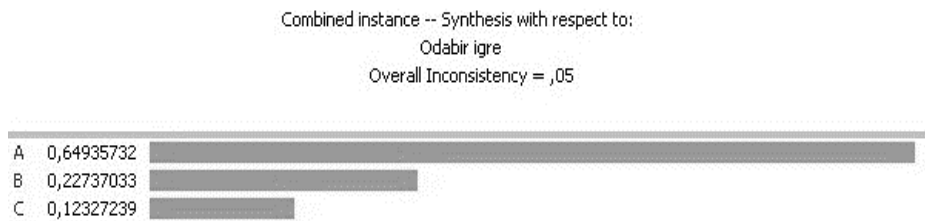
The final results show a different distribution of the importance of the criteria. Student attitudes and the attitude of computer scientists have raised the importance of multimedia content in mathematical computer play to second place. Multimedia is just as important to them as the clarity of the goal and the rules of the game. The most important criterion for them is that the game is in line with the existing educational framework. After the above, it is important for

them that the game supports the development of cognitive abilities and intelligence, as well as the development of creativity and that the interface is user-friendly. Interactivity is, after all, the least important criterion for a good mathematical computer game.

As for alternatives, participants in the decision-making process chose game A (see Figure 4) with equal importance as did the teachers themselves.

Figure 4

Results of group decision making by AHP method - priorities of alternatives - final results (after all participants)



Conclusion

According to teachers, the most important criterion is that the mathematical computer game is in line with the existing educational framework. The next criterion in importance is that the game must have clear goals and rules of the game. After that, it is important for them that the game supports the development of cognitive abilities and intelligence, and then the development of creativity. Teachers attach somewhat less importance to multimedia content in the computer game, as well as to the user-friendly interface and interactivity. The final results show a different distribution of the importance of the criteria. Student attitudes and the attitude of computer scientists have raised the importance of multimedia content in mathematical computer play to second place. Multimedia is as important to students and computer scientists as the clarity of the goal and rules of the game. The most important criterion for them is that the game is in line with the existing educational framework. After the already mentioned criteria, it is important for them that the game supports the development of cognitive abilities and intelligence, as well as the development of creativity, and that the interface is user-friendly. Interactivity is, after all, the least important criterion for a good mathematical computer game. The choice of games for 4th grade primary school students justified the choice of the importance of certain criteria, so the choice of alternatives showed that the most important thing is that the game is in line with the existing educational framework and has clear goals and rules. It is also evident that the other criteria mentioned are important. For further research it is necessary to

increase the number of previous research, case studies and increase the geographical area of respondents. The limitation in the selection of criteria refers to the age of the students and future research should include students of different ages.

References

- Abrams, L. (2008). The Effect of computer mathematics games on elementary and middle school students' mathematics motivation and achievement. Unpublished Doctoral dissertation, Capella University
- Begičević, N., Multicriteria decision-making models in strategic planning of e-learning introduction, Doctoral dissertation, Varaždin, FOI, 2008
- Demirbilek, M. and Tamer, S.L., 2010. Math teachers' perspectives on using educational computer games in math education. *Procedia-Social and Behavioral Sciences*, 9, pp.709-716.
- Dennis, AR and Valacich, JS, Computer Brainstorms: More Heads are Better than One, *Journal of Applied Psychology*, Vol. 78, No. 4, pp. 531-537, 1993
- Furlan, I., *Applied Psychology of Learning (Introduction to Pedagogical Psychology)*, Školska knjiga, Zagreb, 1984
- Gee, JP, What video games have to teach louse about learning and literacy. New York: Palgrave/St. Martin's, 2003
- Hurd, D., Jennings, E., Standardized Educational Games Ratings: Suggested Criteria, *Bethel Journal*, Vol 111, no. 45, 2010
- Ke, F. (2008). Computer games application within alternative classroom goal structures: cognitive, metacognitive, and affective evaluation. *Educational Technology Research and Development*, 56(5/6), 539-556.
- Klawe, MM, When does the use of computer games and other interactive multimedia software help students learn Mathematics?. Unpublished manuscript. Retrieved from <http://www.cs.ubc.ca/nest/egems/reports/NCTM.doc.>, 1998
- Malone, TW, Lepper, MR, Making learning fun: A taxonomy of intrinsic motivations for learning., *Aptitude, Learning and Instruction III: Conative and Affective Process Analyzes*, NJ: Erlbaum, 1987
- Rickards, T., Brainstorming, M Runco & S Pritzker, Eds, *Encyclopedia of Creativity*, San Diego: Academic Press Vol 1 219-228, 1999
- Roach, R., Research schools work to improve classroom use of computer games, *Black Issues in Higher Education*, Issue 21., vol.20, p.42., 2003
- Saaty, TL: *Multicriteria Decision Making: The Analytic Hierarchs Process*, RWS Publications, 4922 Ellsworth Ave., Pittsburgh, PA 15213, 1980

The introduction of digital avatars in real-life classrooms in the Republic of Croatia

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Abstract

As a significant step in the digital transformation of the schools in the Republic of Croatia, the Ministry of Science and Education has cooperated with the Croatian Academic and Research Network (CARNET), distributed preinstalled tablet computers to the pupils, with a start in the year 2020. During the Covid-19 pandemic, classes were held face to face, online, or combined, depending on the situation in specific schools and classes. More resourceful and agile teachers didn't hesitate to implement avatars in their classes using tablets when the occasion arose. Human surrogates, also known as *avatars*, are any objects that act as a substitute for a human. An avatar is a manifestation of the human who inhabits it and controls it. Its constraints determine the range of desired behaviors. The paper explores how avatars can improve the teaching process in real-life classrooms.

Keywords: avatar, human surrogate, physical avatar, real-life classroom, tablet

Introduction

The covid-19 pandemic made a substantial impact on education around the world. Fortunately, the Republic of Croatia was not entirely unprepared for such a scenario. Classes during the Covid-19 pandemic in the Republic of Croatia were held face to face, online, or in combination, depending on the current situation in individual schools and classes.

Digital transformation of the schools in the Republic of Croatia is an ongoing continues process that began in the 1980s, the period before the independence of the Republic of Croatia in the year 1991.

Croatian Academic and Research Network – CARNET is a public institution operating within the Ministry of Science and Education in information and communication technology and its application in education. CARNET began working in 1991 as a project of the then Ministry of Science and Technology and became the first and only provider of Internet services in Croatia. Four years later, the Government of the Republic of Croatia adopted the Decree on

the establishment of CARNET institution to innovate the education system and encourage the progress of individuals and society as a whole through ICT (information and communication technology)⁵¹.

As a significant step in the digital transformation of the schools in the Republic of Croatia, the Ministry of Science and Education, in cooperation with the CARNET, distributed preinstalled tablet computers to the pupils starting in 2020 which certainly contributed to easier coping and functioning during classes in time of the covid-19 pandemic⁵².

Tablets were distributed to all fifth and seventh-grade primary school pupils for two consecutive school years, which ultimately supplied all 5th to 8th primary school pupils. A certain number of tablets were distributed to primary schools for lower grade pupils and to high schools for poor pupils also⁵³.

CARNET also provided 26,350 laptops for teachers to more than 1,200 schools throughout Croatia⁵⁴.

Theoretical background

The definition of an avatar has been changing throughout history.

Hughes (2014) defines a human surrogate as any object, virtual, physical, or even a blend of virtual and physical, that acts as a stand-in for a human. In the context of a virtual environment, a surrogate is more often referred to as an avatar, reflecting that it is intended to represent the person in some context, rather than just carrying out a specific task on his or her behalf. Essentially, an avatar manifests the human who is “inhabiting” it. The inhabiter controls all critical actions, verbal and non-verbal, of his or her avatar. However, the specific manifestation of the avatar may place constraints on how it carries out some of these desired behaviors. Initially, the word *avatar* derives from the Sanskrit word अवतार, *avatāra*, and refers to the incarnation of the Hindu god. A Hindu deity embodies a spiritual being in animal, human or hybrid form to interact with humans (Parrinder, 1997; Lochtefeld, 2002).

Stephenson’s (1992) science fiction novel *Snow Crash* popularized the word avatar in the context of virtual worlds. Morningstar and Farmer (1991) state first usage of an *avatar* in *Lucasfilm’s Habitat* game in the year 1986, while Bailenson and Blascovich (2004) claim that the term and concept appeared as early as 1984 in online multiuser dungeons, or MUDs (role-

⁵¹ <https://www.carnet.hr/en/about-carnet/>

⁵² <https://mzo.gov.hr/vijesti/skolama-u-hrvatskoj-91-tisuca-tableta-za-izvodjenje-nastave-u-sklopu-reforme/3206>

⁵³ <https://mzo.gov.hr/vijesti/kurikularna-reforma-za-ucenike-besplatni-udzbenici-i-tableti-nastavnici-dobivaju-racunala/3487>

⁵⁴ <https://www.carnet.hr/en/26350-laptops-delivered-in-the-scope-of-the-e-schools-programme/>

playing environments), and the concept, though not the term, arose in works of fiction dating back to the mid-1970s.

It should be noted that today's virtual technology, although in steady progress, is still far from the quality shown in the character of Neo from the movie Matrix.

Researchers in psychology and philosophy have widely discussed the meaning of embodiment. Gerhard et al. (2004) did extensive literature research citing the characterization of avatars as a *user embodiment in a collaborative virtual environment* (Gerhart and Moore, 1998); *The avatar as a bodily presence in virtual space provides a focus for conversation and social interaction* (Slater et al., 2000) and, *through avatars, users embody themselves and make real their engagement with a virtual world* (Taylor, 2002).

In a collaborative virtual environment, the avatar can be under the direct control of a user or the user defines goals and instructs an agent to control the avatar (Gerhard et al., 2004).

Defining an avatar as an exclusively virtual space construct moves away from its original meaning and constrain its possibility of use. The James Cameron science fiction movie "Avatar" from 2009 introduces an example of a perfect avatar. Through advanced technology, in the real world, the character of Jake Sully inhabits the body of alien species indistinguishable from others retaining all their senses and capabilities. The two-way telepresence robot system used in Okamura and Tanaka's (2016) research works on the same principle but with significant limitations compared to the movie Avatar. However, the authors did not use the term avatar in their paper. Guizzo (2010) explores several telepresence robots' characteristics naming them *real avatars*. Seet et al. (2012) present the design for the mobile robotic avatar MAVEN (Mobile Avatar for Virtual Engagement by NTU). "MAVEN is an intelligent mobile telepresence system that permits the user ("Inhabitor") to attend an overseas conference or meeting without leaving the comfort of one's office."

Misawa and Rekimoto (2015a, 2015b) explore telepresence, embodying physically and socially using human surrogates. Authors developed a prototype system called *ChameleonMask*, where the remote user provides directions that the surrogate enacts with his or her body.

Lee et al. (2009) explore robot avatars and defines five design elements for communication robots: directing and sharing attention (A), real-time sensory information feedback (B), alleviating the cognitive load of the operator (C), character and personality (D), global accessibility (E).

Research methodology

Before Covid-19, the Republic of Croatia began the process of equipping pupils in primary and secondary schools with digital tablets. Due to illness or self-isolation, long-term absence from school due to contact with persons infected with covid-19 negatively affects pupils. The main goal of the research is to mitigate those adverse effects.

The potential of digital avatar technology can be utilized for use in real-life classrooms.

According to the above mentioned, this research is based on the following hypotheses:

H1: It is possible to create a model of physical avatars using digital tablets in real-life school classes.

H2: By using digital avatar technology and computer tablets, it is possible to improve the quality of the school classes.

Considering the nature of the problems, the research will be conducted deductively, starting from the hypotheses mentioned above. The primary method used to achieve the research goal is the modeling method. Other scientific methods such as qualitative analysis, abstraction, generalization, specialization, aggregation, composition, etc., were used.

Discussion and results

Comparing the two-way telepresence robot system with digital tablets capabilities, respecting five design elements for communication robots offer guidelines for building an avatar model.

Digital tablets can be paired using video calls/chat/conference software. The most popular calls/chat/conference software in Croatian primary and secondary schools are *Microsoft Teams* and *Zoom Cloud Meetings*.

By pairing Tablet A, in possession of the absent pupil (*Inhabitor*), and Tablet B, in possession of the present pupil (*Physical agent*), shown in Figure 1, Tablet B becomes *Avatar*. The physical agent is a classmate executing requests for moving and directing the inhabitor vocally asks for.

Figure 1

Audio-video paired tablets

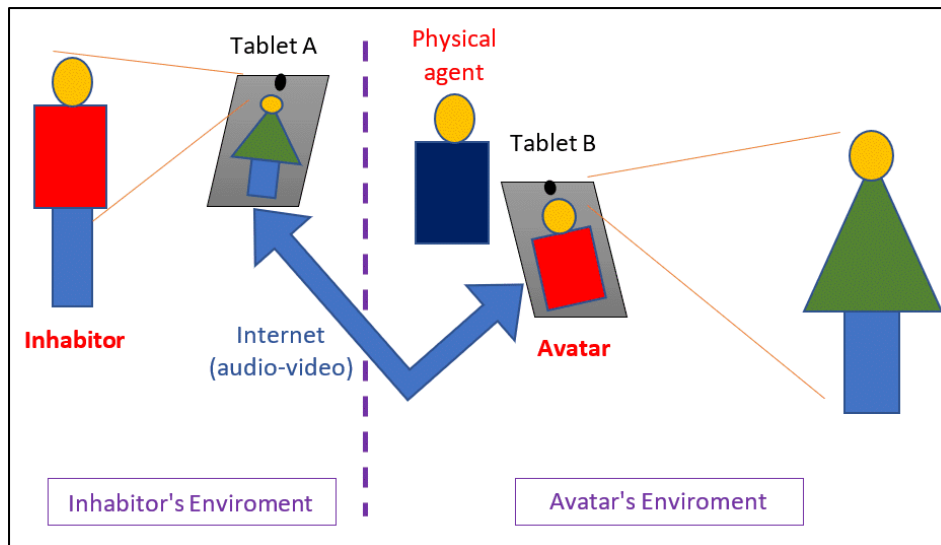


Table 1 displays how the Hybrid model utilizes Tablets and a human (Physical agent) to gain the same abilities as the Mobile robot avatar.

Table 1

Mobile robot avatar and Hybrid model avatar comparison

Mobile robot vs. Hybrid Avatar

MAVEN Platform	Tablet-Human Hybrid Avatar Model
Screen Display	Tablet B - 10.1" IPS display
Host Subsystem	Tablet B - 8-core CPU, 2.0 GHz, RAM 3GB, ROM 32 GB, Linux OS
Internet Telephony	Tablets A and B
Power Supply	Tablet B - 8000 mAh Li-polymer battery (operating up to 9 hours)
Wi-Fi Communication	Tablet A and B - Wi-Fi: 802.11 a/b/g/n/ac 2.4 GHz + 5 GHz, Bluetooth 4.2, 4G/LTE
Application Sensor Modules	Tablet B – Webcam, microphone
Holonomic Mobility platform	Physical agent (Classmate)
Remote Inhabitor Control	Tablet A

The Tablet-Human Hybrid Model defines a physical avatar which confirms the first hypothesis (H1). The number of present pupils limits the maximum number of avatars in the classroom.

Although without scientific knowledge of physical avatars, during the Covid-19 pandemic, more resourceful and agile teachers didn't hesitate to implement avatars in their

classes using tablets when the occasion arose. Quarantine during the pandemic of Covid-19 in the Republic of Croatia for contacts of the infected was from 7 to 14 days, depending on the current situation.

Malcolm et al. (2003) list the effects on the absentee pupils of which these three refer to absence can be due to illness or Covid-19 quarantine: academic underachievement, difficulty making friends, and loss of confidence and self-esteem. The authors point out it could affect other pupils in the following ways: friends and partners were deserted, and disruption in class when absentees returned. Ristić Dedić and Jokić (2021) state that organizational changes and restrictions caused by the pandemic had the most negative impact on motivation to learn, while most students rated their impact on the development of digital skills as positive.

School children in hospitals, especially absentees for a long time, would benefit significantly from physical avatar technology, even if they cannot attend avatar-schooling full time due to hospital rules and obligations.

Figure 2

Avatars in real-life classroom

Illustrations courtesy of Marina Duka

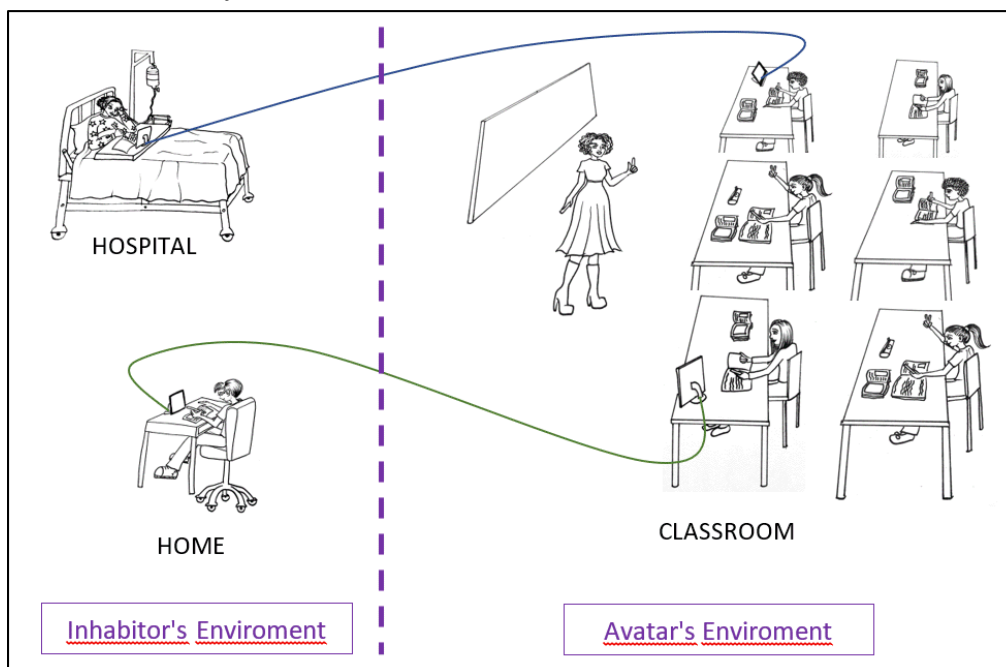


Figure 2 illustrates the model of inclusion of absent pupils in a real-life classroom in the form of avatars, mitigating the adverse effects on them, as Malcolm et al. (2003) warned. Adverse effects on other pupils listed by the same authors are mitigated as well.

Several studies confirmed a positive correlation between class attendance and academic performance as well as a learning outcome (Burns and Ludlow, 2005; Stanca, 2006; Kassarnig et al., 2017; Tetteh, 2018).

During the model testing in proto-research undertaken for this paper, the teacher observed that there was no need for additional explanations of teaching content processed via avatar once the pupil returned to school. The transition from avatar to standard face-to-face teaching passed without any observed difficulty for every pupil included in the testing model.

Inclusion of any absentee pupil in a real-life classroom, even if it's just partial, mitigates adverse effects on them and others. Considering that the increased possibility of class attendance improves the quality of school classes, the second hypothesis (H2) is confirmed.

The Tablet-Human Hybrid Model fully includes all the elements of a communication robot defined by Lee et al. (2009). A - *Directing and sharing attention* is solved by a constant open audio connection and instructing an agent (classmate). B - *Real-time sensory information feedback* comes from a camera on the avatars' tablet and agent (classmate) if something unexpected happens out of the camera's reach. C - *Alleviating the cognitive load of the operator*. Since the agent is a classmate, he is aware of all classroom events, so the inhabitator (in this case – the operator) gives simple vocal requests to the agent. D - *Character and personality* are always present, considering the camera on the user's tablet captures facial expressions and upper body gesticulation. E - *Global accessibility* is granted through the internet.

Figure 3

Schooling photographs made by the teacher



Proto-research for this paper was conducted at a *Primary School Ladimirevci*, in a multi-grade class for children with special needs, integrating seventh and eighth-grade pupils. The class has five pupils and one teaching assistant. Proto-research was taken to test the model's functionality during the school year 2021/2022 when opportunities arose. In proto-research, Microsoft Teams was used for tablet pairing. Absentees (inhabitants) were instructed to place the tablets on the desk to have their hands free to work and see the tablet screen well. Consequently, they filmed the upper body and the work surface of the table as projected on the avatar. In this way, they conveyed their gesticulation in interactions and not just facial expressions. The avatar tablet was replaced with a classroom computer using a standard computer screen, webcam, screen projector, and laptop for testing purposes. Figure 3 shows photographs from the classroom made by a teacher. Initial data suggests that using alternative equipment to tablets takes additional time and disrupts regular real-life classes, but this should be investigated more thoroughly. Since this is the third school year from the beginning of the Covid-19 pandemic, with occasional online classes, pupils are well versed in technology, and no additional training is required to pair tablets. In some situations, due to the imperfection of technology, such as fixed tablet holders or fixed cameras, teachers should approach avatars by respecting their limitations.

During the Covid-19 pandemic, in some phases, in the case of infection, self-isolation was determined for pupils neighboring the infected. Thus, a significant part of the class remained at home while others went to school. Teachers had to hold all the lectures twice (online and live), which was exhausting. They were not paid for the extra work. The Tablet-Human Hybrid Avatar Model could solve this problem without additional costs and loads.

Conclusion

The Tablet-Human Hybrid Avatar Model for the implementation of avatars in real-life classrooms is a new model developed by the authors.

The model, with additional education, is applicable in all primary and secondary schools in the Republic of Croatia and globally if equipped with tablets and with a quality internet connection.

Inclusion of absentee pupils in a real-life classroom using The Tablet-Human Hybrid Avatar Model mitigates adverse effects on them and others, improving the quality of school classes.

Proto-research results indicate readiness for immediate implementation respecting avatars' limitations, and the need for more extensive research.

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References

- Bailenson, J. N., Blascovich, J. J. (2004). Avatars. In W. S. Bainbridge (Ed.), *Encyclopedia of Human-Computer Interaction* (pp. 64–68). Great Barrington, MA: Berkshire Publishing Group.
- Burns, S. M., Ludlow, L. H. (2005). Understanding student evaluations of teaching quality: The contributions of class attendance. *Journal of Personnel Evaluation in Education*, 18(2), 127-138.
- Gerhard, M., Moore, D. (1998). User embodiments in educational CVEs: towards continuous presence. In: *Proceedings of the International Conference on Network Entities (NETIES)*, Leeds, UK
- Gerhard, M., Moore, D., Hobbs, D. (2004). Embodiment and copresence in collaborative interfaces, *International Journal of Human-Computer Studies*, Volume 61, Issue 4, Pages 453-480
- Guizzo, E. (2010). When My Avatar Went to Work. *IEEE Spectrum*, vol. 47, no. 9, pp. 26-50, DOI: 10.1109/MSPEC.2010.5557512.
- Hughes, C. E. (2014). Human surrogates: Remote presence for collaboration and education in smart cities. In *Proceedings of the 1st International Workshop on Emerging Multimedia Applications and Services for Smart Cities* (pp. 1-2).
- Kassarnig V., Bjerre-Nielsen A., Mones E., Lehmann S., Lassen D.D. (2017) Class attendance, peer similarity, and academic performance in a large field study. *PLoS ONE* 12(11): e0187078. <https://doi.org/10.1371/journal.pone.0187078>
- Lee, J. K., Stiehl, W. D., Toscano, R. L., Breazeal, C. (2009). Semi-autonomous robot avatar as a medium for family communication and education. *Advanced Robotics*, 23(14), 1925-1949.
- Lochtefeld, J. (2002). "Avatar" in *The Illustrated Encyclopedia of Hinduism*, Vol. 1: A-M, Rosen Publishing, pages 72–73
- Malcolm, H., Wilson, V., Davidson, J., & Kirk, S. (2003). *Absence from school: A study of its causes and effects in seven LEAs*. The SCRE Centre University of Glasgow: Glasgow.
- Misawa, K., Rekimoto, J. (2015a). ChameleonMask: a human-surrogate system with a telepresence face. *SIGGRAPH Asia 2015 Emerging Technologies (SA '15)*. Association for Computing Machinery, New York, NY, USA, Article 5, 1–3. DOI: <https://doi.org/10.1145/2818466.2818473>
- Misawa, K., Rekimoto, J. (2015b). ChameleonMask: Embodied Physical and Social Telepresence using Human Surrogates. *Proceedings of the 33rd Annual ACM Conference Extended Abstracts on Human Factors in Computing Systems (CHI EA '15)*. Association for Computing Machinery, New York, NY, USA, 401–411. DOI: <https://doi.org/10.1145/2702613.2732506>
- Morningstar, C., Farmer, R. (1991). The Lessons of Lucasfilm's Habitat. In: Benedikt, M. (Ed.), *Cyberspace: First Steps*. MIT Press, Cambridge, USA, pp. 273–301

- Okamura, E., Tanaka, F. (2016). A pilot study about remote teaching by elderly people to children over a two-way telepresence robot system. 11th ACM/IEEE International Conference on Human-Robot Interaction (HRI) (pp. 489-490). IEEE.
- Parrinder, G. (1997). *Avatar and Incarnation: The Divine in Human Form in the World's Religions*. Oneworld. pp. 19–20.
- Ristić Dedić, Z., Jokić, B. (2021). Croatian Pupils' Perspectives on Remote Teaching and Learning during the COVID-19 Pandemic. *Društvena istraživanja*, 30 (2), 227-247. <https://doi.org/10.5559/di.30.2.03>
- Seet, G., Pang, W.C., Burhan, Chen, I., Iastrebov, V., Gu, W., Wong, C.Y. (2012). A design for a mobile robotic avatar - Modular framework. 2012 3DTV-Conference: The True Vision - Capture, Transmission and Display of 3D Video (3DTV-CON), 1-4.
- Slater, M., Sadagic, A., Usoh, M, Schroeder, R. (2000). Small-group behavior in a virtual and real environment: a comparative study. *Presence: Teleoperators and Virtual Environments*. Vol. 9(1), 37–51
- Stanca, L. (2006) The Effects of Attendance on Academic Performance: Panel Data Evidence for Introductory Microeconomics, *The Journal of Economic Education*, 37:3, 251-266, DOI: 10.3200/JECE.37.3.251-266
- Stephenson, N. (1992). *Snow Crash*. Bantam Spectra, New York, USA
- Taylor, T.L. (2002). Living digitally: embodiment in virtual worlds. In: Schroeder, R. (Ed.), *The Social Life of Avatars*. Springer, London, UK
- Tetteh, G.A. (2018). Effects of Classroom Attendance and Learning Strategies on the Learning Outcome. *Journal of International Education in Business*, Vol. 11 No. 2, pp. 195-219. <https://doi.org/10.1108/JIEB-01-2017-0004>
- 26,350 laptops delivered in the scope of the e-Schools programme. Croatian Academic and Research Network – CARNET. Retrieved March 26, 2022, from: <https://www.carnet.hr/en/26350-laptops-delivered-in-the-scope-of-the-e-schools-programme/>
- About CARNET. Croatian Academic and Research Network – CARNET. Retrieved March 26, 2022, from: <https://www.carnet.hr/en/about-carnet/>
- Kurikularna reforma - za učenike besplatni udžbenici i tableti, nastavnici dobivaju računala. Republic of Croatia, Ministry of Science and Education. Retrieved March 26, 2022, from: <https://mzo.gov.hr/vijesti/kurikularna-reforma-za-ucenike-besplatni-udzbenici-i-tableti-nastavnici-dobivaju-racunala/3487>
- Školama u Hrvatskoj 91 tisuća tableta za izvođenje nastave u sklopu reforme. Republic of Croatia, Ministry of Science and Education. Retrieved March 26, 2022, from: <https://mzo.gov.hr/vijesti/skolama-u-hrvatskoj-91-tisuca-tableta-za-izvodjenje-nastave-u-sklopu-reforme/3206>

The Attitudes of Croatian Teachers Regarding the Challenges of Classroom Management During COVID-19 Pandemic

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Abstract

COVID-19 pandemic disrupted the business and personal life of each and every individual. Every business sector had to adapt to the “new normal” and change their ways of work. In 2020, teachers substituted their physical classrooms with virtual ones, as well as the means of interaction with students, parents and colleagues from direct communication to communicating via online platforms, and they also replaced the traditional methods of teaching with those in a digital form, which required certain digital competence from teachers, students and parents as well.

The aim of this research was to find out the attitudes of classroom teachers regarding the challenges of classroom management during COVID-19 pandemic. Research was conducted on 107 Croatian classroom teachers. This applied and transversal research via an online survey confirmed that the majority of teachers believed that the pandemic did not significantly affect their way of keeping pedagogical records, and that their digital competence rose to a new level than they were prior to the pandemic. The majority of teachers claimed that the pandemic period left a negative impact on the quality of teaching since a lot of students did not possess a satisfactory level of digital competence necessary for online learning. Teachers believe that they did not have trouble keeping in touch with parents and students, but the means of communication changed. Teachers developed their digital competence independently and through organized learning about digital platforms, and the most frequently used platforms for communication with both students and parents were Viber, Zoom, Microsoft Teams, WhatsApp, Skype and Google Classroom.

Keywords: digital competence of teachers, classroom management, COVID-19, communication

Introduction*

Classroom management represents the behaviour of teachers and all of the organizational factors in a classroom which lead to creating a positive learning environment (Vizek Vidović et al., 2003), and it consists of strategies, techniques and methods that should ensure a physical and psychological sense of student's safety, as well as encourage prosocial behaviour (Manning, & Bucher, 2007). To maintain a successful classroom management, teachers need to use their own professional competences, especially pedagogic and social ones, and that includes a teacher's ability to create a partnership with parents. Covid-19 pandemic disrupted the usual teaching process, therefore creating a partnership with parents, and making classroom management involve digital competence of teachers, students, and parents.

Matijević and Radovanović (2011) define classroom management as a set of competences that can be seen in the teacher's ability when it comes to explaining each behaviour of the class as a whole and the student as an individual. *Classroom management* is an expression used for "describing the teaching process in a classroom despite the occasional inappropriate behaviour of students. The term also refers to preventing the inappropriate behaviour. The expression classroom management is closely connected to motivation, discipline and mutual respect." (Matijević, & Radovanović, 2011, pp. 293). *Leadership* means having the influence to affect people in order to make them change their beliefs and behaviour (Jurić, 2004), and management is a process of shaping and maintaining an environment in which the individuals can, by working in groups, effectively accomplish chosen goals (Welhrich, & Koontz, 1998). Hess and Siciliano (1996) define management as a process of coordinating the human, technical and financial resources needed for accomplishing organizational goals. Seme Stojnović and Hitrec (2014) explain that leadership is very similar to management, seeing that both of the processes also involve having an influence within a group, and accomplishing goals, but in a different manner. In the continuation of the paper, the term Classroom management will be used, although every teacher should have the qualities of both a manager and a leader (Glasser, 1994).

Rađenović and Smiljanić (2007, pp. 160) state the "obligations of a homeroom teacher: direct work with students; cooperation with parents; cooperation with class council members; cooperation with the school's administrative and professional service both inside and outside of school; administration and organization. In doing so, a homeroom teacher needs to be:

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competent, professional, an authority figure, approachable, polite and consistent. Being professional is crucial in creating cooperation, and partnership with students and parents.” “Partnership is based on mutual respect, sharing information, mutual decision-making and acknowledging the individuality of a family” (Maleš, 2003, pp. 293). Partnership orientation also emphasizes the importance of cooperation between parents and school in the process of education and socialization of children, respecting cultural differences between children and families, as well as the significance of having different perspectives for the (co)creation of a positive school climate for learning (Epstein, 1995). Šušanj Gregorović (2017) conclude that the results of various research from the past few decades confirm the undeniable importance and contribution of the inclusion of parents in the educational process with the aim of developing a partnership that is in the student’s best interest.

Pedagogical and Digital Competences of Teachers Needed for Classroom Management in COVID-19 Pandemic

Pedagogical professionalism of teachers can be seen in: the ability to create a school curriculum, the teaching process and school subsystems; organization and management of the educational process; assessing student’s achievement in school; forming a school and classroom atmosphere, and establishing a continuous partnership with parents (Jurčić, 2012).

Puji Astuti et al. (2019) state the competences a teacher should have in order to provide a quality education for the 21st century generations, including the digital competence, as one of the eight key competences necessary for lifelong learning (European Parliament and Council, 2006). Digital competence is defined as a critical, confident and creative use of digital technologies in order to achieve goals related to education and work, as well as to increase employability and participation in society, and spending one’s free time. Digital literacy (e-literacy) is defined as a set of skills, knowledge and beliefs of an individual who then uses digital tools and resources in the appropriate way to find, access, integrate, evaluate, analyse and synthesize digital resources, in order to create new knowledge, media research, communicate and act in a specific life situation, all in order to enable a constructive social participation and reflection (Ala-Mutka, 2011). Alongside digital competence and e-literacy, there are a few different types of literacy associated with that area, such as ICT literacy, information literacy and media literacy, and it is crucial that the teachers possess them all. Tatković, Diković and Tatković (2016, pp. 110) emphasize that the role of information and communication technology (ICT) “is especially important in educational communication to demonstrate a positive social reversibility, that is the relationship between the subjects of the

educational process”. ICT use has become a normal part of everyday life in educational institutions all over the world. It is not possible to talk about contemporary teaching and learning without e-learning, and it has several advantages: “learning anywhere and anytime”, rationalization of time and investment in business, easy and fast access to information and many other.”

Within the project e-Schools, CARNet (2016) published “The Framework for Digital Competence of Users in School: Teachers, Administrative and Professional Associates and Headmasters”. Being digitally competent, as well as the level of development of those competences is reflected in the frequency of use of these competences. Topolovčan, Rajić and Matijević (2017) conducted research among students and teachers regarding the possession and frequency of use of digital media in teaching. Students assessed that the teaching process is organized in a way to require a lot of online communication, as well as looking for information online and using social media.

World Health Organization (WHO, 2020) declared a global coronavirus pandemic on January 30, 2020, suddenly forcing the whole world to redirect any face-to-face contacts to an online environment which requires digital competences. That was followed by The Decision of the Minister of Health who declared an epidemic of COVID-19 disease caused by the SARS-CoV-2, on 13th of March, 2020 in Croatia. The Government of the Republic of Croatia then passed its first Decision on the suspension of teaching in higher education institutions, secondary and primary schools and the regular operation of preschool educational institutions, as well as the establishment of distance learning (Koronavirus.hr, 2022). Based on the recommendations of the Ministry of Science and Education, we can expect the organization of educational work in three possible models: A- teaching in the classrooms; B- mixed form of teaching and C- distance learning. Distance learning implies a two-way communication between students and teachers, as well as independent work of students from home. CARNet (2020) will organize multiple educations for teachers in order to acquire additional knowledge of tools needed for the implementation of distance learning.

Research results in Sweden (Bergdahl, & Nouri, 2021) show the challenges of the transition from live to distance learning, that is, they show that the schools are technically equipped, but that teachers lack pedagogical strategies for distance learning. Based on the review of relevant literature in the Croatian context, it is necessary to research classroom management in these new circumstances. During the pandemic, it was crucial for teachers, students, and parents to work together in order to determine what works and what does not in a dynamic way, but in limited circumstances (Richmond et al., 2021). There is a lot of research

(Ćurković, Krašić, & Katavić, 2020, Kolak, Markić, & Horvat, 2020, Sablić, Klasić, & Škugor, 2020) regarding the changes in the teaching process, but the area of classroom management and classroom teacher's responsibilities are often left out in Croatian scientific research, therefore the aim of this research is to establish the teachers' attitudes on the challenges of classroom management caused by Covid-19 pandemic. That being the *research aim*, it is expected that the pandemic has changed a way of classroom management, the teaching process, and that the teachers have developed their digital competences privately and through organized learning. By an applied and transversal research of the present based on a positivist paradigm, we will try to confirm the following *hypotheses*: The majority of teachers believe that the pandemic has not had a significant effect on their way of managing pedagogical documentation; The majority of teachers believe that they are more digitally competent compared to the pre-COVID -19 Pandemic period; The majority of teachers believe that the pandemic period left a negative effect on the quality of teaching; Teachers believe that they did not have any problems in maintaining contact with parents and students.

Method

Participants

Research was conducted via an online survey and it included primary school teachers from 18 Counties in Croatia (N=107), 106 being female and 1 male. The majority of participants were between 51 and 60 years old, and those with 26 years and more work experience. The majority of participants work in urban area (63%), 72,2% in district schools, and the majority of teachers have between 16 to 24 students (56%).

Research instruments

This research is based on a survey, which contains open, closed and combined questions. It consists of 29 questions. The first three questions refer to socio-demographic data (gender, age, work experience), the next five questions refer to out the characteristics of the school and the class in which they work (place of work and class composition). This is followed by closed and opened questions. There are twelve closed-ended questions divided into three subscales to which teachers answered with yes, no or I don't know. The subscales are: the management of pedagogical documentation (Chronbach's alpha = 0.614); digital competencies, communication with parents and students (Chronbach's alpha = 0.702) and the quality of teaching (Chronbach's alpha = 0.714), all during the COVID-19 pandemic. There are nine open-ended questions that further clarify: why teachers self-assess that they felt competent enough to keep records independently; why they believe that a higher level of digital

competences is needed to keep pedagogical documentation now than before the COVID-19 pandemic period; in what ways they communicated with students, and in what ways with parents during the COVID pandemic.

Procedure

The survey was conducted online and anonymously using Google Forms during May and June 2021. An online survey was sent to primary school teachers through closed social groups for teachers on Facebook. The estimated time for completing the survey was 15 minutes. Teachers volunteered to participate in research upon reading the instructions indicating the research aim and guaranteeing anonymity.

Results

The results will show a descriptive statistic (Table 1) with included closed type particles. Since this is the nominal level of measurement, non-parametric statistics follow for which purposes JASP 0.16.1.0. computer statistical program is used.

Table 1

Descriptive statistics

Variable	Valid	Mean	Std. Deviation	Minimum	Maximum
The impact of the pandemic on the management of pedagogical documentation	107	1.682	0.468	1.000	2.000
Digital competence for classroom management	107	1.738	0.442	1.000	2.000
Means of communication with students	107	3.972	1.377	1.000	5.000
Implementation of Homeroom class	107	1.953	1.403	0.000	5.000
Forms of collaboration with parents	107	1.028	0.166	1.000	2.000
Parental feedback	107	1.557	0.731	1.000	3.000
Organized digital course	107	2.226	1.430	0.000	4.000
Competence in managing pedagogical documentation	107	1.368	0.681	1.000	3.000
Cooperation with parents	107	1.792	0.529	1.000	3.000
Information on students	107	1.736	0.708	1.000	3.000
Growth of digital competences	107	1.274	0.594	1.000	3.000
Digital competence of students	107	1.698	0.692	1.000	3.000
Student feedback	107	1.472	0.650	1.000	3.000
Digital competence of parents	107	1.613	0.670	1.000	3.000
Parental feedback	107	1.443	0.663	1.000	3.000
Negative effect of the pandemic on the teaching process	107	1.358	0.693	1.000	3.000

When asked *Did the period of the COVID-19 pandemic affect your way of managing pedagogical documentation?* 68% of respondents said no, and 32% of respondents said yes,

and they answer an open-ended question that they believe that the evaluation of students has changed, adding longer descriptive grades, more demanding preparation of classes, and that distance learning made it difficult to actually assess students' knowledge, also adding additional administrative tasks. The majority of teachers (74%) do not believe that a *higher level of pedagogical competences* is needed to manage pedagogical documentation now than prior to COVID-19 pandemic period. Fewer teachers on the question of the open type they state that a higher level of digital competences is needed see this as learning about and analysing new digital tools and content, taking notes and checking students' tasks on online platforms. An equal number of schools had (39%) and did not have (35%) an *organized course on learning to use digital learning platforms*, and most teachers who did attend an organized course found the course useful (95%). The majority of teachers (80%) believe that their *digital competences* are now at a higher level than before the pandemic. *Teachers used various platforms to communicate with students*. They answer an open-ended question about how they communicated with students that some of them, but still in the highest percentage (30%) chose Viber as a medium of communication, then Zoom (16%), Microsoft Teams (8%), WhatsApp (8%), Mail (6.5%) and Google Classroom (6.5%).

The pandemic was *the main topic of the Homeroom class* with 21% of the teachers, while 10% of them did not hold Homeroom class during the pandemic at all. In case some of the students had some personal problems, teachers would talk to them via Messenger and online platforms (38%) or via calls and text messages (33%). Most teachers believe that *the pandemic period had a negative impact on the teaching process* (77%). As much as 43% of teachers believe that students have a satisfactory level of digital competences for communication and participation in distance learning. Most teachers received sufficient feedback from students (62%) and parents (68%) during the pandemic. They answer an open-ended question about how they communicated with parents and they say PTA meetings were organized via video calls on various platforms, sending a summary of the PTA meeting to parents via Viber groups and by holding the meeting live in open areas in front of schools. As much as 50% of teachers believe that the majority of parents possess a satisfactory level of digital competence for distance communication.

Discussion

Research confirmed the attitudes of primary school teachers on the classroom management during Covid-19 pandemic. All of the set hypotheses were confirmed based on the teacher's assessment. The majority of teachers believed that the pandemic did not

significantly affect their way of managing pedagogical documentation, that they have more digital competences compared to the pre-pandemic period, that the pandemic period had a negative impact on the quality of teaching and that they had no problems maintaining contact with parents and students.

In accordance with the hypothesis of managing the pedagogical documentation, research (Wahid, Farooq, & Azoz, 2021) showed that teachers faced new online challenges, but most teachers felt competent enough for that challenge, and that managing pedagogical documentation did not change significantly during the pandemic period. A survey by Sablić, Klasnić and Škugor (2020) conducted among primary school teachers shows that most teachers need more time per week to plan classes online than to teach them live. The Ministry of Science and Education (MSE) (2020) states that the majority of teachers did better than expected during distance learning. Research results by Sablić, Klasnić and Škugor (2020) as well as our research show that the majority of teachers miss having direct contact with students, but that the intensity of communication with students has not changed and that they manage to maintain communication with students during the pandemic, although distance learning has been a challenge in most countries (Bergdahl, & Nouri, 2021). During the challenging times of the COVID-19 pandemic, parents became teachers in a way, and they often mediated the communication between students and teachers. The results of a survey conducted among parents (Ivanković, & Igić, 2021; Kolak, Markić, & Horvat, 2020; MSE, 2020) showed that most parents are satisfied with distance learning and have a positive attitude about the use of ICT in distance learning during the COVID-19 pandemic.

Research results indicate that teachers cope well in unforeseen circumstances, are flexible in managing the pedagogical documentation and communicating with students and parents, and that their digital competences have improved. However, there are some problems, such as difficulties in assessing the real level of student's knowledge, difficulties in communication with students and parents who are not digitally competent, and extensive management of pedagogical documentation, which is why it is important to research the experiences of teachers, understand the advantages and disadvantages of distance learning and then introduce some changes in the practice. The scientific and professional contribution of the research is evident in the selection of a current topic that is insufficiently researched, and the coverage of respondents from all over Croatia. The disadvantage is a small number of respondents, as well as the instrument which, due to the current topic, was made solely for the purposes of this research. Therefore, we propose a validation of questionnaires to be conducted on a larger sample in future research.

Conclusion

COVID-19 pandemic has been insufficiently researched in all segments of society, especially in education, so it is necessary to further research the changes the pandemic made to the educational process, as well as to all participants of the educational process. The paper provides an overview of teachers' assessments of the pandemic and the changes it caused regarding classroom management, the teaching process, and the digital competences of teachers. Most teachers believe that the pandemic did not significantly affect their way of managing pedagogical documentation, despite the increase in the volume of administrative work and the transition to distance communication through various digital platforms. Most teachers believe that they are more competent digitally to the pre-pandemic period, which is caused by the more frequent use of different digital platforms. Although there were educations on digital competence in the past, teachers quickly began to apply the acquired knowledge and improve it through frequent use, but also individual learning and through courses organized by schools, the Agency for Education and the Ministry of Science and Education. Most teachers believe that the pandemic period had a negative impact on the quality of teaching, and they pointed out the difficulties in the field of student evaluation. Teachers believe that they had no problems maintaining contact with parents and students, but still point out the difficulty of communicating with students and parents who are not digitally competent, so it is necessary for schools and relevant institutions to plan an education for all stakeholders of the educational process, in order to develop a partnership between teachers, students and parents even through distance forms of collaboration.

Reference

- Ala-Mutka, K. (2011). Mapping digital competence: towards a conceptual understanding. Luxembourg: Joint Research Centre of the European Commission. <http://doi.org/10.13140/RG.2.2.18046.00322>
- Bergdahl, N, & Nouri, J. (2021). Covid-19 and crisis-prompted distance education in Sweden. *Technology, Knowledge and Learning*, 26(3), 443-459. <http://doi.org/10.1007/s10758-020-09470-6>
- CARNET (2016). Framework for digital competence of school users: teachers and professional associates, principals and administrative staff. Zagreb: Hrvatska akademska i istraživačka mreža CARNet.
- CARNET (2020). Distance learning. Tips for distance learning. Zagreb: Hrvatska akademska i istraživačka mreža CARNet. <https://www.carnet.hr/usluga/udaljenoucenje/>

- Ćurković, N., Krašić, S., & Katavić, I. (2020). Attitudes of teachers and parents of primary school students towards distance education. *Odgojno-obrazovne teme*, 3(5), 5-24.
- Epstein, J. L. (1995). School-family-vommunity partnerships: caring for the children we share. *Phi Delta Kappan*, 76, 701-712. <https://doi.org/10.1177/003172171009200326>
- European Parliament and Council (2006). Recommendation of the european parliament and of the council of 18 December 2006 on key competences for lifelong learning. <https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32006H0962>
- Glasser, W. (1994). *Managing Students without coercion*. Zagreb: Educa.
- Hess, P., & Siciliano, J. (1996). *Management: responsibility for performance*. New York: McGraw Hill Inc.
- Ivanković, I., & Igić, I. (2021). Attitudes of parents of primary school students of the City of Zagreb on the use of ICT in distance learning during the COVID-19 pandemic. *Metodički ogledi*, 28 (1), 39-62. <https://doi.org/10.21464/mo.28.1.5>
- Jurčić, M. (2012). *Pedagogical competencies of modern teacher*. Zagreb: Recedo d.o.o.
- Jurić, V. (2004). Educational management- the reflection of general idea of management. *Pedagogijska istraživanja*, 1(1), 137-146.
- Kolak, A., Markić, I., & Horvat, Z. (2020). When home becomes school (parent as a substitute teacher). In V. Strugar, A. Kolak, & I. Markić (eds.), *Home schooling and distance learning at the time of HR-COVID-19* (pp 47-86). Zagreb-Bjelovar: Hrvatska akademija znanosti i umjetnosti i Zavod za znanstvenoistraživački i umjetnički rad u Bjelovaru.
- Koronavirus.hr (2022). Government official website for timely and accurate information on coronavirus. Vlada Republike Hrvatske <https://www.koronavirus.hr/podaci/489>
- Maleš, D. (2003). Parenting afirmation. In Puljiz, V., & Bouillet, D. (eds.), *National family policy* (pp 277-301). Zagreb: Državni zavod za zaštitu obitelji, materinstva i mladeži.
- Matijević, M., & Radovanović, D. (2011). *Student-Centred Teaching*. Zagreb: Školske novine.
- Manning, M.L., & Bucher, K.T. (2007). *Classroom management: models, applications, and cases* (2nd Edition). London: Pearson.
- Ministarstvo znanosti i obrazovanja (2020). Questionnaire on distance learning in the period from 16 March 2020 to 26 June 2020 - answers of teachers and professional associates. <https://skolazazivot.hr/upitnik-o-izvodenju-nastave-na-daljinu-u-razdoblju-od-16-ozujka-2020-do-26-lipnja-2020-odgovori-ucitelja-nastavnika-i-strucnih-suradnika/>
- Puji Astuti, A. Aziz, A., Susilogati Sumarti, A., & Bhartati, D. (2019). Preparing 21st century teachers: implementation of 4c character's pre-service teacher through teaching practice. *Journal of Physicy: Conferences series*, 1233. <https://iopscience.iop.org/article/10.1088/1742-6596/1233/1/012109/meta>
- Rađenović, A., & Smiljanić, M. (2007). *Handbook for class teachers*. Zagreb: Alinea.

- Richmond, G., Cho, C.H, Gallagher, A., He, Y., & Bartell, T. (2021). Fast and slow thinking to address persistent and complex problems in teaching and learning. *Journal of Teacher Education*, 72(4), 401-404. <https://doi.org/10.1177/00224871211030367>
- Sablić, M., Klasnić, I., & Škugor, A. (2020). Teachers in quarantine: challenges for the new normal. In V. Strugar, A. Kolak, & I. Markić (eds.), *Home schooling and distance learning at the time of HR-COVID-19* (pp 87-107). Zagreb-Bjelovar: Hrvatska akademija znanosti i umjetnosti i Zavod za znanstvenoistraživački i umjetnički rad u Bjelovaru.
- Seme Stojnović, I., & Hitrec, S. (2014). *Modern leadership in education*. Zagreb: Golden marketing-Tehnička knjiga.
- Sušanj Gregorović, K. (2017). Parental involvement in child education: teacher attitudes and practices. *Školski vjesnik*, 66 (3), 347-376.
- Tatković, N., Diković, M, & Tatković, S. (2016). *Pedagogical and psychological aspects of communication*. Pula: Sveučilište Jurja Dobrile u Puli.
- Tkalec, D. (2021). *Class management challenges during the COVID-19 pandemic*. (Graduate thesis). Osijek: Faculty of Education Josip Juraj Strossmayer University of Osijek.
- Topolovčan, T., Rajić, V., & Matijević, M. (2017). *Constructivist teaching: theory and empirical research*. Zagreb: Učiteljski fakultet Sveučilišta u Zagrebu.
- Vizek Vidović, V., Vlahović-Štetić V., Rijavec, M., & Miljković, D. (2014). *Educational Psychology [Psihologija obrazovanja]*. Zagreb: Vern.
- Wahid, R., Farooq, O., & Azoz, A. (2021). The new normal: online classes and assessments during the COVID 19 outbreak. *Journal of E-Learning and Knowledge Society*, 17(2), 85-96. <https://doi.org/10.20368/1971-8829/1135346>
- Weirich, H., & Koontz, H. (1998). *Management*. Zagreb: MATE.
- World Health Organization (2020). *Emergency Committee regarding the outbreak of novel coronavirus (2019-nCoV)*. [https://www.who.int/news/item/30-01-2020-statement-on-the-second-meeting-of-the-international-health-regulations-\(2005\)-emergency-committee-regarding-the-outbreak-of-novel-coronavirus-\(2019-ncov\)](https://www.who.int/news/item/30-01-2020-statement-on-the-second-meeting-of-the-international-health-regulations-(2005)-emergency-committee-regarding-the-outbreak-of-novel-coronavirus-(2019-ncov))

Information and Communication Technology (ICT) in Teaching Students with Disabilities during the COVID-19 Pandemic

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Abstract

During COVID-19 pandemic, the Croatian educational system was facing a major change in educational process. Many countries, including the Republic of Croatia, have developed the concept of remote teaching, the model of teaching without the physical presence of students and teachers. The new model of teaching had a significant impact on teaching methods, as well as on the participants in the educational process. Teachers were faced with the challenge of how to fulfill educational goals and processes with the help of information and communication technology, but also how to ensure the prerequisite for the education of all students. Since all students have the right to suitable knowledge in accordance with their developmental abilities created in various educational contents individually adapted to them, the use of the information and communication technology is important for educational purposes and to achieve the functional skills of children with disabilities. The aim of this paper is to give insight into the information and communication technology teachers were using while remote teaching children with disabilities, as well as the challenges they were facing. Participants of the research were teachers coming from the following counties: Osijek-Baranja, Brod-Posavina, Požega-Slavonia, and Vukovar-Srijem. They were given a questionnaire on information and communication technology they have been working with. Collected results give insight into the information and communication technology teachers were using while remote teaching children with disabilities and into the challenges they were facing. Obtained data represents contribution to defining guidelines for work with students with disabilities during remote teaching using information and communication technology.

Keywords: remote teaching, children with disabilities, information and communication technology

Introduction

Since the World Health Organization announced the outbreak of a pandemic spreading across continents on March 11, 2020, the pandemic COVID-19 has impacted education systems around the world. At the time of maximum school closures (April 15, 2020), 191 countries had closed their schools nationwide (UNESCO, 2020). Therefore, many countries, including the Republic of Croatia, have developed the concept of remote teaching (Vlada Republike Hrvatske, 2020). According to UNESCO (2020), remote teaching occurs when the learner and the instructor or source of information are physically separated and therefore cannot meet in a traditional classroom. In remote teaching, the use of ICT became one of the most important requirements and the only option for continuing the educational process (Bohak Adam & Metljak, 2022). The new way of teaching brought special challenges for all participants of the educational process, as well as for teachers. One of the special challenges for teachers is to minimize the inequality and reduce the learning loss of students with disabilities (UNESCO, 2022). Since all students have the right to appropriate knowledge that matches their developmental abilities, delivered in different educational content that is individualized to them, the use of ICT is important for the educational purpose and to achieve functional abilities of the children with disabilities.

Remote teaching in the Republic of Croatia

Similar to the other countries, the Croatian Ministry of Education and Science, in cooperation with educational agencies, developed a remote teaching model due to the outbreak of the pandemic COVID -19 (Ministarstvo znanosti i obrazovanja Republike Hrvatske, 2021). The basic principles of remote teaching were that the content and learning should be accessible to all students (MZO, 2020) and that each solution must've an additional backup plan (Škola za život, 2020). With the development of the remote teaching model by the Ministry, the real world has shifted to the virtual one, and the paradigm of remote teaching has become a reality (Sablić et al., 2020).

Since younger elementary school students (7-10 years old) aren't yet able to use digital tools independently, the Ministry established remote teaching in cooperation with the public television "Škola na Trećem" (MZO, 2020). In addition, 15-minute video lessons "Škola za život" were created for older elementary school students (ages 10-14) (MZO, 2020). Older elementary school students were provided with the necessary equipment and Internet access. In addition, to ensure that every student has Internet access and appropriate equipment at home,

more than 90,000 tablets were distributed to students and more than 26,000 computers were distributed to teachers (Akcijski plan za provedbu nastave na daljinu, 2020).

During remote teaching, teachers have the important task of adapting the process of remote teaching for all students (Averett, 2021), including students with disabilities. This process can be innovated through the use of ICT. For this to work, teachers need to improve their digital competencies (Žuvić et al., 2016), as many of them in the Republic of Croatia don't have sufficient digital competencies and don't know how to use ICT in the classroom (Paar & Šetić, 2015).

Synchronous and asynchronous teaching

There are two ways for teachers to teach remotely: synchronous and asynchronous teaching (Worcester State University, 2022). Worcester State University (2022) indicates that in synchronous teaching, instructors and students meet at the same time and interact in "real time," while in asynchronous teaching, instructors prepare course materials for students before they access them. According to Worcester State University (2022), both synchronous and asynchronous teaching have their advantages and disadvantages (Table 1).

Table 1

Advantages and disadvantages of synchronous and asynchronous teaching, according to Worcester State University (2022)

	Advantages	Disadvantages
Synchronous teaching	Immediate personal engagement between students and instructors which fosters feeling of connection	More challenging to schedule
	More responsive exchanges between students and instructor	Some students may face technical challenges or difficulties
Asynchronous teaching	Higher levels of temporal flexibility, which may make the learning experiences more accessible to different students	Students may feel less personally exchanged and less satisfied without the social interaction between their peers and instructors.

Increased cognitive engagement (students have more time to engage with and explore the course material)	Course material may be misunderstood or have the potential to be misconstrued
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Depending on the content or material to be taught, teachers engage their students synchronously or asynchronously (Vuković, 2020). Regarding students with disabilities in the context of synchronous and asynchronous teaching, a survey of 105 students was conducted at a university that serves students with learning disabilities, ADHD, and autism (Dahlstrom-Hakki et al., 2020). Results indicate that while students with disabilities expressed a preference for synchronous discussions and self-reported greater engagement and understanding, their performance on conceptual understanding assessments was slightly better following asynchronous discussions (Dahlstrom-Hakki et al., 2020). In contrast to the previous study, Careaga-Butter et al. (2020) believe that asynchronous teaching may be more difficult for students with disabilities because it implies that teaching and learning activities are conducted independently of time and place.

Synchronous teaching uses various ICT tools such as Skype, Zoom, Microsoft Teams, or Google Hangouts, while ICT used for asynchronous teaching mostly consists of tools such as Canva, Genially, Omoguru, BookWidgets, Educandy, Jigsaw, Powtoon, Storyboard, etc. (Kim, 2004).

ICT

According to Smiljčić et al. (2017), the term ICT includes all technologies that can be used for the purpose of information processing. Although the increase in the use of ICT was observed even before the pandemic COVID -19 (Smiljčić et al., 2017), the expansion of many opportunities for communication and collaboration using ICT technology was noted with remote teaching (Bohak Adam & Metljak, 2022). In the Republic of Croatia, the curriculum reform since 2017 includes the need to improve the digital skills of students, teachers, professional staff, and school leaders and to equip schools. Special attention has been paid to the development of digital skills of teachers and their need to work in a virtual environment (Škola za život, 2020).

Due to the new reality of teaching and remote teaching, some organizations published educational applications classified according to the need of remote teaching and the need of teachers to share information and knowledge with students in this period (Careaga-Butter et

al., 2020). For example, UNESCO (2022) has compiled an online guide with links to remote teaching applications and other resources, as well as a list of digital education tools. Table 2 lists some of the ICT tools used for synchronous and asynchronous teaching.

The distinctive feature of ICT is that it can be easily and quickly adapted to different educational environments. Moreover, ICT implies access to various tools that create an environment that promotes communication between students with disabilities and various people (professionals, parents), including peers (MZO, 2021) and can support the development of basic skills, lifelong learning and the acquisition of complex skills (Smiljčić, et al., 2017). In addition, Bohak Adam & Metljak (2022) claim that online learning with the effective use of ICT can be a great tool to personalize and visualize learning for students. During the COVID - 19 pandemic, there is an urgent need to use assistive technologies to communicate important information to students with disabilities. Therefore, ICT can provide easy-to-read materials, captioning, Braille, large print, etc. to improve the communication needs of children with disabilities (Cahapay, 2020). In addition, digital tools can also contribute to the quality of educational processes by speeding up the creation of individualized materials or improving the functional skills of children with disabilities (MZO, 2021). When adapting materials to support learning and teaching for students with disabilities, attention should be paid to achieving meaningful communication and providing them with new knowledge and skills. A student's disability must also be considered when selecting ICT. As UNESCO (2011) asserts, ICT is no longer considered just a right for people with disabilities, but a tool for knowledge, skills, and communication.

Table 2

List of some ICT tools used for synchronous and asynchronous teaching

Viber	Instant messaging application with cross-platform capabilities that allows users to exchange audio and video calls, stickers, group chats, and instant voice and video messages.
Microsoft Teams	The hub for teamwork in Microsoft 365. The Teams service enables instant messaging, audio and video calling, online meetings, mobile experiences, and extensive web conferencing capabilities.
Zoom	A video conferencing platform that can be used through a computer desktop or mobile app. Allows users to connect online for video conference meetings, webinars and live chat.

Canva	An online graphical tool that combines design, photo editing, and layout for teachers to generate posters, guidance, and projects. Students can also access it for tasks.
Genially	An online tool that can be used to create still, animated, or interactive visuals, such as posters, infographics, quizzes, and presentations.
BookWidgets	An easy-to-use platform for creating interactive exercises like exit slips, games, timelines, photo- and video-based activities, etc.
Powtoon	A tool that creates animated videos for personal, educational, or business/professional use. It is a free, web-based (with options to upgrade), user- friendly software that creates presentations via three simple and easy steps: writing a script, recording a voiceover, and adding visuals.
Educandy	A website that allows teachers to quickly and easily create simple games for students to practice vocabulary and answer basic content questions. The site offers eight types of games, from crossword puzzles to multiple-choice quizzes.

Students with disabilities during remote teaching

According to the World Health Organization (2001), a disability is a physical or mental condition (impairment) that makes it difficult for the person to perform certain activities and interact with his or her environment. Like every child, a child with a disability has a right to education. Therefore, society must provide inclusive education and strengthen the capacity of the education system. Inclusive education (UNESCO, 2008) is an ongoing process based on fundamental human rights, providing equal education for all, taking into account diversity, different needs and abilities, and making children with disabilities an equal part of society. In the Republic of Croatia, according to *Pravilnik o osnovnoškolskom i srednjoškolskom odgoju i obrazovanju učenika s teškoćama u razvoju* (NN 24/15), a student with disabilities is a student whose abilities interact with environmental factors that limit his/her full, effective and equal participation in the educational process with other students. Students with disabilities constitute a heterogeneous group and require different adaptations of educational content. This refers to the adaptation of educational outcomes of learning and teaching according to the individual abilities and developmental characteristics of students with disabilities to the lowest level of educational performance prescribed in the curriculum for the grade in which the student is placed (MZO, 2021). For students with disabilities, teachers develop an individualized curriculum. An individualized curriculum (IC) is a written document that is an integral part of the subject curriculum and is focused on an individual student with developmental disabilities (MZO, 2021).

During remote teaching, teachers face the challenge of using ICT to conduct the educational

process, but also to create the conditions for all students to have access to information, because access to information means more learning opportunities (UNESCO, 2011). However, remote teaching poses an additional challenge for them due to the use of information and communication technologies, the handling of platforms, the high demands on self-regulation, metacognitive skills, motivation and concentration, but also the lack of resources, parental support and support from the environment (Ashbury et. al, 2021). Students with disabilities need support in learning new knowledge, acquiring new skills, and assuming new social functions needed in the new normal (Cahapay, 2020).

The aim and problem

The aim of this paper is to get insight into the information and communication technology used by teachers working with students with disabilities, as well as the challenges they encountered while using ICT in remote teaching of students with disabilities. This research provides insight into the way of teaching inclusive education during remote teaching of students with disabilities from the perspective of elementary school teachers in Osijek-Baranja, Brod-Posavina, Požega-Slavonia, Virovitica-Podravina and Vukovar-Srijem counties.

Methods

Considering the aim of the research and the research problem, the purpose of a quantitative research is to investigate the ICT used by teachers during remote teaching, and the challenges during remote teaching. A descriptive approach was chosen as the method because it can be used to understand a situation or phenomenon (Goodwin & Goodwin, 1996). For the purpose of this study, the researchers created 10 questions in a questionnaire that corresponds to a theoretical framework of quantitative research. The data for the research were collected online on February 22, 2022 with the 327 participants of the professional conference Application of visual schedule in work with students with disabilities from the Osijek-Baranja, Brod-Posavina, Požega-Slavonia, Virovitica-Podravina and Vukovar-Srijem counties. With the help of quantitative research, the results can reveal the challenges faced by teachers during remote teaching and suggest changes to improve the situation (Walliman, 2016).

Participants

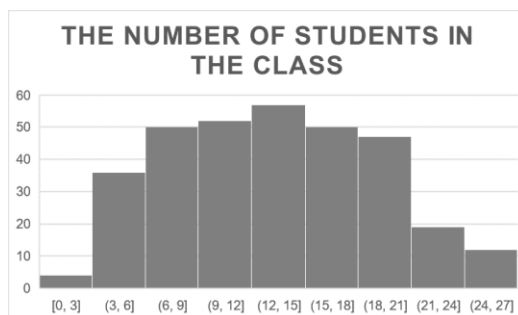
The participants in the research were elementary school teachers who teach students aged 7 to 10 years (in the Republic of Croatia also called *classroom teachers*) that participated in the professional conference Application of visual schedule in work with students with disabilities from the Osijek-Baranja, Brod-Posavina, Požega-Slavonia, Virovitica-Podravina and Vukovar-Srijem counties.

Results

According to the answers of the classroom teachers, the average number of students in the class they teach is 14 (13.9%). Likewise, most teachers teach between 12 and 15 students. The maximum number of students in the class is 26, and 4 is the minimum number of students in the class (Figure 1).

Figure 1

The number of students in the class



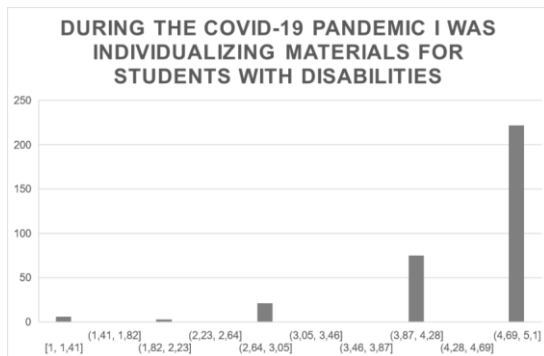
In addition, most teachers (51.4%) answered that there is a student with disabilities in their class. The second most common response is that they currently teach two students with disabilities in their class (19.3%). Finally, 10.7% of the participants indicated that they do not have any students with disabilities in their class.

When asked about the disabilities of the students in their classes, 56.9% of teachers indicated that the students with disabilities they teach have specific learning disabilities or speech and language disorders. Students with intellectual disabilities were the second most common (48.9%). Finally, 25.7% of teachers reported teaching students with multiple disabilities.

During the remote teaching, 67.9% of teachers reported that they fully individualize the material for students with disabilities, and 17.1% of them answered that they mostly individualize the material for students with disabilities (Figure 2).

Figure 2

Individualizing materials for students with disabilities



Regarding the mode of remote teaching for students with disabilities, 50.8% of the teachers in this study reported that they teach students with disabilities synchronously, and 49.2% of them claimed that they teach students with disabilities asynchronously (Figure 3).

Figure 3

Ways of remote teaching students with disabilities

WAYS OF REMOTE TEACHING STUDENTS WITH DISABILITIES



The most commonly used platforms for synchronous teaching were Viber (71.4%), Microsoft Teams (42%), and Zoom (26.3%). Regarding asynchronous teaching, 76.9% of teachers reported sending and posting materials online, 10.3% reported handing out paper materials to students, and 6.2% of students with disabilities viewed "Škola na Trećem"

To create digital materials for students with disabilities, teachers mainly used Genially (63.2%) and Canva (60.4%) programs. They also used BookWidgets (26.7%) and Powtoon (19.8%). Jigsaw was used by 13.9% of the teachers.

On the one hand, teachers state that the cost of using programs is the greatest difficulty in using ICT (41.2%). On the other hand, 35% of them think that they have no difficulty in using ICT. In addition, 28% of teachers think that they lack knowledge about using ICT, and

25.7% of them say that English-language instructions for using ICT make it difficult for teachers to use it.

When asked about the ICT application they would like to know better, they mentioned Canva (30.3%), Bookwidgets (29.7%) and Educandy (29%).

Discussion

According to the answers of the classroom teachers, the average number of students in the class they teach is 14 (13.9%). Most teachers (51.4%) said that there is one student with disabilities in their class, and 19.3% of them said that they currently teach two students with disabilities in their class. These data are in line with the Ministry's policy of teaching a maximum of three students with disabilities in each regular class (Pravilnik o broju učenika u redovitom i kombiniranom razrednom odjelu i odgojno-obrazovnoj skupini u osnovnoj školi, NN, 124/2009). Accordingly, it seems that most teachers taught one or two students with disabilities together with other students during remote teaching. In addition, 56.9% of teachers reported that their students with disabilities had specific learning disabilities or speech and language disorders. It is evident that children with disabilities form a heterogeneous group in Croatian mainstream classrooms. Therefore, they require different adaptations of the educational content, i.e. the adaptation of the pedagogical outcomes of learning and teaching to their individual abilities and developmental characteristics (MZO, 2021). When surveyed on this topic, 67.9% of teachers indicated that they fully individualize materials for students with disabilities during remote teaching, and 17.1% responded that they mostly individualize materials for students with disabilities. These data are encouraging, although it must be taken into account that this is a self-assessment. However, Opić and Kudek-Mirošević (2018) claim that classroom teachers are statistically significantly more likely to use adaptation methods and individualized procedures when working with students with difficulties than their colleagues in the subject teaching (teachers who teach older elementary school students). In addition, 50.8% of the teachers in this study reported that they teach students with disabilities synchronously, and 49.2% of them reported that they teach students with disabilities asynchronously. As mentioned earlier, Dahlstrom-Hakki et al. (2020) claim that while students with LD, ADHD, and autism expressed a preference for synchronous discussions and self-reported greater engagement and understanding, their performance on conceptual understanding assessments was slightly better following asynchronous discussions. In contrast to the

aforementioned research, Careaga-Butter et al. (2020) believe that asynchronous teaching may be more difficult for students with disabilities because it implies that teaching and learning activities are conducted independently of time and place. To remove the doubt between synchronous and asynchronous teaching, instructors can incorporate strategies from synchronous and asynchronous remote teaching environments into their courses to take advantage of both methods (Brady & Pradhan, 2020). This is referred to as hybrid remote teaching and provides students with multiple opportunities for synchronous and/or asynchronous participation and interaction (Brady & Pradhan, 2020). All in all, more research is needed to find ways of remote teaching that meet the diverse needs of children with disabilities. As shown in the results, most teachers used a variety of ICTs (the most commonly used platforms for synchronous teaching were Viber and Microsoft Teams, while teachers for asynchronous teaching mainly used Genially, Canva, and BookWidgets). Most of the ICT tools used are free, with the exception of Bookwidgets, which teachers have to pay for because it offers many benefits to the learning process. Although the use of ICT in the learning process should be interesting and facilitate learning (Mayasari & Kemal, 2020), it can sometimes be a problem for some students with disabilities because they require individual student participation (Denić, et al., 2017). Students with disabilities may find it difficult to complete activities and assignments in a variety of different apps and platforms each day due to the lack of consistency, routine, and structure that comes with remote teaching (Averett, 2021). In addition, the use of different ICTs and the combination of synchronous and asynchronous learning may affect student performance. According to the results, most teachers had difficulties with the use of ICT due to the charging policy for the use of programs and lack of knowledge of the English language. It appears that despite the training that came with the curriculum reform, teachers still feel that they do not have sufficient knowledge in using ICT. The role of the teacher has also changed a lot during remote teaching, as they have multiple roles, such as educator, motivator, manager, and evaluator (Mayasari & Kemal, 2020), and they have had to learn new digital skills. Sometimes the potential benefits of the learning process are not always realized due to the difficulties of navigating online platforms (Averet, 2021). Finally, some teachers feel that their knowledge of ICT is not yet good enough and that they need more training in using ICT. Teachers reported that they wanted to know the benefits of using Canva, Bookwidgets, and Educandy because these ICTs provide many learning

opportunities, not only for remote teaching but also for daily use in the learning process. For successful implementation and use of ICT in the learning process, the following activities are essential (Denić, et al., 2017): improvement of educational conditions in schools, involvement of teachers and students in the acquisition of skills and knowledge in ICT.

Conclusion

In March 2020, the learning environment has changed from the classroom to a virtual environment, and everyone involved in the educational process has had to adapt and learn new skills. Teachers faced the challenge of how to meet educational goals and processes using information and communication technology, but also how to ensure the conditions for the education of all students, including students with disabilities. Since all students have the right to appropriate knowledge corresponding to their developmental abilities, provided in various educational contents individually adapted to them, the use of information and communication technology for educational purposes and to achieve the functional abilities of children with disabilities is important. The purpose of this article is to provide insight into the information and communication technology teachers use during remote teaching of children with disabilities and the challenges they face. The participants of the study were teachers from the Eastern Croatian counties. The teachers were given a questionnaire about the ICT they used during remote teaching of students with disabilities. The collected results show that during remote teaching, teachers faced the challenge of finding the best way to deliver information and knowledge to students with disabilities, and they chose synchronous (50.8%) or asynchronous (49.2%) teaching almost equally. The most commonly used platforms for synchronous teaching were Viber (71.4%), Microsoft Teams (42%), and Zoom (26.3%). For asynchronous teaching, teachers primarily used Genially (63.2%), Canva (60.4%), BookWidgets (26.7%), and Powtoon (19.8%). 41.2% of the teachers state that the charging policy for the use of programs is the biggest difficulty in using ICT, 28% of the teachers think that they lack knowledge for the use of ICT, and 25.7% of them state that English instructions for the use of ICT make it difficult to use. It seems that although teachers have received some training during the curriculum reform, most of them have problems in using ICT in remote teaching of students with disabilities for various reasons and they need more support in using ICT. The limitation of this study

is that the perspective of students with disabilities was not considered but they also needed to learn new skills related to remote teaching and the use of ICT, as well as adopting the learning outcomes prescribed in the individual curriculum. Further research could include finding ways of remote teaching that meet the diverse needs of children with disabilities. The data obtained will be a contribution to the definition of guidelines for working with students with disabilities during remote teaching using information and communication technology.

References

- Akcijski plan za provedbu nastave na daljinu (srpanj, 2020). Ministarstvo znanosti i obrazovanja. Retrieved from <https://skolazazivot.hr/akcijski-plan-za-provedbu-nastave-na-daljinu-prijedlog/>
- Ashbury, K., Fox, L., Deniz, E., Code, A., Toseeb, U. (2021). How is COVID-19 Affecting the Mental Health of Children with Special Educational Needs and Disabilities and Their Families?. *Journal of Autism Developmental Disorder*, 51, 1772–1780. <https://doi.org/10.1007/s10803-020-04577-2>
- Averett, K. H. (2021). Remote Learning, COVID-19, and Children With Disabilities. *AERA Open*. <https://doi.org/10.1177/23328584211058471>
- Bohak Adam, T. & Metljak, M. (2022). Experiences in distance education and practical use of ICT during the COVID-19 epidemic of Slovenian primary school music teachers with different professional experiences. *Social Sciences & Humanities Open*, 5 (1). <https://doi.org/10.1016/j.ssaho.2021.100246>.
- Brady, A.K., Pradhan, D. (2020). Learning without Borders: Asynchronous and Distance Learning in the Age of COVID-19 and Beyond. *ATS Scholar*, 1 (3), 233-242. <https://doi.org/10.34197/ats-scholar.2020-0046PS>.
- Cahapay, M.B. (2021). Ushering children with disabilities in the ‘new normal’ post-COVID-19 period: collective actions in the Philippines. *Disability & Society*, 36 (1), 145-150. <https://doi.org/10.1080/09687599.2020.1829557>
- Careaga-Butter, M., Badilla Q., Graciela M., Fuentes-Henríquez, C. (2020). Critical and prospective analysis of online education in pandemic and post-pandemic contexts: Digital tools and resources to support teaching in synchronous and asynchronous learning modalities. *Aloma: revista de psicologia, ciències de l’educació i de l’esport Blanquerna*, 38 (2), 23-32, <https://doi.org/10.51698/aloma.2020.38.2.23-32>.

- Dahlstrom-Hakki, I., Alstad, Z., Banerjee, M. (2020). Comparing synchronous and asynchronous online discussions for students with disabilities: The impact of social presence. *Computers & Education*, 150. <https://doi.org/10.1016/j.compedu.2020.103842>.
- Denić, N., Gavrilović, S., Kontrec, N. (2017). Information and communications technologies in function of teaching process. *The University Thought - Publication in Natural Sciences*, 7(2), 58-63. <https://doi.org/10.5937/univtho7-15472>
- Goodwin, W.L., Goodwin, L.D. (1996). *Understanding Quantitative and Qualitative Research in Early Childhood Education*. Teacher College, Columbia University.
- Kim, Y. (2004). Online Education Tools. *Public Performance & Management Review*, 28(2), 275–280.
- Kolak, A., Markić, I., Horvat, Z. (2020). (Pre)opterećenost učenika "koronastavom". In Strugar V., Kolak A., Markić I. (ur.), *Školovanje od kuće i nastava na daljinu u vrijeme HR-COVID-19* (pp 108-146). HAZU Zavod za znanstvenoistraživački i umjetnički rad u Bjelovaru, Hrvatsko pedagoško društvo, Element d.o.o.
- Livazović, G., Alispahić, D., Terović, E. (2015). *Priručnik: Inkluzivni odgoj i obrazovanje u školi*. UNICEF Bosna i Hercegovina.
- Mayasari, L.I., Kemal, I. (2020). The role of teachers in implementing distance learning in the middle of the COVID-19 plague. *Systematic Reviews in Pharmacy*, 11 (12), 1553-1557.
- Ministarstvo znanosti i obrazovanja Republike Hrvatske (2020). *Modeli i preporuke za rad u uvjetima povezanim s Covid-19*. Retrieved 6. siječnja 2022. from [https://mzo.gov.hr/UserDocsImages/dokumenti/Modeli%20i%20preporuke%20za%20provedbu%20nastave%20u%202020-2021%20\(29.8.2020\).pdf](https://mzo.gov.hr/UserDocsImages/dokumenti/Modeli%20i%20preporuke%20za%20provedbu%20nastave%20u%202020-2021%20(29.8.2020).pdf)
- Ministarstvo znanosti i obrazovanja (2021, srpanj). *SMJERNICE ZA RAD S UČENICIMA S TEŠKOĆAMA*. Retrieved from <https://mzo.gov.hr/UserDocsImages/dokumenti/Obrazovanje/Smjernice%20za%20rad%20s%20ucenicima%20s%20teskocama.pdf>
- Online i digitalni alati za korištenje u obrazovanju. Agencija za mobilnost i programe EU. Retrieved from https://www.europskesnagesolidarnosti.hr/cms_files/2021/02/1612770339_online-i-digitalni-alati-u-neformalnom-obrazovanju.pdf
- Opić, S., Kudek Mirošević, J.(2018). Specifičnosti provođenja metoda prilagodbe i individualiziranih postupaka u radu s učenicima s teškoćama. *Research in Education and Rehabilitation*, 1(1), 48-58.
- Paar, V. i Šetić, N. (ur.). (2015). *Hrvatsko školstvo u funkciji razvoja gospodarstva i društva: doprinos kurikulnim promjenama*. Zagreb: Hrvatski pedagoško-književni zbor.
- Pravilnik o broju učenika u redovitom i kombiniranom razrednom odjelu i odgojno-obrazovnoj skupini u osnovnoj školi (Narodne novine, 124/2009). Retrieved from https://narodne-novine.nn.hr/clanci/sluzbeni/2009_10_124_3065.html

- Pravilnik o osnovnoškolskom i srednjoškolskom odgoju i obrazovanju učenika s teškoćama u razvoju (Narodne novine, 24/2015). Retrieved from https://narodne-novine.nn.hr/clanci/sluzbeni/2015_03_24_510.html
- Raghavendra, P., Bornman, J., Granlund, M., Björck-Åkesson, E. (2007). The World Health Organization's international classification of functioning, disability and health: implications for clinical and research practice in the field of augmentative and alternative communication, *Augmentative and Alternative Communication*, 23(4), 349-361, <https://doi.org/10.1080/07434610701650928>
- Sablić, M., Klasnić, I., & Škugor, A. (2020). Učitelj u izolaciji: izazovi novog normalnog. In V. Strugar, A. Kolak & I. Markić (Eds.), *Školovanje od kuće i nastava na daljinu u vrijeme HR-COVID-19* (pp. 87-107). Zagreb-Bjelovar: Hrvatska akademija znanosti i umjetnosti Zavod za znanstvenoistraživački i umjetnički rad u Bjelovaru, Hrvatsko pedagogijsko društvo, Element.
- Smiljčić, I., Livaja, I. & Acalin, J. (2017). ICT U OBRAZOVANJU. Zbornik radova Veleučilišta u Šibeniku, (3-4/2017), 157-170.
- Škola za život (veljača, 2020). E- učenje. Retrieved from <https://skolazazivot.hr/e-ucenje/>
- Tonković, A., Pongračić, L. i Vrsalović, P. (2020). Djelovanje pandemije Covid-19 na obrazovanje diljem svijeta. *Časopis za odgojne i obrazovne znanosti Foo2rama*, 4 (4), 121-134.
- UNESCO (2008). "INCLUSIVE EDUCATION: THE WAY OF THE FUTURE". International Conference on Education 48th session Geneva, Switzerland. Retrieved from http://www.ibe.unesco.org/sites/default/files/resources/ice_2008_final_report_eng.pdf
- UNESCO (2011). ICTs IN EDUCATION FOR PEOPLE WITH DISABILITIES. UNESCO Institute for Information Technologies in Education.
- UNESCO (2020). COVID-19 response –remote learning strategy. Retrieved from https://unesdoc.unesco.org/in/documentViewer.xhtml?v=2.1.196&id=p::usmarcdef_0000373764&file=/in/rest/annotationSVC/DownloadWatermarkedAttachment/attach_import_dadf48e7-674f-4636-8d51-172a27cc0eb6%3F_%3D373764eng.pdf&locale=en&multi=true&ark=/ark:/48223/pf0000373764/PDF/373764eng.pdf#%5B%7B%22num%22%3A50%2C%22gen%22%3A0%7D%2C%7B%22name%22%3A%22XYZ%22%7D%2C0%2C540%2C0%5D
- Vlada Republike Hrvatske (2020). Odluka o načinu izvođenja nastave u osnovnim i srednjim školama kao i na visokim učilištima te obavljanju redovnog rada ustanova predškolskog odgoja i obrazovanja. (Narodne novine, 55/2020).
- Vuković, N. (2020). Učitelji i učenici u kreativnoj školi. *Varaždinski učitelj - digitalni stručni časopis za odgoj i obrazovanje*, 3(3), 144-157.
- Žuvić, M., Brečko, B., Krelja Kurelović, E., Galošević, D., Pintarić, N. (2016). Okvir za digitalne kompetencije korisnika u školi: učitelja/nastavnika i stručnih suradnika, ravnatelja te

administrativnih djelatnika. CARNET. Retrieved 5.3.2022. from <https://pilot.e-skole.hr/hr/rezultati/obrazovanje-i-podrska/okvir-za-digitalnu-kompetenciju/>

Walliman, N. (2015). Social research methods: The essentials. Sage.

Worcester State University (2022). Synchronous vs. Asynchronous?. Retrieved from <https://www.worcester.edu/CTL-Remote-Teaching-Synchronous-vs-Asynchronous/>

World Health Organization (2007). International classification of functioning, disability and health: children and youth version: ICF-CY. World Health Organization. Retrieved from <https://apps.who.int/iris/handle/10665/43737>

Immersive Technology in Education

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Abstract

Teachers around the globe are constantly facing new challenges. They have to professionally develop themselves to be able to teach new generations of students. The traditional classroom teaching and learning environment was especially affected by the COVID-19 pandemic. The teachers' and students' reality changed and education shifted to online teaching. To make teaching and learning more effective and interesting, teachers started using different approaches. One of the innovative approaches in teaching is immersive technology. It can be used in life, but virtual and augmented reality can also be used in education. It can be applied in all school subjects and on all educational levels. This paper examines the differences between virtual and augmented reality in education, as augmented reality is a more recent technology than virtual reality, and analyses attitudes of teachers towards using virtual and augmented reality in educational purposes. The research was conducted through surveys. The sample consisted of primary and secondary school teachers in the Republic of Croatia. The results of the quantitative research were analysed by descriptive statistics. Immersive technology could be used in education because teaching methods should be adapted to 21st century learners.

Keywords: augmented reality, education, immersive technology, virtual reality

Immersive Technology in Education

Teachers around the globe are constantly facing new challenges. They have to professionally develop themselves to be able to teach new generations of students. According to Darling-Hammond, Hylar and Gardner (2017), effective teacher professional development is a structured learning that changes teacher practices and improves student learning outcomes.

The traditional classroom teaching and learning environment was especially affected by the COVID-19 pandemic. The teachers' and students' reality changed and education shifted to online teaching. To make teaching and learning more effective and interesting, teachers started using different approaches. One of the innovative approaches in teaching is immersive

technology. It can be used in life, but virtual and augmented reality can also be used in education. It can be applied in all school subjects and on all educational levels.

Augmented versus virtual reality

Contrary to the popular belief that this technology is new, immersive technology has been present for decades. Sadly, it is still not widely used in education. The combination of immersive technology with the educational content can enhance the effectiveness of teaching and learning and increase students' learning motivation. Makransky and Lilleholt (2018) claim that virtual reality will play an important role in education by increasing students' motivation.

Bower, DeWitt and Lai (2020) say that recently there has been a higher interest in using immersive technology in education. They claim that the use of immersive technology in education corresponds with the increased affordability of the hardware and software needed for their use in the classroom. They also say that the equipment is far more accessible and functional.

These authors claim that the Immersive Virtual Reality "has the potential to enhance immersion, improve spatial capabilities, promote empathy, increase motivation and possibly improve learning outcomes. However, the extent to which teachers capitalise on these potentials in the future depends on their perceptions of Immersive Virtual Reality and their behavioural intentions to use it." (Bower, DeWitt and Lai, 2020).

Berryman (2012) defines augmented reality as technology that overlays digital information on objects or places in the real world for the purpose of enhancing the user experience. Cipresso, Chicchi Giglioli, Alcañiz Raya and Riva (2018) say that augmented reality is a more recent technology than virtual reality and that it shows an interdisciplinary application framework.

Huang, Ball, Francis, Ratan, Boumis and Fordham (2019) claim that the use of mobile devices such as smartphones has increased the use of virtual and augmented reality. They compared these pieces of immersive technology to examine their impact on learning outcomes. The results of their study have shown that virtual reality is more immersive and engaging than augmented reality through the mechanism of spatial and visual presence and that augmented reality is more effective than virtual reality for conveying auditory information.

According to Serin (2019), virtual reality is a system in which users feel that they are in another world by using various equipment. The author thinks that virtual reality can be useful in many fields, especially in education. Virtual reality applications in education could enable

students gain experience that is impossible to gain in real life. The students could not learn by doing because the tasks might be too dangerous so virtual reality could be used.

The author conducted a research in 2017 and 2018 and the sample consisted of 101 teachers in private schools in Iraq. The results have shown that "the vast majority of teachers think that virtual reality is interesting, encourages students to be active, is suitable for students with schematic and visual thinking style, provides students with a general idea about the subject, facilitates the implementation of information, makes it easier to learn, and it provides a quick review of the course they have studied. They also think it requires concentration." (Serin, 2019).

Methodology

The aim of this research was to analyse the differences between virtual and augmented reality in the classroom. The problem of his research was to analyse the attitudes of participants towards virtual and augmented reality in education.

The hypotheses for this research were:

H1: Teachers are familiar with the term virtual reality.

H2: Teachers are familiar with the term augmented reality.

H3: Teachers use virtual reality in the classroom.

H4: Teachers use augmented reality in the classroom.

H5: The use of virtual reality can be useful in education.

H6: The use of augmented reality can be useful in education.

H7: The use of virtual reality can motivate students.

H8: The use of augmented reality can motivate students.

H9: Teachers do not have adequate conditions for the use of virtual reality in the classroom.

H10: Teachers do not have adequate conditions for the use of augmented reality in the classroom.

H11: Teachers are not educated enough to be able to use virtual reality in the classroom.

H12: Teachers are not educated enough to be able to use augmented reality in the classroom.

H13: Teachers face problems with immersive technology in education.

The research was conducted in February 2022. There were 106 participants (N=106). The sample of this research consisted of primary and secondary school teachers in the Republic of Croatia. The data was collected through surveys. This method of research was chosen because it was the most appropriate as it could be conducted online and the participants were

from the whole country. The data of this quantitative research was analysed by descriptive statistics.

This research respected the ethics in conducting a research. The participants were given all the information before filling out surveys. The surveys were anonymous and the participants filled them out willingly.

Results and discussion

Sociodemographic factors

There were 106 participants in this research, predominantly female. Most of the participants are from 30 to 50 years old. All the participants have a higher level of education, predominantly a Masters Degree in Education. Most of the participants have been working in the field of education for 10 to 30 years. Half of participants work in primary schools and the other half in secondary schools.

Table 1

Frequencies for variables sex, age, length of work in education, level of education and type of school (N=106)

Variables		N
Sex	Male	16
	Female	90
Age	30 or less	15
	31 - 40	34
	41 - 50	34
	51 - 60	19
	60 or more	4
Length of work in education	Up to 5 years	19
	6 - 10	21
	11 - 20	27
	21 - 30	29
	30 years or more	10
Level of education	B.A.	3
	M.A.	88
	PhD	15
Type of school	Elementary school	53
	Secondary school	53

They are teachers of primary school subjects (grade 1 to 4), mother tongue (Croatian), foreign languages (English and German), mathematics, informatics, history, geography, biology, chemistry, physics, P.E., music, religion, psychology, vocational subjects and other.

Attitudes towards virtual and augmented reality

The hypothesis “Teachers are familiar with the term virtual reality.” was confirmed as 93.4% of participants said that they are familiar with the term of virtual reality.

The hypothesis “Teachers are familiar with the term augmented reality.” was confirmed as 59.4% of participants said that they are familiar with the term of virtual reality.

There are differences between the two terms of immersive technology. The participants were more familiar with the term of virtual reality than with the term of augmented reality.

The hypothesis “Teachers use virtual reality in the classroom.” was confirmed as 50% of participants said that they use virtual reality in the classroom.

The hypothesis “Teachers use augmented reality in the classroom.” was confirmed as 30% of participants said that they use augmented reality in the classroom.

Although teacher use virtual and augmented reality in the classroom, the participants were asked how many times they used virtual and augmented reality in the classroom in the school year 2021/2022. Almost 50% of teachers answered that they used virtual reality in education and only 30% of teachers used augmented reality in the classroom.

Table 2

Frequencies for variables virtual reality, augmented reality, use of virtual reality in education, use of augmented reality in education (N=106)

Variables		N
Are you familiar with the term "virtual reality"?	Yes	99
	No	7
Are you familiar with the term "augmented reality"?	Yes	63
	No	43
How many times have you used virtual reality when teaching in this school year?	0	54
	1-3	16
	3-5	7
	5-10	8
	10 or more	21
How many times have you used augmented reality when teaching in this school year?	0	75
	1-3	14
	3-5	8
	5-10	7
	10 or more	2

The participants were then asked to use the Likert’s scale (1-5) to mark their agreement with the statements about immersive technology (the mean (3) was used as a basis for confirmation or rejection of hypotheses).

The hypothesis “The use of virtual reality can be useful in education.” was confirmed as the arithmetic mean for that statement was 3,97.

The hypothesis “The use of augmented reality can be useful in education.” was confirmed as the arithmetic mean for that statement was 3,78.

The hypothesis “The use of virtual reality can motivate students.” was confirmed as the arithmetic mean for that statement was 4,14.

The hypothesis “The use of augmented reality can motivate students.” was confirmed as the arithmetic mean for that statement was 3,93.

The hypothesis “Teachers do not have adequate conditions for the use of virtual reality in the classroom.” was confirmed as the arithmetic mean for the statement “Teachers have adequate conditions for the use of virtual reality in the classroom.” was 2,78.

The hypothesis “Teachers do not have adequate conditions for the use of augmented reality in the classroom.” was confirmed as the arithmetic mean for the statement “Teachers have adequate conditions for the use of augmented reality in the classroom.” was 2,75.

The hypothesis “Teachers are not educated enough to be able to use virtual reality in the classroom.” was confirmed as the arithmetic mean for the statement “Teachers are educated enough to be able to use virtual reality in the classroom.” was 2,92.

The hypothesis “Teachers are not educated enough to be able to use augmented reality in the classroom.” was confirmed as the arithmetic mean for the statement “Teachers are educated enough to be able to use augmented reality in the classroom.” was 2,64.

Table 3

Arithmetic mean, standard deviation, minimal and maximal value for statements about virtual and augmented reality (N=106)

Statement	M	SD	Min	Max
The use of virtual reality can be useful in education.	3,97	1,03	1	5
The use of augmented reality can be useful in education.	3,78	1,08	1	5
The use of virtual reality can motivate students.	4,14	0,97	1	5
The use of augmented reality can motivate students.	3,93	1,02	1	5
I have adequate conditions for the use of virtual reality in the classroom.	2,78	1,39	1	5
I have adequate conditions for the use of augmented reality in the classroom.	2,75	1,25	1	5
I am educated enough to be able to use virtual reality in the classroom.	2,92	1,40	1	5

The hypothesis “Teachers face problems with immersive technology in education.” was confirmed as teachers listed a number of problems with immersive technology in education. The teachers answered that it was too expensive; that there are no lectures or workshops of how to work with this type of technology; that they lack the required conditions at work and at home and in the classroom; that the technology is still not advanced enough; that they lack support from their colleagues or principals and that they are not motivated for using immersive technology in the classroom.

The participants could also leave additional comments about the topic. They said that the students should be more acquainted with the possibilities of immersive technology; that the concept of immersive technology is good, but that it has to be adapted to the subject in which it will be used; that there are both benefits and restrictions when working with such technology; that the teachers should be more educated in that field and how to use immersive technology in the classroom; that there are other more effective methods for motivating students; that the immersive technology could be motivating for learners, but that its use should be restricted as “virtual reality is not healthy because of looking at the screens and being separated from the real world.”

According to authors previously mentioned in this paper, this research corresponds to the results of their research. Immersive technology could be useful in many fields, especially in education. It could be a way of effective teacher professional development. It could further play an important role in education by increasing students' motivation.

The advantage of this research and the professional contribution is that it has shown the differences in types of immersive technology (augmented versus virtual reality) and that it analysed the attitudes of teachers in the Republic of Croatia towards virtual and augmented reality in education which can serve as a basis for implementation of immersive technology into the national curricula and the continuous teacher education courses.

The possible disadvantage of this research is that it has not tested the claim that the use of mobile devices such as smartphones has increased the use of virtual and augmented reality, but it could serve as a basis for further research.

Conclusions

The aim of this research was to analyse the differences between virtual and augmented reality in the classroom. The problem of his research was to analyse the attitudes of participants

towards virtual and augmented reality in education. The sample consisted of primary and secondary school teachers in the Republic of Croatia. The data was collected through surveys and analysed by descriptive statistics.

The results have shown that there are both similarities and differences between virtual and augmented reality in education. The teachers are more familiar with the term virtual reality and they use it more often in the classroom. However, only half of the teachers used it at least once this school year so there is need for improvement. They agree that immersive technology could be useful in the classroom and that it could help motivate students.

The teachers shared their problems with the use of immersive technology which could be solved by creating lectures and workshops about the topic so the teachers could be educated. There could be examples of good practice designed for each subject, but also to connect them as teaching nowadays should be cross-curricular. Teachers should learn how to use immersive technology as an effective motivating tool and use this technology with other non-virtual tools. There should also be improvements in the working conditions and support of fellow educators.

Immersive technology can be innovative and used in all school subjects. According to Boras (2022), visual representation is very important to use in lessons because it makes teaching and learning more interesting and enjoyable. Immersive technology could be used in education because teaching methods should be adapted to 21st century learners. There needs to be more research on this important topic as immersive technology should be more implemented in the national school curricula.

References

- Berryman, D. R. (2012). Augmented Reality: A Review, *Medical Reference Services Quarterly*, 212-218.
- Boras, M. (2022). Augmented Reality in the Classroom. *INTED22 Proceedings*, 1411-1416.
- Bower, M., DeWitt, D. and Lai, J. W. M. (2020). Reasons associated with preservice teachers' intention to use immersive virtual reality in education. *British Journal of Educational Technology*, Vol. 51, No. 6, 2214- 2232. <https://doi.org/10.1111/bjet.13009>
- Cipresso, P., Chicchi Giglioli, I. A., Alcañiz Raya, M. and Riva, G. (2018). The Past, Present, and Future of Virtual and Augmented Reality Research: A Network and Cluster Analysis of the Literature, *Frontiers in Psychology*. <https://doi.org/10.3389/fpsyg.2018.02086>
- Darling-Hammond, L., Hyler, M. E. and Gardner, M. (2017). *Effective Teacher Professional Development*, Learning Policy Institute.
- Huang, K-T., Ball, C. Francis, J., Ratan, R., Boumis, J. and Fordham, J. (2019). Augmented Versus Virtual Reality in Education: An Exploratory Study Examining Science Knowledge Retention

When Using Augmented Reality/Virtual Reality Mobile Applications. *Cyberpsychology, Behavior, and Social Networking*, Vol. 22, No. 2. <https://doi.org/10.1089/cyber.2018.0150>

Makransky, G. and Lilleholt, L. (2018). A structural equation modeling investigation of the emotional value of immersive virtual reality in education. *Education Tech Research Dev* 66, 1141–1164. <https://doi.org/10.1007/s11423-018-9581-2>

Serin, H. (2019). Virtual Reality in Education from the Perspective of Teachers. *The Revista Amazonia Investiga*, Vol. 9, No. 26. <https://doi.org/10.34069/AI/2020.26.02.33>

Hybrid learning as a new challenge of teacher professionalization

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Abstract

The COVID-19 pandemic has significantly speed up the application of blended learning methods worldwide. The educational process is becoming increasingly predestined to take place in hybrid learning spaces, where they really and virtually merge. Teachers were also forced to use information and communication technologies in teaching in order to be able to successfully deal with everyday challenges imposed by the emergency situation and respond to the needs of their students as well as their own professional needs. In such circumstances, hybrid learning becomes an indispensable part of their professionalization, which is already facing certain problems. The paper discusses the factors of hybrid learning in the context of the development of professional identity of teachers as well as various aspects of the educational process that are affected by hybrid learning. The features of a hybrid learning environment in which learning needs to be carefully planned are highlighted because it also allows more flexibility for students without compromising their learning experiences. In this way, the paper analyzes the new dimensions of teacher professionalization through the relationships between teaching practice and their own examples of hybrid learning. Based on this knowledge, the paper provides recommendations for planning hybrid spaces for learning.

Keywords: hybrid learning, hybrid learning environment, professionalization, student, teacher

Introduction

The COVID-19 pandemic has spurred and speed up the adoption and application of hybrid learning approaches around the world. Extensive use of open educational resources, online courses and professional development and applications enables the acquisition of the necessary information and skills even during a pandemic crisis, which overall has a major impact on the functioning of the education system. Information and communication technology

(ICT) has become an integral part of modern society. Distance learning has proved useful in situations where students are physically distant from teachers. Nowadays, technology-based learning is a new alternative for creating interesting and active learning. Various online tools such as discussion forums, blogs, wikis, and emails are increasingly being integrated into teaching to better contribute to student learning and interaction (Wichadee, 2013).

Linder (2017) states that the hybrid learning model is defined using technology as an alternative to classroom teaching to make the student learning environment more effective. In doing so, Saichaie (2020) explains that if teaching in one class is held three times a week, then one lecture is replaced by technologically enhanced lessons or extracurricular activities (e.g. watching video lectures, collaborative activities). Such an alternative approach can alleviate the pressure on the physical space in the classroom and allow for a more flexible schedule.

Hediansah & Surjono (2020) define hybrid learning as a learning method that combines two or more learning approaches in order to achieve learning process goals. One of the main characteristics of hybrid learning is flexibility in terms of time, space and pace of learning which, among all available options (offline or online, synchronized or asynchronous) allows students to find the optimal combination for themselves (Xiao et al., 2020). As newer technologies expand online learning opportunities, this pedagogical approach emphasizes collaborative or interactive learning activity, in which teaching content emerges in students' interactions with each other and with the teacher or other sources of knowledge (Means et al., 2013).

Hung et al. (2016) conclude that learning styles are perceived as features that can influence learning experience and learning performance in different settings. Teachers can design personalized learning materials or instructions that suit an individual's needs based on multiple student learning styles. They also find that hybrid learning style is significantly associated with learning performance. Students with visual, reflective, and intuitive abilities showed a significantly greater problem-solving effect. Therefore, Bordoloi et al. (2021) point out that, before implementing hybrid activities in practice, many variables need to be considered, including the social, cultural and socioeconomic background of students, their age, their access to technological infrastructure, technological readiness of educational institutions and so on.

Methodology

The paper provides literature review about hybrid learning as a new challenge of teacher professionalization. The aim was to study different concepts of hybrid learning in the context of teachers' professional identity. In addition, we analyzed the role of teacher professionalization in a hybrid learning environment.

We searched the following scientific databases: EBSCOhost, ERIC, Google Scholar, J-Store, SAGE and ScienceDirect. Initial key words were identified from the researchers' knowledge of the field. These included hybrid learning, hybrid learning environment, professionalization. The free Zotero application (<https://www.zotero.org/>) was used to store the chosen list of references.

The concept of hybrid learning

The hybrid learning model is a process of acquiring students' skills and knowledge developed by integrating traditional and online learning methods based on media and digital factors as well as different learning strategies. The system of combining face-to-face learning and online learning creates a unique, structured and meaningful learning system where 30-70% of learning instructions are implemented through ICT. In addition, the learning model is implemented by combining direct and indirect learning, collaborative learning, individual learning and online learning (Akla, 2021), and is useful to facilitate the provision of knowledge information.

While some authors argue that there is no exact definition of hybrid learning, others define it as 75% of the course delivered in the face-to-face format and 25% of the course as being delivered asynchronously online (Cusano, 2018, p. 1). It is a type of learning whose purpose is to make learning more practical and to optimize the learning effect. Combining online communication and face-to-face communication, hybrid learning restructures learning resources to greatly improve the quality of learning activities, achieving high quality teaching (Wang, 2014). It is important to emphasize that the goal of such learning should not only be the integration of technology into teaching, but pedagogical goals should determine a different learning approaches (Azhar & Iqbal, 2018).

Wang (2014) finds that hybrid learning has a number of advantages over traditional ways of learning. It makes teaching and research activities meaningful and interesting, which can improve teachers scientific research ability. The combination of different texts, graphics,

images, animations and sounds to convey information makes learning and research activities more interesting and effective. Supporting factors are, among others availability of internet access both at school and at home; knowledge of high technology or teachers and students computer literacy; availability of online learning resources that can be found and downloaded (Sutisna & Vonti, 2020).

On the other hand, when it comes to the shortcomings of hybrid learning, Rao (2019) lists several: shortcomings in technical aspects because hybrid learning depends on technical resources or equipment; students need to have basic technological knowledge and computer literacy to access learning materials; it is challenging to achieve group work due to management difficulties in the online environment; providing effective feedback is longer and slower; access to network infrastructure; lack of student motivation and inefficient use of digital tools.

Cusano (2018) points out that planning is a key component of successful hybrid teaching and that teaching in a hybrid environment requires more preparation than teaching in a traditional face-to-face environment. Demaziere (2021) agrees, noting that hybrid learning should be designed to promote student learning. Hybrid learning environment provides much more flexibility to students who have no travel opportunity. In addition, the availability of learning videos and electronic resources makes this teaching format particularly suitable for continuing education and lifelong learning.

In addition, it has been found that hybrid learning requires systematic design and careful formulation of educational goals in order to create an effective learning system. In this regard, when considering blended education, it is necessary to focus on students needs, changing context of their learning and availability of feasible digital tools to facilitate such learning (Bordoloi et al., 2021). Research results (Jokinen and Mikkonen, 2013) show that teachers perceive joint planning in hybrid learning as affirmative because it supports their development. However, it is obvious that teachers need time to plan and research together so that different learning settings can be integrated, which requires teachers to know different pedagogical approaches.

Hybrid learning space

Hybrid learning spaces combine different conceptions of space and allow for the mixing of pedagogical concepts that are traditionally separated. Teachers create hybrid environments to improve collaborative relationships and thus the quality of student learning. Collaborative learning is understood as a process that encourages various forms of interaction that lead to

significant progress of common ideas for solving learning problems (Gutiérrez-Braojos et al., 2019).

The concept of a hybrid virtual classroom consists of one group of students participating in face-to-face teaching, while at the same time another group participates in distance learning from a location of their choice by connecting to the same platform (Raes et al., 2020). Xiao et al. (2020) explain that hybrid learning spaces can be defined as learning spaces that blur the line between a physical and virtual environment in which online students and offline students and teachers can continue to communicate with each other, and teaching content can be transmitted using digital tools.

Creation of a hybrid environment cannot be based only on the integration of learning methods and tools. Face-to-face activities should help lay the foundations for more effective development of subsequent online activities, defining goals, objectives, deadlines and expected results (Trentin, 2015). Studying hybrid learning environment characteristics Allaire et al. (2011) concludes that combining live and online interaction creates a collaborative learning environment that improves teachers' knowledge and skills.

Research results (Vernadakis et al., 2012) show that hybrid learning environments have the potential to strengthen teaching and learning processes to provide students better education and encourage them to take greater responsibility for their learning and greater active involvement in it. However, teachers state that the educational environment does not affect their learning style because they could easily communicate with their students in the way they are used to (Raes et al., 2020). Blair (2012) emphasizes that teachers should take care of careful media selection and student technology use. He further emphasizes that technological tools should be constantly developed to improve problem solving, innovation, decision-making and teamwork. Some research shows that appropriate learning media use can accelerate and improve teacher-student interaction, so that learning material discussed leads to critical attitude and thinking (Jusuf et al., 2019).

Challenges to Professionalization

Professionalization as well as improving the quality of education are current topics of many educational experts' discussions. In doing so, it is important to emphasize that teacher professionalism should not be interpreted as a universal value because it varies between different contexts, sometimes at the most basic levels (Dodillet et al., 2018). It has become quite normal to associate professionalism with a well-run organizational environment and focus on

new hybrid professional practices in which professional work is reorganized. Conflicting professional and managerial principles such as autonomy and control, or quality and efficiency, are combined to establish contemporary professional action (Noordegraaf, 2015). Cremers et al. (2016) demonstrate that fostering authenticity, the interconnection of work and learning, and reflexivity improve authentic, self-directed learning and the development of teachers' professional identities.

The need for teachers' professionalization is not self-evident (Van Driel, 2008), but it should certainly imply profession autonomy. Domović (2011) defines professionalism as one of the key aspects in teaching profession autonomy. On the other hand, the lack and suffocation of professional autonomy is a sign of deprofessionalization. In this regard, Milner (2013) points out that teaching was seen as a semi-profession, as an occupation that is not worthy of professional status. Furthermore, the lack of teachers autonomy over curriculum design also contributes to the suffocation of professionalization. In other words, they lose the ability to make professional decisions and do not draw much from their professional knowledge because mostly someone outside the practice determines what should and should not be emphasized in the curriculum. Bognar (2017) also points to the problem of non-existence of measures to monitor teachers supply and demand and their selection when enrolling in extraordinary programs of pedagogical and psychological education, which indicates a lack of care for professionalizing the teaching profession (p. 148). To significantly improve teachers professionalization, their profession needs to become competitive with other professions, not only by increasing salaries, but also by changing social prestige (Mehta & Teles, 2014).

The need for teachers' professionalization includes their continuous professional development as well as regular professional development. Teachers need to continuously improve their professionalism by developing or improving their personal, social, pedagogical and professional competencies. Most teachers feel and express the need to improve their pedagogical and professional competencies, which can be achieved by implementing a hybrid learning training strategy (Mulhayatiah et al., 2021). Although teachers teach in dehumanizing times, teacher educators and education policy makers need to ensure professional development, policy reforms, and working and learning conditions that enhance teacher professionalism and foster teachers positive professional self-perceptions (Carter Andrews et al., 2016).

Professionalization is a matter of critical reflection on the knowledge and skills that make up professional practice and therefore is an integral part of professional learning and professional development within the professional environment. It emphasizes cooperation and

co-construction of knowledge among participants and represents development at the individual, local practice, institutional and systemic level (Havnes, 2018). Teacher collaboration along with (self) reflection is a key aspect in improving teacher professionalism. Cooperation should be implemented to develop teachers' competencies and improve their actions reflection, but it is not used enough among teachers. Improving and increasing the use of collaborative activities in teacher education can lead to their greater performance at work (Bush & Grotjohann, 2018). Using research, reflection and observation, teachers raise the status of teaching as a profession and thus bridge the gap between researchers and practitioners, which is an important teaching challenge (Gentry et al., 2016). Following this, Carter Andrews et al. (2016) point out that teachers ability to design and implement action research projects can serve to improve their professional self-perception, improve their professionalization and finally introduce culturally relevant and sustainable pedagogies in the classroom.

New professionalization may require reinvestment in teaching, teacher training and teacher preparation. In particular, teachers take on a new role, the role of coordinator who guides and facilitates the learning process in the social, intellectual and emotional context of the individual student, integrating learning and development through many learning tools. If digital tools are well designed, well selected, and well deployed, they can make teachers more effective in new roles, especially in their new coordinator role. Teachers nurture deeper, more personalized relationships with students and thus make it easier for them to work on an individualized basis. At the same time, they help students to direct the received feedback to their learning goals and learning strategies (Shaffer et al., 2015). That is, teachers need to help students with other factors such as how to understand, analyze, act, succeed, and function with others inside and outside the school (Milner, 2013).

Klimova & Kacetl (2015) note that a hybrid approach to learning requires the independence of students and teachers who support them in such learning. In this way, the roles of both students and teachers change. If teaching and learning is seen as social processes in which students are active co-constructors of knowledge with their teachers, then teacher becomes a leader or mentor. Trentin (2015) also agrees that teachers become facilitators in the process of learning content by contributing to learning materials preparation and coordinating students activities, both online and face-to-face. He points out that change in their function depends on the type of adopted approach, i.e. whether it is more traditionally focused on teachers or collaborative learning.

Conclusion

The concept of hybrid learning is rooted in the idea of providing innovative educational solutions through a combination of traditional classroom teaching and online activities for teachers and students outside the physical classroom and thus facilitates better access to learning. However, hybrid learning has been shown to have its advantages and disadvantages. In any case, in the uncertain times that COVID-19 pandemic brings, it becomes an integral part of the functioning of the educational system. Thus, it affects, directly or indirectly, the development of the process of professionalization of teachers. The set goals, the concept of work, the competencies that the teacher possesses as several factors determine his professional identity. When analyzing the process of its professionalization, it is necessary to consider different cultures and concepts important for initiating useful processes of adaptation to new challenges. Certainly, the hybrid concept of learning opens up new possibilities for achieving autonomy as one of the key aspects of the teaching profession. That is why it is extremely important for teachers to invest in continuous professional development in order to follow all the changes and know how to successfully deal with new challenges, but also to get involved in action research to achieve these changes in practice.

Hybrid learning creates a more flexible, interesting learning environment compared to a completely online environment or a completely traditional environment, which is reflected in the availability of appropriate media that connect pedagogy and technology in a new and different way. Therefore, it is important to start by providing the appropriate infrastructure and taking care of the careful selection of media and students' use of technology. Furthermore, it is important to prepare appropriate learning materials that enable students to learn individually or collaboratively. Combining live and online interaction has been shown to create a collaborative learning environment that offers more support for students' learning and achievement and encourages them to participate more often in online discussions and express their own ideas. Cooperation encourages the process of acquiring knowledge and designing a learning environment, which greatly improves the quality of learning. This should encourage practitioners to consider new ways of fostering student needs in hybrid learning environments.

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References

- Akla (2021). Arabic Learning by Using Hybrid Learning Model in University. *Jurnal Al Bayan: Jurnal Jurusan Pendidikan Bahasa Arab*, 13(1), 32-52. <https://doi.org/10.24042/albayan.v%vi%i.7811>
- Allaire, S., Laferrière, T., & Gervais, F. (2011). Enhancing pre-service teachers' knowledge building discourse with a hybrid learning environment. *Research on Education and Media*, 3(1), 67-83.
- Azhar, K. A., & Iqbal, N. (2018). Effectiveness of Google Classroom: Teachers' Perceptions. *Prizren Social Science Journal*, 2(2), 52-66. Retrieved from <https://prizrenjournal.com/index.php/PSSJ/article/view/39>
- Blair, N. (2012). Technology Integration for the "New" 21st Century Learner. *Principal*, 91(3), 8–11.
- Bognar, B. (2017). Ususret promjenama odgojno-obrazovnog sustava. *Radovi Zavoda za znanstvenoistraživački i umjetnički rad u Bjelovaru*, 11, 143-166. <https://doi.org/10.21857/ypn4oc82o9>
- Bordoloi, R., Das, P., & Das, K. (2021). Perception towards online/blended learning at the time of Covid-19 pandemic: an academic analytics in the Indian context. *Asian Association of Open Universities Journal*, 16(1), 41-60. doi:10.1108/AAOUJ-09-2020-0079
- Bush, A., & Grotjohann, N. (2018). Professionalization through Collaboration in Teacher Education – Identifying the Status Quo. PUPIL. *International Journal of Teaching, Education and Learning*, 2(2), 189-203. <https://dx.doi.org/10.20319/pijtel.2018.22.189203>
- Carter Andrews, D.J., Bartell, T., & Richmond, G. (2016). Teaching in Dehumanizing Times: The Professionalization Imperative. *Journal of Teacher Education*, 67(3), 170-172. <https://doi.org/10.1177/0022487116640480>
- Cremers, P. H. M., Wals, A. E. J., Wesselink, R., & Mulder, M. (2016). Design principles for hybrid learning configurations at the interface between school and workplace. *Learning Environments Research*, 19(3), 309-334. <https://doi.org/10.1007/s10984-016-9209-6>
- Cusano, C.C. (2018). *Vocational Instructors Experience and Practice Teaching in the Hybrid Environment*. Walden University. ProQuest Dissertations Publishing.
- Demaziere, C. (2021). Using active learning in hybrid learning environments. *EPJ Web of Conferences*, 247, PHYSOR2020. <https://doi.org/10.1051/epjconf/202124714001>
- Dodillet, S., Lundin, S., & Krüger, J. O. (2018). Constructing professionalism in teacher education. Analytical tools from a comparative study. *Education Inquiry*. <https://doi.org/10.1080/20004508.2018.1529527>
- Domović, V. (2011). Učiteljska profesija i profesionalni identitet učitelja. U: V. Vizek-Vidović (Eds.), *Učitelji i njihovi mentori*. Zagreb: IDIZ.
- Gentry, J. E., Baker, C., & Lamb, H. (2016). Professionalization of Teaching in America: Two Case Studies Using Educational Research Experiences to Explore the Perceptions of Preservice

- Teachers/Researchers. *Administrative Issues Journal*, 6(1), 53-72.
<https://doi.org/10.5929/2016.6.1.2>
- Gutiérrez-Braojos, C., Montejo-Gamez, J., Marin-Jimenez, A., & Campaña, J. (2019). Hybrid learning environment: Collaborative or competitive learning? *Virtual Reality*, 23, 411–423.
<https://doi.org/10.1007/s10055-018-0358-z>
- Havnes, A. (2018). ECEC Professionalization – challenges of developing professional standards. *European Early Childhood Education Research Journal*, 26(5), 657-673.
<https://doi.org/10.1080/1350293X.2018.1522734>
- Hediansah, D., & Surjono, H. D. (2020). Hybrid learning development to improve teacher learning management. *Jurnal Kajian Teknologi Pendidikan*, 3(1), 1-9.
- Hung, Y.H., Chang, R. I., & Lin, C.F. (2016). Hybrid learning style identification and developing adaptive problem-solving learning activities. *Computers in Human Behavior*, 55, 552-561.
<https://doi.org/10.1016/j.chb.2015.07.004>
- Jokinen, P., & Mikkonen, I. (2013). Teachers experiences of teaching in a blended learning environment. *Nurse Education in Practice*, 13(6), 524-528. <https://doi.org/10.1016/j.nepr.2013.03.014>
- Jusuf, H., Ibrahim, N., & Suparman, M.A. (2019). Hybrid learning strategy for facilitating learning and improving performance. *Asia Proceedings of Social Sciences*, 4(2), 20-23.
<https://doi.org/10.31580/apss.v4i2.697>
- Klimova, B. F., & Kacetl, J. (2015). Hybrid learning and its current role in the teaching of foreign languages. *Procedia - Social and Behavioral Sciences*, 182, 477–481.
<https://doi.org/10.1016/j.sbspro.2015.04.830>
- Linder, K.E. (2017). Fundamentals of Hybrid Teaching and Learning. *New Directions for Teaching and Learning*, 149, 11–18.
- Means, B., Toyama, Y., Murphy, R., & Baki, M. (2013). The effectiveness of online and blended learning: A meta-analysis of the empirical literature. *Teachers College Record*, 115(3), 1–47.
- Mehta, J., & Teles, S. (2014). Professionalization 2.0: The Case for Plural Professionalism in Education. In M. McShane, & F. Hess (Eds.), *Teacher Quality 2.0: Will Today's Reforms Hold Back Tomorrow's Schools?*. Cambridge: Harvard Education Press.
- Milner, H.R. (2013). Policy Reforms and De-professionalization of Teaching. Boulder, CO: National Education Policy Center. Retrieved [16.1.2022.] from
<http://nepc.colorado.edu/publication/policy-reforms-deprofessionalization>
- Mulhayatiah, D., Sinaga, P., Rusdiana, D., Kaniawati, I., & Suhendi, H. Y. (2021). Pedagogical and professional physics teacher training: why hybrid learning is important? *Journal of Physics: Conference Series*, 1806(1). <https://doi.org/10.1088/1742-6596/1806/1/012036>
- Noordegraaf, M. (2015). Hybrid professionalism and beyond: (New) Forms of public professionalism in changing organizational and societal contexts. *Journal of Professions and Organization*, 2, 187–206. <https://doi.org/10.1093/jpo/jov002>

- Raes, A., Vanneste, P., Pieters, M., Windey, I., Van Den Noortgate, W., & Depaepe, F. (2020). Learning and instruction in the hybrid virtual classroom: An investigation of students' engagement and the effect of quizzes. *Computers & Education, 143*. <https://doi.org/10.1016/j.compedu.2019.103682>
- Rao, V.C.S. (2019). Blended Learning: A New Hybrid Teaching Methodology. *Journal for Research Scholars and Professionals of English Language Teaching, 3*(13).
- Saichaie, K. (2020). Blended, Flipped, and Hybrid Learning: Definitions, Developments, and Directions. *New Directions for Teaching and Learning, 164*, 95-104.
- Shaffer, D.W., Nash, P., & Ruis, A. R. (2015). Technology and the New Professionalization of Teaching. *Teachers College Record, 117*(12).
- Sutisna, E., & Vonti, L. H. (2020). Innovation development strategy for hybrid learning based English teaching and learning. *English Review: Journal of English Education, 9*(1), 103-114. <https://doi.org/10.25134/erjee.v9i1.3783>
- Trentin, G. (2015). Orientating Pedagogy towards Hybrid Learning Spaces. In R. V. Nata (Ed.), *Progress in Education*, (pp. 105-124). Nova Science Publishers Inc., Hauppauge, NY.
- Van Driel, J. (2008). Van een lerende vakdocent leer je het meest.. [You learn the most of a teacher who learns]. Leiden: Universiteit Leiden.
- Vernadakis, N., Giannousi, M., Derri, V., Michalopoulos, M., & Kioumourtzoglou, E. (2012). The impact of blended and traditional instruction in students' performance. *Procedia Technology, 1*, 439 – 443. <https://doi.org/10.1016/j.protcy.2012.02.098>
- Wang, S. (2014). A Practical Research of Hybrid Learning Mode in Teaching and Research Activities. In: S.K.S. Cheung, J. Fong, J. Zhang, R. Kwan, & L.F. Kwok (Eds.), *Hybrid Learning. Theory and Practice. ICHL 2014. Lecture Notes in Computer Science*. Springer, Cham. https://doi.org/10.1007/978-3-319-08961-4_8
- Wichadee, S. (2013). Facilitating Students' Learning with Hybrid Instruction: A Comparison among Four Learning Styles. *Electronic Journal of Research in Educational Psychology, 11*(1), 99-116.
- Xiao, J., Sun-Lin, H., Lin, T., Li, M., Pan, Z., & Cheng, H. (2020). What makes learners a good fit for hybrid learning? Learning competences as predictors of experience and satisfaction in hybrid learning space. *British Journal of Educational Technology*. <https://doi.org/10.1111/bjet.12949>
- Zotero, Personal research assistant. Accessed 20 January 2021. <https://www.zotero.org/>

Importance of Gamification in E-Learning for Elementary School Pupils in Albania

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Abstract

Games are an essential part of the person from the moment it is born. Through the games children learn to find solutions to problems, build confidence and skills. This research purpose is to identify the importance of games in learning process focused on education domain, as a methodology to increase engagement, motivation, and satisfaction of pupils. The paper analyse how important is gamification in e-learning system for elementary school pupils focused on Albania country. To answer this question, we conducted a questionnaire to measure the applying level of gamification methodology in Albanian schools and evaluated the perspective of teachers and pupils towards the methodology of gamification. Our results showed a low level of applying of this methodology in learning process. Results also revealed that teachers and pupils have a very positive perspective related gamification methodology. Also, they think that this methodology improves performance of learning, increase motivation and satisfaction of pupils. From the perspective of the results, this research recommends some applications and e-learning model that have incorporated gamification approach, and emphasizes the importance of gamification in e-learning.

Keywords: gamification, education system, elementary school, e-learning, pupils motivation

Introduction

Education system in Albania is faced with fully e-learning approach during covid-19 pandemic. This form of learning cause different problems and difficulties to pupils related learning process. One of the most important point was engagement and motivation of pupils. They expressed a low level of satisfaction towards this method of learning. Also, another difficulties encountered was related learning and understanding knowledges and concepts. This

research suggests and analyse the importance of incorporating the methodology of gamification in learning process on purpose to improve the experience of pupils towards e-learning approach.

Definition of Gamification was presented for the first time in 2011, by Deterding as the use of game elements in non-game context (Deterding, Dixon, Khaled, & Nacke, 2011). Gamification is “using game-based mechanics, aesthetics and game thinking to engage people, motivate action, promote learning, and solve problems” (Kapp, 2012). Gamification has gained a significant and very important attention in educational context (Koivisto, 2017), (Koivisto, 2014). Research and literature review indicate that education and learning environment are the most common context for empirical research and application of gamification methodology (Hamari, 2014).

Games are an important part of children life, because through the games children learn to find solutions to problems, build confidence and skills. Based on these research, is important to encourage education system and teachers to incorporate gamification methodology in learning process also in school. Basic principle of every game is to reach a certain goal. Whether, the goal is to win points, awards, accomplish an assignment or to be ranked in leaderboard, it is a mechanism that involves engagement, motivation, emotion and appropriate behavioral pattern (ŠĆEPANOVIĆ, ŽARIĆ, & MATIJEVIĆ, 2015).

Game elements in gamification methodology are characterized in different ways in literature review. One of the most used and important approaches is through the MDA framework, which describes the game elements as belonging to one of these categories: Mechanics, Dynamics and Aesthetics (Toda, Oliveira, Klock, & Palomino, 2019). This type of framework has been adopted to generic gamification methodology. Mechanics are related to the game’s components, control, and courses (U., 2015). Dynamics are related to the game’s context, constraints, chance, consequences, completion, continuation, competition, and cooperation (U., 2015). Aesthetics are related to the game’s challenge, commendation, confidence, cognizance, creativity, contribution, community, and compliance (U., 2015).

Throughout of this research, we focus on various concepts and elements of gamification methodology that are represent in introduction of the paper. Followed with methodology that presents research techniques, analysis and interpretation of data collected. The results of research as the product of analysing data. In the end, conclusion and recommendation of the research.

Methodology

In this section, we will introduce the methodology that is used in this research. The methodology is separated in three parts that are instrument development, data collecting, and data analysis.

Instrument Development

This research have developed a questionnaire instrument. The questionnaire is adopted in the form of e-learning and face to face. Questions formulated into it are in the form of statements and have similar definition for the purpose of better analysing data. In the survey description was clearly explained the concept and methodology of gamification, followed with 12 statements.

The survey items are formulated to measure firstly the the level of motivation and satisfaction of pupils towards learning process in online mode. Secondly, to measure the level of applying gamification approach in learning process, by asking for specific game elements incorporated in learning. Thirdly, we measure viewpoint of teachers towards influence of gamification in online learning process. Link of survey: <https://forms.gle/dTWH68bYY7BUhSJJ7>.

Data collection

The research used a quantitative research approach. The survey was conducted through the google form and the links were shared with the teachers of elementary schools in Albania through the WhatsApp, email, and face to face. We supervised some teachers that have difficulties to understand the concept of gamification, or specific questions in the survey. The convenience sampling technique is used. In the survey are participated 104 teachers that teaches in different elementary schools in Albania. The survey is conducted from February 18, 2022 to February 28, 2022.

Table 2

Statments of survey

S1	Engagement and satisfaction of pupils towards learning process in online mode was high.
S2	Motivation of pupils towards learning process in online mode was high.
S3	Quizzes are applied regularly during e-learning approach.
S4	Competition/ Leader board/ Scoreboards are applied regularly during e-learning approach.
S5	Sensation/ Virtual Reality/ Augmented Reality are applied regularly during e-learning approach
S6	Time track are applied regularly during e-learning approach
S7	Renovation/ Extra life/ Boosts are applied regularly during e-learning approach

S8	Gamification develop critical thinking and problem solving skills to pupils.
S9	Gamification help pupils to develop clear and more understandable knowledges.
S10	Gamification increase satisfaction and motivation of pupils
S11	Gamification increase creativity to pupils
S12	Gamification methodology helps to improve performance of online learning to pupils

Data Analysis

Through analyzing data we generate charts to interpret them based on the results. The purpose of survey is to measure:

- Level of motivation and satisfaction of pupils towards learning process in online mode
- Level of applying gamification approach (specific game elements) in learning process
- Viewpoint of teachers towards influence of gamification in online learning process

Figure 1

Clustered column chart of data collected from survey

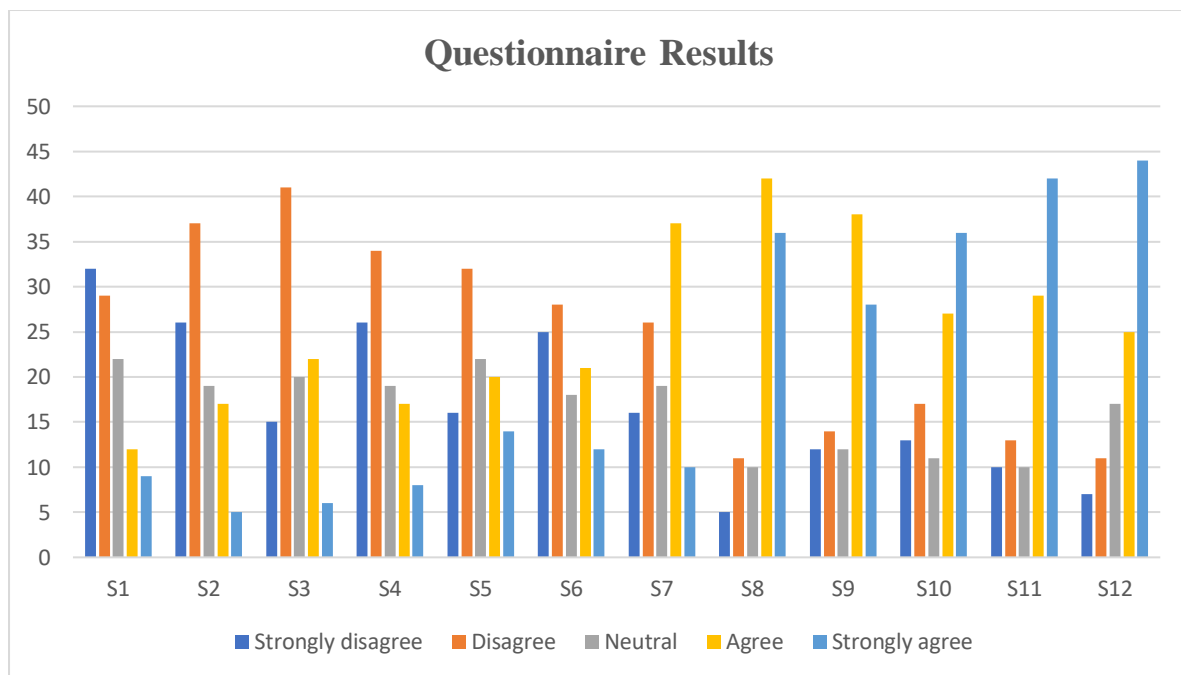


Figure 2

Stacked column chart of data collected from survey

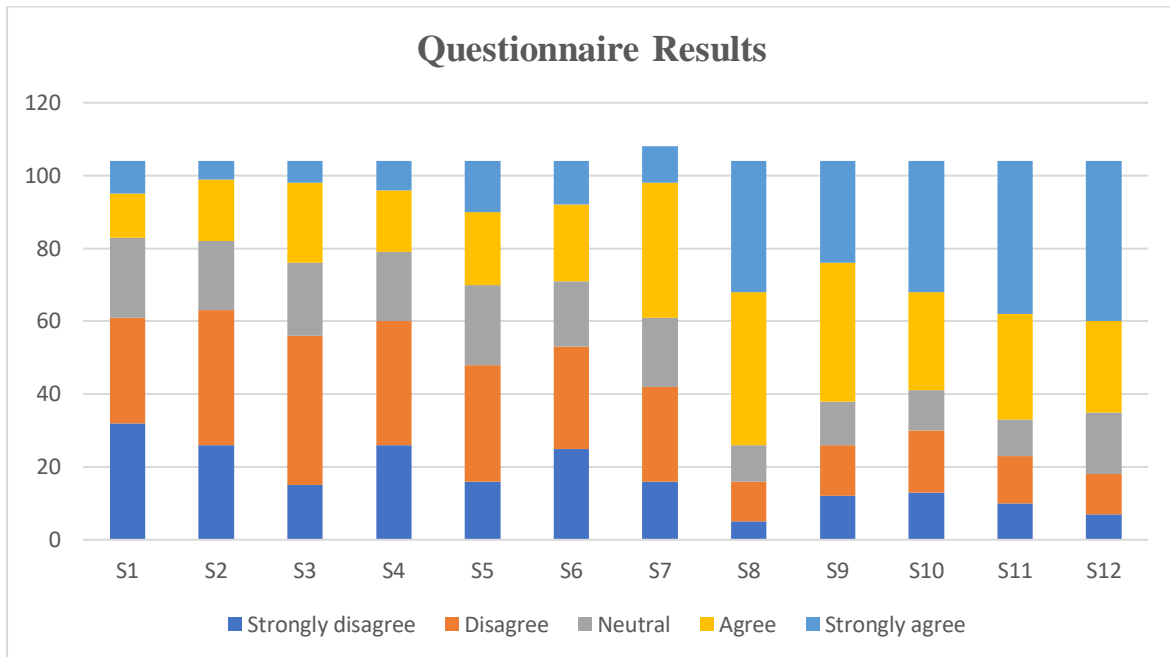


Table 2

Table of results of data collected from survey in % (percentage)

	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
S1	30.8	27.9	21.2	11.5	8.7
S2	25.0	35.6	18.3	16.3	4.8
S3	14.4	39.4	19.2	21.2	5.8
S4	25.0	32.7	18.3	16.3	7.7
S5	15.4	30.8	21.2	19.2	13.5
S6	24.0	26.9	17.3	20.2	11.5
S7	15.4	25.0	18.3	35.6	9.6
S8	4.8	10.6	9.6	40.4	34.6
S9	11.5	13.5	11.5	36.5	26.9
S10	12.5	16.3	10.6	26.0	34.6
S11	9.6	12.5	9.6	27.9	40.4
S12	6.7	10.6	16.3	24.0	42.3

Data collected from questionnaire are analysed and represented through charts and table. Most of teachers disagree that satisfaction and motivation of pupils was high during online learning. Then, we asked for the level of applying some game elements in learning process. Quizzes, competition/ leader board/ scoreboards, sensation/ virtual reality/ augmented reality, time track and renovation/ extra life/ boosts are game elements included in survey. Result show us that level of applying game elements in learning process is low. Most of teachers disagree or are neutral related the statements of applying these game elements in learning

process. The third part of questionnaire is related viewpoint and prespective of teachers related the role of gamification methodology in critical thinking, problem solving skills, creativity, clear knowledge, satisfaction and motivation towards learning. Most of teachers express positive viewpoint and agree to incorporate gamification in learning process.

Results

This paper, set to answer two research question. The first research question is “What is the level of applying gamification methodology in elementary schools in Albania”. The second research question is “What is the prespective and viepoint of teachers towards the influence of gamification methodology in learning process, especially in e-learning methodology to pupils?”. To answer these questions this research used quantitative research methodology throught the questionnaire realized to teachers. Regarding the first research question, we identify that level of applying game elements in learning process was low. Very few teachers have applied quizzes, time track and competition to complete assignments, during learning process. Related second research question, teachers are enthusiastic and they agree that gamification methodology improves learning process for pupils. They agree that gamification improves critical thinking and problem solving skills, creativity, motivation and satisfaction of the pupils. Also, most of teachers agree that gamification methodology help them to develop clear and understandable knowledges and improve the performance of e-learning to pupils.

Conclusion and Recommendation

This paper discuss about the importance of gamification methodology in e-learning for elementary school pupils in Albania. We discussed the gamification methodology by presenting definictions, concepts and elements of this approach. Throug analysing the data we conclude that level of applying gamification in education system is low, but teachers are satisfied and agree to implement this approach in learning process. It shows that this methodology improve learning process, increase motivation, engagement and satisfaction to pupils. Also, gamification simplifies different knowledges and concepts, and improve creativity to childrens. Also, we identify that gamification is a crucial and very approapriate approach to be incorporated in e-learning methodology. E-learning as a standalone techniques is not very effective to keep pupils satisfied and motivated to learning. Incorporating gamification methodology in e-learning mode makes e-learning more effective, satisfied and attractive. Schools have been using game-like elements in classroom activities, such as giving points to pupils for completing assignments;

and time limits in completing those assignments. This form of learning increase competition and collaboration between them (Nah, Telaprolu, Rallapalli, & Venkata, 2013).

Various gamification models can be applied to increase motivation and satisfaction to learners (Kusuma, Wigati, Utomo, & Suryapranata, 2018). We recommend approaches and techniques to incorporate game elements in learning environment, and specifically MDA framework by breaking them into three components, mechanics, dynamics and aesthetics. This gamification method could be used to increase motivation, achievement and engagement in learning activities (Kusuma, Wigati, Utomo, & Suryapranata, 2018).

References

- Deterding, A., Dixon, D., Khaled, R., & Nacke, L. (2011). From Game Design Elements to Gamefulness: Defining “Gamification”. *Proceedings of the 15th International Academic MindTrek Conference: Envisioning Future Media Environments*.
- Hamari, J. K. (2014). Does Gamification Work? *47th Hawaii International Conference on System Sciences*, (pp. 3025–3034).
- Kapp, K. M. (2012). The gamification of learning and instruction: game-based methods and strategies for training and education. *John Wiley & Sons*.
- Koivisto, J. &. (2014). Demographic differences in perceived benefits from gamification. 179-188.
- Koivisto, J. &. (2017). The Rise of Motivational Information Systems: A Review of Gamification Research.
- Kusuma, G., Wigati, E., Utomo, Y., & Suryapranata, L. (2018). Analysis of Gamification Models in Education Using MDA Framework. *3rd International Conference on Computer Science and Computational Intelligence 2018*, (pp. 385-392).
- Nah, F., Telaprolu, V., Rallapalli, S., & Venkata, P. (2013). Gamification of Education Using Computer Games. *Proceedings of the 15th international conference on Human Interface and the Management of Information: information and interaction for learning, culture, collaboration and business - Volume Part III*.
- ŠĆEPANOVIĆ, S., ŽARIĆ, N., & MATIJEVIĆ, T. (2015). GAMIFICATION IN HIGHER EDUCATION LEARNING – STATE OF THE ART, CHALLENGES AND OPPORTUNITIES. *The Sixth International Conference on e-Learning*. Belgrade, Serbia.
- Toda, M., Oliveira, W., Klock, A., & Palomino, P. (2019). A Taxonomy of Game Elements for Gamification in Educational Contexts: Proposal and Evaluation. *IEEE 19th International Conference on Advanced Learning Technologies*.
- U., R. (2015). *Level Up Your Strategy: Towards a Descriptive Framework for Meaningful Enterprise Gamification*. Technology Innovation Management Review.

Challenges and Strategies of E-Learning in Education: A New Era of Normalisation

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Abstract

In the last years, all the world was faced with new form of learning, from face-to-face learning, was forced to change learning approach into e-learning. E-learning became a mandatory methodology to face education process during covid-19 pandemic. The target group of the research are elementary school pupils and teachers in Albania. The first goal of this research is to identify approaches and tools used in elementary schools during distance learning. The second point of research is identifying level of engagement, satisfaction, and motivation of pupils through this approach of learning. This was achieved by collecting data from questionnaire applied on the pupils and teachers. The analysis consists in presenting the effectiveness of e-learning approach in elementary schools. From the result, even though online learning was applied to pupils, motivation and satisfaction of pupils related this approach is not very high. In the end, this research will recommend some strategies and identify challenges of e-learning in the framework of improving learning process and increase motivation of pupils.

Keywords: e-learning, education system, elementary school, learning process, pandemic situation

Introduction

The entrenchment of the Covid-19 pandemic in the life of billions of people all around the world, has profoundly impacted the way activities are carried out involving humans interactions (Turnbull, Chugh, & Luck, 2021). Referred to this situation, e-learning became an integral part of learning process during covid-19 pandemic situation. Even though the e-learning was already elaborated and applied partial as a methodology to support distance learning in special cases, application of full online learning faced many difficulties. Covid-19 pandemic forced transition to online learning and became the only applicable option for

preventing the whole closure of institution. It is critical to emphasise that as the world should deal with the reality of covid-19 pandemic and its challenges, especially in the education space, appropriate strategies need to be applied to continue to engage learners for teaching and learning. (Ananga, 2020) The solution for this crisis was applying and incorporating e-learning and online learning approach. The concept and definition of e-learning and online learning have been considered by different authors in various perspectives. Literally e-learning can be defined as electronic learning that includes all learning situations and techniques that employ the new technologies (Ananga, 2020). On the other side, online learning technically entails a variety of technologies like the email, audio, chat, web, newsgroup, text, video conferencing that are delivered over networks for education purpose (Yelland, 2008). Information Technology tools and appropriate infrastructure was an important and critical point during pandemic situation, to facilitate fully online learning for all education systems. In the whole world as well as in Albania, ICT is becoming an important factor in learning and teaching process.

Education systems incorporate the use of digital technologies for easier and faster communication between pupils and teachers, managing and explaining different subjects. (Prodani, Çobani, Bushati, & Andersons, 2020). Moreover, the research in this category analyses featured that pupils and teachers delivering information and subject in online mode faced difficult in the technological confidence in using computers, technological tools (Andersson & Grönlund, 2009). Information technology tools can be classified into two broad groups: asynchronous and synchronous (Larasati, 2017). Asynchronous learning systems are build on communication platforms that do not require time-sensitive interaction in the education process. Learning Management Systems (LMS) such as Moodle are an example of asynchronous distance learning platforms that are structured to facilitate interaction based on request-response method of communication of the users and not dependent and unconstrained by time limitation (Larasati, 2017). On the other hand, synchronous online learning involving the real-time interchange of information that is usually conducted via video conferencing platforms such as Microsoft Teams, Zoom Meeting, Google Meet (Kohnke, 2020).

Throughout this paper, we are trying to focus on various issues and challenges of implementing e-learning in education system. E-learning is a very large area of research in terms of education domain. In this paper, it starts with an introduction of e-learning system, some definition and concepts like e-learning, online learnings, asynchronous and synchronous learning and the role of e-learning methodology during covid-19 pandemic situation in education system. Follows with section 2, methodology that represents research techniques that

are used in this paper, also analysis and interpretation of data collected. In section 3, introduce results of this research. In the end, section 4 presents conclusion and recommendation to overcome challenges of e-learning in education.

Methodology

In this section, we will introduce the methodology that is used in this research. The methodology is separated in three parts that are instrument development, data collecting, and data analysis.

Instrument development

Current study has developed a survey instrument. The questionnaire was adopted and reworded in the form of E-learning. Embedded questions have various definition like multiple choice, single choice, and likert scale, to keep the user satisfied from various type of questions. The questionnaire items are formulated to measure the use of e-learning before, during and after covid-19 pandemic in Albanian schools. Measure advantages and disadvantages that pupils and teachers identified for e-learning methodology. Also, platforms they used to enable the use of e-learning and challenges of applying e-learning in education.

Data collecting

The research used a quantitative approach. The survey was conducted through the Google form and the links were shared with the pupils and teachers through the WhatsApp group of teachers with pupils. Teachers supervised pupils to explain the questions that pupils find out difficulties. The convenience sampling technique was used. Total number of 83 pupils and 28 teachers have participated in online survey conducted from March 07, 2022 to March 12, 2022. Pupils were in middle school from 6th to 9th graders (11 – 15 years old).

Table 1

Teacher and pupils participated in survey

Teacher	Pupils	Total
28	83	111
25.2%	74.7%	100%

Data Analysis

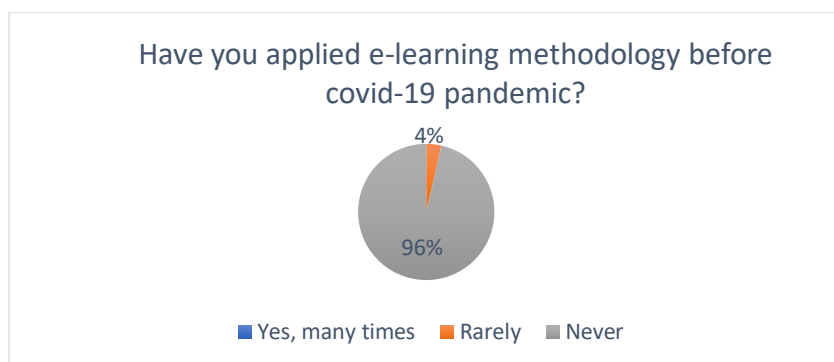
Through collecting the data we generate charts to interpret them based on result. The purpose of the survey is:

1. Level of applying e-learning in learning process, before, during and after covid-19 pandemic.
2. Tools and platforms that are used to enable e-learning.
3. Difficulties and benefits that pupils and teachers accomplished during applying e-learning.
4. Challenges of e-learning and future perception

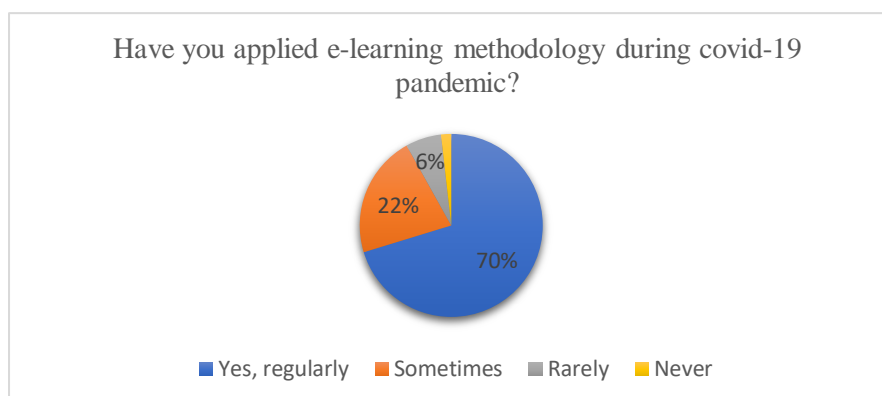
First question of the survey is related to applying e-learning methodology before covid-19 pandemic. Based on response collected we conclude that 96% of teachers and pupils have never applied e-learning before pandemic situation and 4% of them have applied rarely.

Figure 1

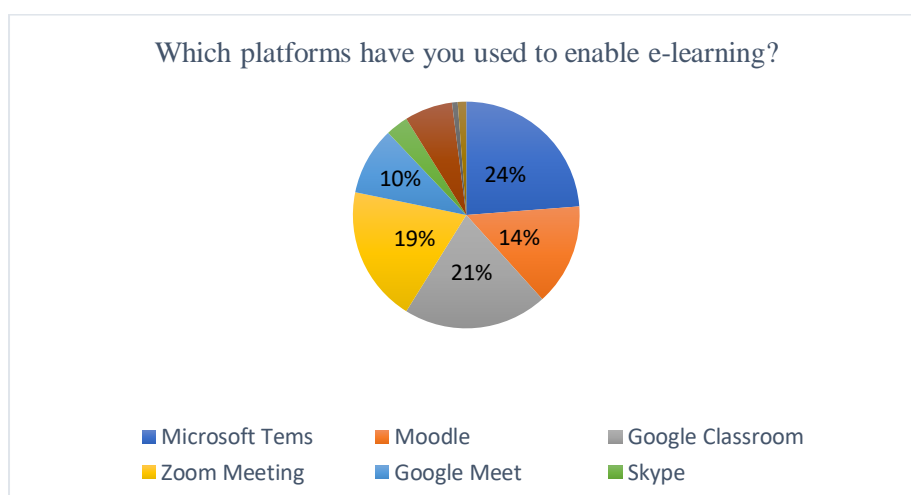
Level of applying e-learning methodology before covid-19 pandemic



The second question of the survey is concerned about application of e-learning methodology during covid-19 pandemic. Important to emphasize that during pandemic situation, e-learning was the only solution in order to continue the learning process. Based on data collected results that 70% of them have applied e-learning regularly, 22% sometimes, 6% of them rarely and only 2% of teachers and pupils have never applied e-learning. The majority of students and pupils have applied regularly e-learning during lockdown, pandemic situation.

Figure 2*Level of applying e-learning during covid-19 pandemic*

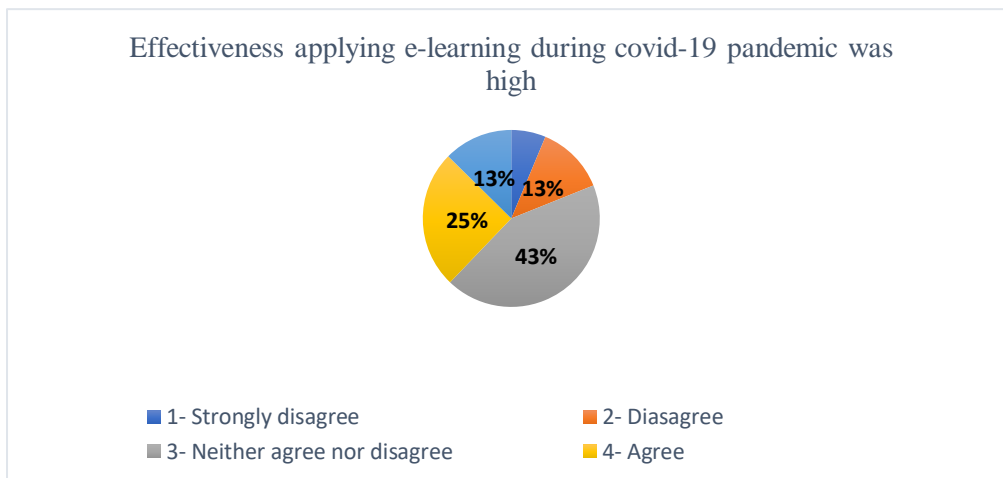
The third question in the questionnaire is related the platform and tools that are used to enable online learning. Based on response of teachers and pupils result that 24% of them have used Microsoft Teams, 21% google classroom, 14% Moodle, 19% Zoom Meeting, 10% Google Meet and 3% skype. The most used platform for e-learning was Microsoft Teams with 21% and Zoom Meeting with 19%.

Figure 3*Platform used to enable e-learning*

The other question in the survey concerned to measure the effectiveness of e-learning during pandemic situation. Based on response resulted that 43% of them responded that they are agree “Neither agree, nor disagree”, 25% of them agree, 13% of them disagree.

Figure 4

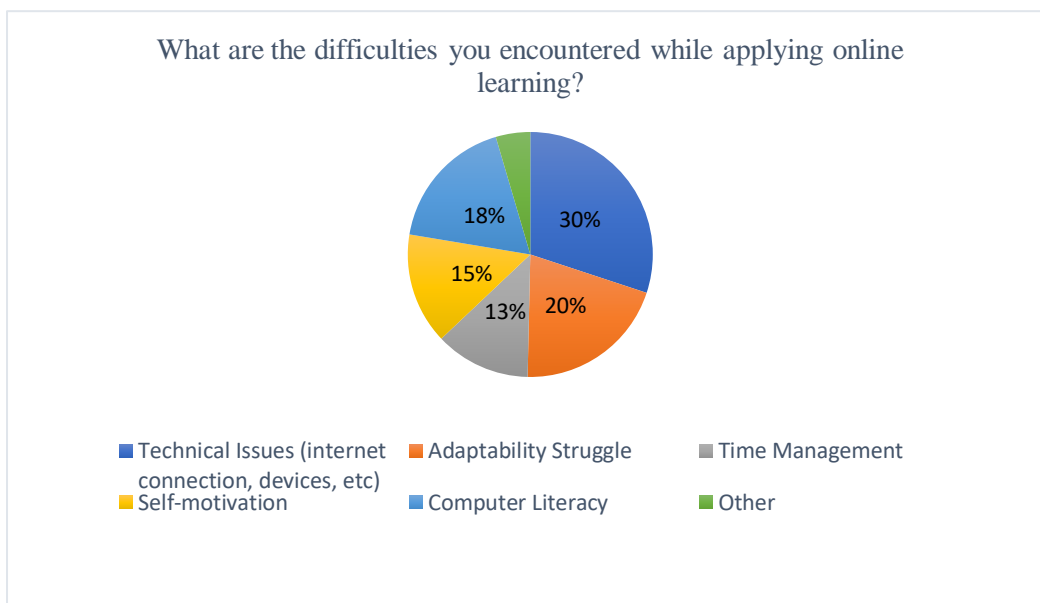
Effectiveness applying e-learning during covid-19 pandemic



This question of the survey is concerned about the difficulties encountered by pupils and teachers while applying online learning. The most concerns and difficulties are Technical Issues with 30%, 20% with Adoptability Struggle, 18% Computer Literacy.

Figure 5

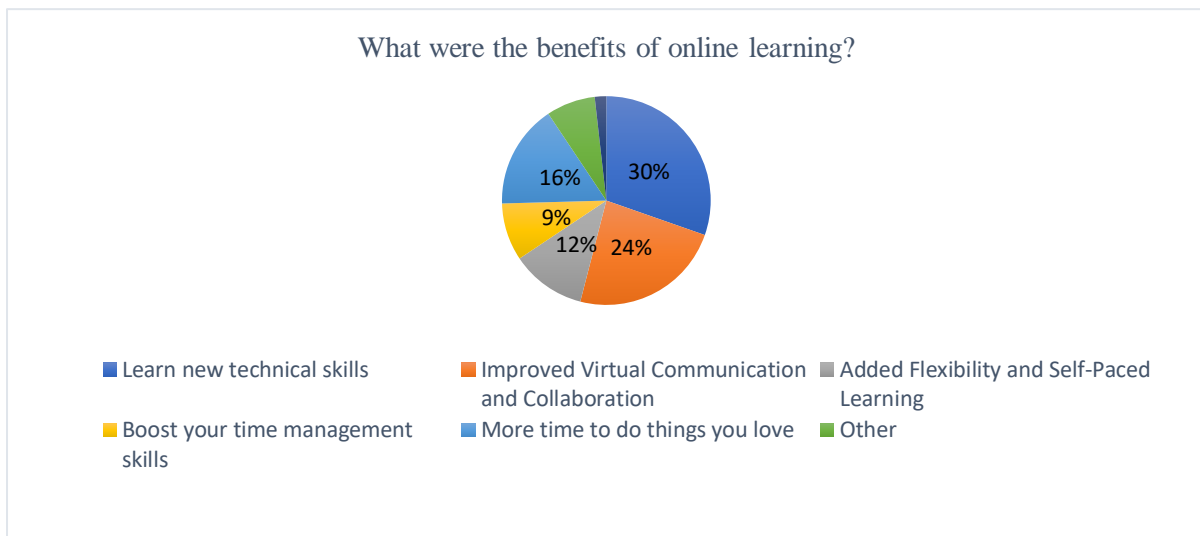
Difficulties encountered while applying online learning



Next question is about the benefits that pupils and teachers shown during applying online learning. Based on data collected 24% of them have noticed “Improved Virtual Communication and Collaboration”, 30% of them have learned new technical skills, 16% of them have noticed more time to do things they love.

Figure 6

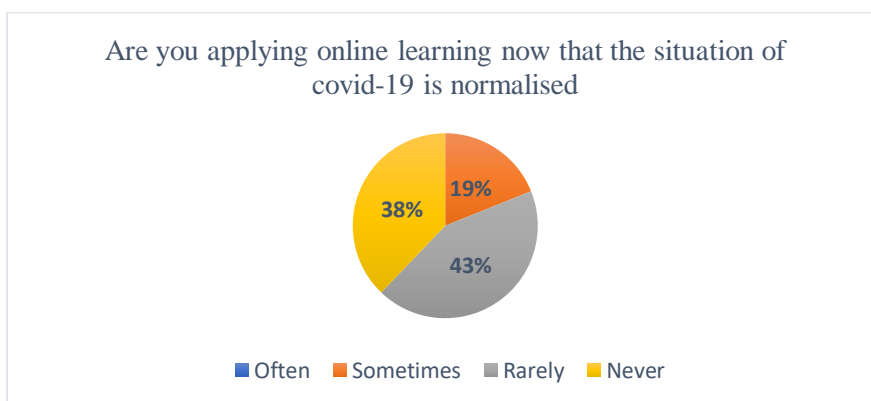
Benefits of online learning



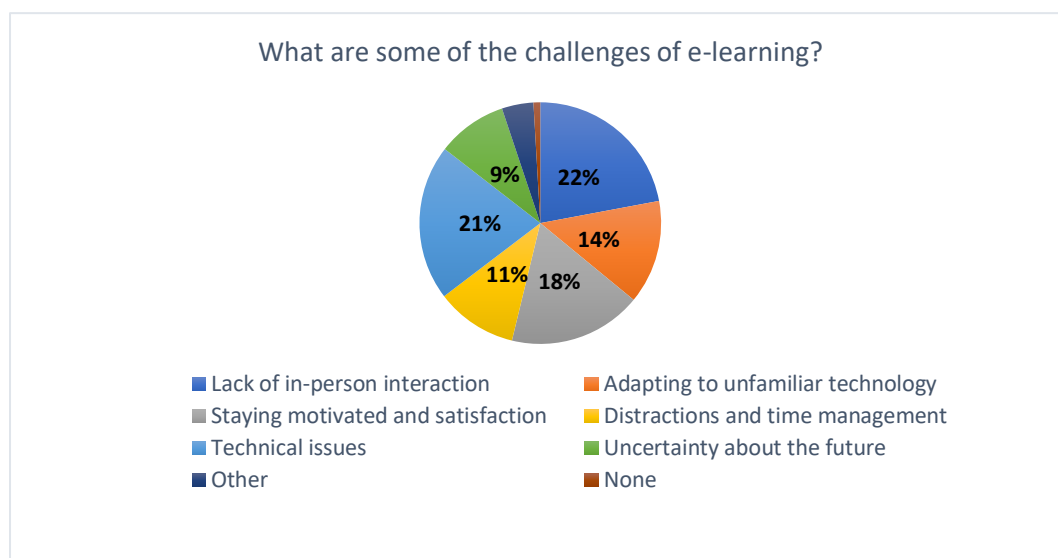
This question is to measure applying online learning now that the situation of covid-19 pandemic is normalized. Based on response of pupils and teachers 38% of them are responded for never, 43% of them rarely and 19% sometimes. Most of them have applied rarely e-learning after pandemic situation.

Figure 7

Applying online learning, when the situation of pandemic is normalised



An important point that is in the main focus of the research is about challenges of e-learning that pupils and teachers encountered. Based on data collected 18% of them vote for staying motivated and satisfied, 21% of them respond for technical issues, 22% of them for Lack of in-person interaction.

Figure 8*Challenges of e-learning*

The last question of survey is to measure the perception of pupils and teachers for statement if they consistently recommend the application of e-learning in a normalized situation. 29% of them are neither agree, nor disagree, 20% of the strongly agree, 16% agree, and 24% are disagree.

Results

This paper, set to answer two research questions: “What is the level of applying e-learning methodology before, during and after covid-19 pandemic in Albania? “, and “What are advantages/disadvantages and challenges of e-learning in the new era of normalization? ”. To answer these questions this paper has used quantitative research methodology throughout the questionnaire realized to pupils and teachers. Regarding the first research question, by analyzing data collected, identify that level of applying e-learning methodology was very low (almost 0%) in Albania middle schools. When covid-19 pandemic starts, schools prepared to adopt learning approach into e-learning on purpose to enable continuation of learning process in distance learning mode. After covid-19 pandemic, that situation is normalized the learning process continued in face to face learning mode, but also they apply e-learning in specific cases and is easy to switch in e-learning mode right now. Regarding the second research question, we identify some of the difficulties that education system face. Technical issues like bad internet connection, lack of appropriate devices, was a critical problem that most of pupils and teachers face during e-learning. Also adoptability struggle and self-motivation was a key point to

emphasise that most of pupils and teachers face many difficulties. Some of positive points that this research conclude about applying e-learning in pandemic situation was that e-learning helps pupils and teachers to improve and learn new technical skills related IT tools and platforms, and improve virtual communication and collaboration with each other. One of the most important challenges identified in this research for e-learning methodology is motivation and satisfaction of pupils and teachers and lack of in-person interaction. Although, e-learning is a good approach, that enable learning process in a comfortable and flexible way, in-person interaction is irreplaceable and extremely necessary to build human relationships and interaction especially in education domain.

Conclusion and Recommendation

This paper discuss about e-learning methodology in education field. We discussed the influence of e-learning during covid-19 pandemic situation followed by challenges and prospective of e-learning in new era of normalization. Through analyzing data we conclude that the emergency of incorporating in e-learning in learning process during covid-19 pandemic, have influenced in the changing approach against e-learning methodology by increasing significantly usage of e-learning methodology in learning process even after covid-19 pandemic, that the situation is normalized. Second prospective is related to challenges of e-learning. In this research we conclude that one of most critical points of e-learning are technical issues, motivation & satisfaction, and lack of in-person interaction. Technical issues is one of the paint that almost all pupils and teachers faced during applying e-learning like internet connection and lack of appropriate devices. In person interaction is noticed as a very important and irreplaceable relation to maintain collaborations and human interaction in the education environment. Teachers and pupils noted that they struggle to adoptability and low of motivation and satisfaction to this approach of learning. All these challenges are related with each other as a cause of lack of in-person interaction. To improve e-learning process by doing more interactive for learners and teachers, researchers and education institution need to take decision at every level of learning cycle (Rana, Rajiv, & Lal, 2014) in case to provide appropriate tools, infrastructure and methodology to apply e-learning in a more effective way. Recommendation for overall enchantment of online learning encourage on discovering methods and approaches to motivate students in learning process (Simamora, 2020). Now, e-learning is covered under a large term of technology based learning through different types of websites, learning tools and video conferencing software (Shahzad, Hassan, Aremu, Hussain, & Lodhi, 2020). We recommend techniques to keep pupils active by applying assessment, quizzes and entertainment

approach during online learning to promote challenges in order to increase motivation and satisfaction against e-learning methodology.

References

- Ananga, P. (2020). Pedagogical Considerations of E-Learning in Education for Development. *International Journal of Technology in Education and Science*, 310-321.
- Andersson, A., & Grönlund, Å. (2009). A CONCEPTUAL FRAMEWORK FOR E-LEARNING IN DEVELOPING COUNTRIES: A CRITICAL REVIEW OF RESEARCH CHALLENGES. *The Electronic Journal on Information Systems in Developing Countries*.
- Kohnke, L. &. (2020). Facilitating synchronous online language learning through Zoom. *RELC Journal*.
- Larasati, P. &. (2017). Interaction Design Evaluation and Improvements of Cozora - A Synchronous and Asynchronous Online Learning Application. *2017 7Th World Engineering Education* , (pp. 536-541).
- Prodani, R, Çobani, S, Bushati, J, & Andersons, A. (2020). An Assessment of the Factors that Influence the Use of Digital Technologies in Teaching: A Case Study. *Universal Journal of Educational Research*.
- Rana, H., Rajiv, & Lal, M. (2014). E-learning: Issues and Challenges. *International Journal of Computer Applications*.
- Shahzad, A., Hassan, R., Aremu, A., Hussain, A., & Lodhi, R. (2020). Effects of COVID-19 in E-learning on higher education institution students: the group comparison between male and female. *Quality & Quantity*.
- Simamora, R. M. (2020). The Challenges of Online Learning during the COVID-19 Pandemic: An Essay Analysis of Performing Arts Education Students. *Studies in Learning and Teaching*.
- Turnbull, D., Chugh, R., & Luck, J. (2021). Transitioning to E-Learning during the COVID-19 pandemic: How have Higher Education Institutions responded to the challenge? *Education and Information Technologies*.
- Yelland, N. T. (2008). *E-Learning: issues of pedagogy and practice for the information age*. University of Wollongong, OUW Library.

Challenges of online courses

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Abstract

The challenges of modern society are increasingly complex, and human action is supported by technology in all areas of work. Great technological advances have also affected education, which aims to prepare students for active action in the modern community. Online learning has been developing in the world for years, and today it is available to everyone and is used every day, not only in the teaching process, but also in extracurricular and self-initiated learning. Online learning encompasses all scientific disciplines and is accessible to almost all segments of society. There are numerous advantages of online learning, such as raising the quality of educational content, availability of materials, facilitated application of educational materials, multimedia learning tailored to specific needs and ways of learning. Online learning often involves the acquisition of content at a distance and is a very effective way of learning since it is not limited to a specific time and space, and can include a larger number of students. Multimedia is one of the advantages of online learning because it involves the connection of visual, auditory and audio-visual content, facilitates the understanding of abstract and complex concepts and positively affects memory and motivation to learn. Digital educational technology affects the motivation of students, but also the motivation of teachers, who facilitate the work and transfer of knowledge. To prepare for online teaching, it is important to constantly develop digital competencies of lecturers, in order to avoid possible negative aspects of online learning and multimedia in non-lifelong learning. The aim of this paper is to point out the positive and negative aspects of online learning and the impact of technology on motivation and facilitating the adoption of new content.

Keywords: network learning, e-learning, ICT technology, motivation, education

Introduction

As technology becomes more prevalent in the world, so do the ways of life and needs of people in general. Because the school's core mission is to prepare students for active action in their community, teachers and students face new, digital, challenges. From the stated needs

of society and education, new ways of organizing and implementing learning arises, whether it is self-initiated learning or learning as part of regular classes - distance learning, which is most often manifested as online learning. According to Perraton (1987), distance learning is an educational process in which the lecturer is spatially and temporally distant from the student. According to Chung (2005), e-learning is a concept that encompasses almost everything related to learning through information and communication technology, and Bakia et al. (2012) point out that distance learning is the use of electronic and telecommunications devices to communicate with students in greater distances. Marinac (2020) highlights the many benefits of online learning, such as raising the quality of educational content, availability of materials, facilitating the application of educational materials, and multimedia learning tailored to specific needs and ways of learning. Jukić (2017) considers online learning a very effective way of learning since it is not limited to a certain time and space, but can also involve a larger number of students. Teaching supported by modern and appropriate educational technologies influences student motivation (Marinac, 2020). Therefore, the aim of this paper is to show the impact of distance on the adoption of educational outcomes and the conditions that need to be met in order to achieve them. An analysis of the literature selected using the snowball method was performed (Naderifar, Goli and Ghaljaie, 2007). The importance of students' digital competencies is evidenced by the Curriculum of the cross-curricular topic of the use of information and communication technologies and the introduction of Informatics from the first grade of primary school.

Distance learning

Distance learning was experienced by all participants in the educational system during the Covid-19 pandemic, but it has been used as such much earlier. Distance learning is mainly related to digital online tools, which have become increasingly present at all levels of education in recent years. Ladan (2017) divides digital tools into media exchange tools, communication tools, collaboration tools, creative learning tools, learning material creation tools, from which various learning management systems are developed, and educational games. In order to understand the meaning and goal of distance learning, it is necessary to look at the historical overview of the development of this way of education. Zenović and Bagarić (2014) point out that distance education has been present since 1858. At this time the University of London decided that students were not required to come to the lecture. In its beginnings, this method was intended for marginalized groups in society and was known as "correspondence education" because it took place with the help of postal services. Katavić (2015) describes this period as

one-way communication where the teacher sends teaching materials to the student. Today, this approach to distance education is changing, and communication is two-way, with the teacher sending teaching materials, receiving and then sending feedback. Online learning is a special area of distance learning. In this case, student to teachers communication with the help of computers as a medium of communication. Distance learning and e-learning are often equated, and they are connected by three basic features: separation, interactive communication system, and connection by the learning triangle - technology, content and service. In the Republic of Croatia, online learning has a short history. It has its roots in the organization of teaching in study programs, with 50% of teaching hours held online (National Council for Higher Education, 2013). Katavić et al. (2018) point out that this approach to education in the Republic of Croatia is still often challenged. However, if the increasingly present information and communication tools are taken into account, this form of learning is becoming more and more acceptable. On the benefits of online learning, Katavić et al. (2018, p. 98) conclude: "Online education is an innovation that provides better educational opportunities and therefore increases the quality of education. The capacities and opportunities of online education not only contribute to the development of online materials and expertise in the online environment, but also to building a culture of critical thinking, research, creativity, synchronous and asynchronous communication and the use of multimedia materials in education. "

Teacher and student in distance learning

The role of teachers and students in online teaching is specific. The organization and implementation of online teaching require a number of additional skills, compared to the traditional approach to teaching. The role of students, who direct and independently organize their own work and learning, is also changing. Marciuš Logožar (2021) points out that online learning requires teachers to concentrate on educational outcomes, according to which they organize teaching content. It is desirable that the contents, in addition to being didactic and methodologically adapted, encourage students to further research and learn. For the adoption of the content, it is important that the students actively deal with the set content. This is exactly one of the challenges of online teaching. If one of the conditions is not met by teachers and students, educational outcomes will not be met. Furthermore, the author points out as one of the challenges is the modest knowledge of teachers about designing digital tools that will help students learn. Students take a much bigger role in online teaching because, regardless of the teaching materials, they manage the learning process themselves. Hugger and Walber (2010) highlight motivation as one of the important parameters of successful online learning. It

connects motivation with the role that students play during online teaching, ie with the model according to which students develop competencies based on their own work and research.

Numerous studies have been devoted to the issues of online teaching. Ellis (2001) and Jukić (2017) point out that the great advantages of online learning are that it exceeds the physical distance between students and teachers. Students point out the unhindered access to teaching materials as an advantage. Yughoubi et al. (2008) emphasize the flexibility of time and the rapid availability of teaching materials in online teaching. According to Mihaljević (2016), online learning does not require a special space to maintain the educational process, but not all spaces are adequately equipped for quality online learning due to poor Internet access or an insufficient number of computers. Each student determines the learning time according to his abilities, but he is also given the freedom to use the learning time for something else. The necessary data and information can be obtained quickly and easily, but it is difficult to assess which sources are reliable in the mass of information on the Internet. Digital tools are easily published and maintained online, but there is a risk of unauthorized downloads. Mujić (2007) states numerous advantages of high technology for education: mentoring and distance communication, access to real-time information, exchange of knowledge through networks and verification of acquired knowledge through the network. It is moving from geographical to virtual space, which makes education more accessible to a wider circle of people. Research on the negative consequences of online teaching highlights the lack of socialization and loneliness of students (Sit et al., 2005). Pupils and students need direct personal contact and connection, both with other colleagues and with teachers. This is, at least initially, easiest to achieve live in order to better assess other people. Furthermore, motivation and skill in managing learning time are important for online learning success (Holder, 2007). If we take into account the time lag, it is clear that information and communication technologies are increasingly developed. Therefore, one can compare research conducted several years ago and today. Nowadays, it is especially important to question the technical equipment of participants in teaching. The research of the author Jukić (2017) shows that Croatian students estimate that they are well equipped to conduct online classes, but they estimate that educational institutions are not sufficiently technologically equipped. In addition, institutions cannot provide technical support to help all students in every lecture at all times. The question arises as to whether this reduces the quality of distance learning and whether it is possible to fully achieve educational outcomes in partially met technical conditions. Bondandy et al. (2020) states that technical preconditions are necessary because the lack of technical equipment puts teaching in a rather long lag. This can cause low student outcomes, regardless of their ability and high motivation. This confirms that the basic

precondition is the technical equipment of all participants in the class, and only after that should the necessary competencies be considered that will enable the proper use of information and communication technologies. In his paper, Rudić (2021) describes a survey that shows that half of students are satisfied with online teaching, but satisfaction is closely related to good technical equipment. The other half of the students associate their dissatisfaction with technical problems or other personal reasons related mainly to learning. McBrien et al. (2009) point out the most common technical problems are difficulties with registration in the system and difficulties with sound, which sometimes causes students to miss part of the lecture or have poor interaction. Tejedor et al. (2020) looks back at Spanish schools and points out that the lives of current students are shaped by the internet and that for this reason students are expected to master digital educational tools well. Insufficient technical education of older teachers is shown to be a special problem in this research. Mishra et al. (2020) point out that online teaching for teachers has been quite demanding. The greatest efforts were focused on the development of digital competencies, communication with students and encouraging students to participate in teaching. In conclusion, numerous studies have focused on the final outcome of online teaching, with students showing better results during online teaching than during traditional teaching (Kalamković et al., 2013; Zhang et al., 2014). Mendenhall (2009), according to Berbović (2020) refutes such allegations and points out that research shows that e-learning can be effective, but not significantly more effective than the traditional approach. Russel (2020), according to Berbović (2020), based on several of his researches, concludes that traditional teaching and online teaching can be equally successful. Jukić (2017) also cites the positive impact of online teaching on faculty development and progress. The possibility of hosting foreign experts and scientists through videoconferencing is opening up, which makes the faculties more attractive to students and has the possibility of expanding the choice of courses. The author points out that this form of teaching is financially viable in the long run since the lecture hall is located online and for that reason, it is not necessary to travel. In addition, student materials are available online at all times, making it easier for universities to share materials. Learning is individualized, and the student has control over the way, strategies and pace of mastering the material. Grimes (2002) cites a large share of graphic components in multimedia content as an advantage of online learning, which makes students memorize material more efficiently, and it is known that human is a visual being who receives 90% of information from the environment visually. In a study conducted by Dukić (2011), students of Croatian universities believe that online learning should be an accompanying technique to the traditional form of teaching and that such a way of learning simplifies the educational process. They also point out that online

learning is useful for people with limited mobility. The author concludes that online learning is most common in Croatian universities in the form of using computers to create multimedia presentations, using the Internet as an additional source of information, communicating via e-mail and downloading exam materials from professors' websites. Similar results were obtained by Požgaj and Knežević (2007) where students cite avoidance of travel and traffic jams, the closeness of parents and friends, the ability to find all materials in one place, easy access to information and the possibility of education for people with reduced mobility. Research students cite the impossibility of direct communication with fellow students, the lack of direct communication with professors and the harmfulness of long work on the computer as a lack of online learning. In a study conducted by Brumini et al. (2012), students who had not attended any e-course in college at the time of the study had a less positive attitude towards online learning, and the authors cited ignorance about online learning, negative perceptions of the new and fear of additional extracurricular activities.

Digital competencies of teachers

Šejtanić (2018) conducts research and concludes that teachers have modern knowledge in the field of technology, but do not critically evaluate the information they obtain through technology. Digital competencies, in addition to knowledge and use of technology, represent the active use of technology in life, work and learning (Kolić-Vehovec et al., 2020). Given that the task of teachers is to prepare teaching materials, it is important to know the media and select them in relation to the educational outcomes he wants to achieve (Matijević and Topolovčan, 2017). Digital competencies of teachers are divided into three disciplines: general digital competencies, competencies for the application of digital technologies in teaching and competencies for school management (Žuvić et al., 2016), and the most important competence for teachers is the application of digital tools in teaching. Roncevic Zubkovic et al. (2020) emphasize the importance of a positive attitude of teachers towards technology, as a prerequisite for the development of digital competencies and the successful integration of technology in teaching. Šejtanić (2018) points out that teachers do not have enough competencies to work with technology and that they have developed technological skills on their own initiative. This is supported by the fact that many teachers have not had the opportunity to acquire digital competencies in regular teacher education. Erle (2002) points to poor preparedness in the use of educational technologies. ICLS, according to Brash Roth et al. (2013) conducts research concluding that the Republic of Croatia is working intensively on improving digital competencies. The same research indicates that teachers have a rather negative attitude towards

digital tools. The European Commission (2012) is conducting a similar study according to which there is a close relationship between teachers' attitudes and the frequency of the use of ICT in teaching (Kolić Vehovec et al., 2020). Special attention is paid to digital technology suitable for students with disabilities. Martinac Dorčić et al. (2020) point out that teachers believe that there are not enough such technologies. Since students use technologies even before starting school, it is important that teachers can guide and manage the learning process supported by ICT (Matijević and Topolovčan, 2017). It is extremely important that teachers do not replace their roles with a computer (Šejtanić, 2018). According to Berge (1995), in addition to digital skills, pedagogical competencies (orientation towards educational goals), social competencies (maintenance of two-way communication) and managerial competencies (accessibility, patience, organization) should be considered for successful distance learning. The complex role of distance learning teachers is presented in the American National Standards for the Quality of Virtual Teaching. According to the National Standards for Online Teaching (2019), it is important that teachers demonstrate professional responsibility, encourage learning through various digital tools, involve students in interactive processes and develop students' collaborative competencies, strive for student success, educate students for safe and ethical behavior online, respects individual differences of students and their different needs, evaluates and measures student progress, creates teaching materials, tools and strategies that will enable the inclusion of all students.

The curriculum of cross-curricular topics - use of information and communication technologies

In addition to the presented challenges, which are reflected in the lack of technical equipment, insufficient education of individual teachers, etc., the digital competencies of students can also be problems. In order to prevent this type of challenge, the subject of informatics has been introduced since the first grade of primary education as an elective school subject, and classes take place for 70 hours per year in primary school. Marinac (2020) describes the teaching of informatics according to the basic document, the Curriculum of the subject Informatics for primary and secondary schools. In computer science classes, students will develop abstract thinking, logical connection, algorithmic thinking, and formulate problems and their solutions. The curriculum is divided into four domains: Information and Digital Technology, Computer Thinking and Programming, Digital Literacy and Communication and e-Society. The question arises as to how to digitally literate students who do not attend computer science classes to attend distance learning classes. One of the answers is in the prescribed

Curriculum of the cross-curricular topic of the use of information and communication technology for primary and secondary schools. This document, regardless of the teaching of informatics, obliges the teacher to train students for the active use of digital educational technology during the teaching activities of any school subject: "Cross-curricular topic communication technology in all subjects, areas and at all levels of education. " (Curriculum, 2019, p. 5). This part of the paper will focus on curriculum analysis. The need for the introduction of digital tools in teaching stems from the needs of the digital age society, therefore all students need to be provided with equal and equal use of modern technology. Also, the curriculum is aimed at students with disabilities and gifted students. The main goals are to apply educational technology for school and private needs, responsible and safe use of information and communication technology, effective communication and cooperation, information evaluation and the creation of new creative content. There are four domains for achieving outcomes: (A) Functional and responsible use of information and communication technologies, (B) Communication and collaboration in the digital environment, (C) Research and critical evaluation in the digital environment, and (D) Creativity and innovation in the digital environment. environment. Domain A elaborates the outcomes according to which students acquire knowledge, skills and motivation to use technology, students learn to choose certain technologies in the right way and use digital tools. It is important to teach students to distinguish between the real and virtual worlds and how to organize their own time. Domain B includes knowledge and use of digital programs for collaborative forms of learning. Domain C imposes the acquisition of knowledge on the proper thinking and evaluation of available information and programs. Domain D considers creating a creative spirit and encouraging innovative action. In the continuation of the paper, the outcomes that need to be achieved at the end of the first and last cycle from domain A, domain B and domain C (Curriculum of the cross-curricular topic Use of information and communication technology) in primary school and compulsory education will be presented (Table 1).

Table 1*Key outcomes at the beginning and end of compulsory education*

Curriculum of interdisciplinary topics Use of information and communication technology
Key contents
1st cycle - 1st and 2nd grade
<p>Domain A:</p> <p>basic application of devices and programs</p> <p>navigating the OS user interface</p> <p>use of ready-made educational content (drawing, arithmetic, writing, reading) to support learning</p> <p>use of simple computer programs and applications intended for education</p> <p>strategies to protect computers and personal data</p> <p>password storage, not publishing personal data in a network environment</p> <p>educational content Five for net curriculum - worksheets, games, multimedia content, textbooks, manuals, virtual classroom</p> <p>computer protection (concept of virus, malware and antivirus program)</p> <p>safe and responsible use of technology</p> <p>encouraging positive patterns of behavior in the real and virtual world</p> <p>distinguishing between activities and possibilities of the virtual and real world</p> <p>health and environmental care</p> <p>stretching techniques, proper body position, distance from the screen</p> <p>responsible handling of technology (When you are not using the device, turn it off, use the device carefully and carefully ...)</p> <p>digital waste sorting and disposal</p> <p>Domain B:</p> <p>programs and devices for communication and collaboration in the digital environment</p> <p>programs that do not require registration</p> <p>educational social networks, digital collaborative learning environments, and learning management systems to support learning</p> <p>school video conferencing websites</p> <p>communication in the digital environment</p> <p>Exchanging simple text messages and short video and audio messages in synchronous and asynchronous environments</p> <p>virtual student encounters in a safe environment</p> <p>non-verbal expression with the help of pictorial representation (emoticons)</p> <p>listening to and interpreting simply received messages in a digital environment</p> <p>use of the basics of standard language in the digital environment</p> <p>videoconferencing as a form of learning and teaching (eg between schools to mark events or as part of a project)</p> <p>simple collaborative educational games</p> <p>collaborative learning in the clouds, making a simple joint work, e.g., drawings, picture books</p> <p>participation in simple projects (project teaching)</p>

appropriate behavior in the digital environment
 getting to know the basic rules of appropriate behavior on the Internet
 creating class rules
 comparison of polite behavior in a real and digital environment
 (e.g. watching short videos about online behavior)
 appropriate behavior while respecting the basic rules of polite behavior during collaborative and communication activities in the digital environment
 recognizing and respecting diversity and respecting human rights

Domain C:

simple auditory, visual, audiovisual programs and devices that students can use digital information: image, text, sound, video
 critical evaluation: who said what was said, where it was said, when it was said
 sources of information: educational games, e-picture books, e-books for children, e-magazines, e-encyclopedias for children, educational portals
 research process: action research, problem identification, research conduct
 information retrieval - what we know, what we don't know, where and how to find what we don't know in the digital environment
 information management: responsible recording of information and preparation for use

Domain D

use of creative techniques
 simple techniques for developing creativity in a digital environment (eg free speech/thought storm, humor, random concepts, asking questions, traveling in the imagination - eg in a text formatting program)
 creative problem solving
 creative expression
 way of storing content (text, image, sound) for future work
 Transforming content into the content of the same or different type: combining visual, auditory and textual content when designing new content (eg creating a digital calendar, greeting cards, invitations, etc.) using existing educational tools and programs
 transforming text into multimedia content - stories into animated (cartoon) films, stories into auditory form, etc.
 creating a common fairy tale/story, creating a picture on a given topic, creating a multimedia greeting card and invitation
 protection of property (what is allowed and what is not allowed to take over)
 ownership, license or permission marks

3rd cycle - 6th, 7th, 8th grade

Domain A

basic service to devices and programs
 devices and programs for creating and presenting content
 online programs that do not require registration (or registration by a teacher)

user program installation procedure
ways to store and organize data and content on your computer
knowledge of space capacities of devices and clouds for content storage
protection of computers and personal data
recognizing and responding to warning messages while working on a computer
computer security programs
fraud and risks when using the Internet (dangerous e-mails (phishing), dangers on social networks, in mobile applications and in real-time correspondence)
safe and responsible use of technology
the legal consequences of using illegal programs
terms of use and collection of personal data - highlight important parts, compare examples of several programs
adjusting privacy settings on social networks - show examples of social networks we use in education and examples of commercial social networks for adults (age limit 13 years)
digital identity - examples of positive and negative digital identity (celebrities, videos); examples of how to actively create your own positive identity
educational content Five for the net - worksheets, games, multimedia content, textbooks, manuals, virtual classroom
dependence on technology and its use
protection against electronic violence, how to recognize it, how to prevent it, actively oppose it and how to find a solution and who to turn to for help
analyzing concrete examples of hate speech and electronic violence and finding solutions to problems (animated stories and videos Five for the Net, examples from social networks)
health and environmental care

Domain B

programs and devices for communication and collaboration in the digital environment
-the most represented social networks, eg for communication during project work or for individualization of teaching
BYOD - the use of student devices for educational purposes
presentation programs
communication in the digital environment
presenting and presenting to a familiar audience
collaboration in the digital environment
collaboration in research learning
collaboration in the clouds, eg making e-books, multimedia presentations
appropriate behavior in the digital environment
critical appraisal of examples of polite behavior in real and digital environments
encouraging interculturalism and tolerance
an open and tolerant debate on the differences between peoples and nations

Domain C

more complex auditory, visual, audiovisual programs and devices that students can use
digital information retrieval
research process
analyze the problem, design the course of problem-solving, explore possible solutions, find
new solutions if found do not match, formulate conclusions, present the course of research
and problem solving and results
sources of digital information
message, information, data
e-journals, e-books, e-encyclopedias, educational portals that students have not used in
previous cycles, information portals, museum pages, theaters, online school catalogs
and city libraries, digitized material
independent selection of methods and tools for finding information, responsible recording of information
and storage for use
critical evaluation of digital information - why something is said, how it is said, for whom it is intended, what is
left out, what techniques are used to attract attention
the hidden meaning of messages, prejudices in information
facts: attitudes in information, values and beliefs as the content of information
elements of assessing the value of digital information - formal and substantive:
recognition of information smog/garbage, recognition criteria
display of beauty in the digital environment
interpretive message frames
online and mobile advertising
surreptitious advertising
digital information management
ways to transform information:
a retelling of information in audio format, audiovisual and multimedia format and its written retelling with
citation
literal citation of information with its source (citation and authorship), plagiarism

Domain D

use of creative techniques
content reshaping
creative problem solving
creative expression
recording an experiment on a subject and publishing it on the school's website
recording experiences from fieldwork or a rare craft and posting them on the school's website
use spreadsheets, smart maps, concepts, movies, websites, or collaboration and communication programs to
creatively solve simpler problems
creation of e-books, e-posters, animated or moving presentations, musical compositions and their publication
making and publishing a video story on a given topic on school websites

recording, editing and publishing a play by a drama group or sports competition/dance on the school's website
creation of a digital school newspaper in a simpler program and publication on school websites
photographing phenomena in nature and making videos of the time course and publishing it on school websites
creating an e-portfolio and adding your own works to it • protection of property (artwork, scientific work,
technical and cartographic) and types of copyright (moral, property)
basic provisions of the legislation for ownership and sharing of content
application of the permission mark for use on one's own digital work

Conclusion

Online learning and digital educational technology have become indispensable parts of the education system. They are increasingly being developed in practice and in official documents, which is evident from the cross-curricular topic presented. From analysis of that document it can be concluded that after completing compulsory education, every student should be digitally literate. During primary education, students will constantly, gradually develop their information and communication technologies - from learning about computer equipment to safe and responsible participation in the virtual world. The teaching process will encourage creativity and innovation, evaluation of various sources of information, problem-solving, adoption of ethical issues in the field of information technology and information retrieval, communication skills and collaborative learning and management of learning and personal development. Also, opinions of educational scientists are divided, but everyone will agree that successful online teaching requires meeting all prerequisites: technical equipment, motivation to learn, mastery of information and communication technologies, both teachers and students, and high competence of teachers in the pedagogical and didactic field. The starting point for successful online teaching is the digital competencies of teachers. This implies knowledge and active use of information and communication technology.

Digital competence implies confident and critical management of information and communication technology. Basic digital skills are the use and operation of a computer, which requires creativity and develops innovation. These are skills that include the ability to search, collect and process data. Information and communication technology requires a critical and reflective attitude towards information and responsibility in publishing new data (Sunara, 2021). It is necessary to look at the conditions that online teaching requires, both from students and from teachers. Since the teacher is the organizer of the teaching process, he is expected to know and use digital tools, respect the individual needs of each student and actively send feedback, monitor student work, and evaluate. Before online classes, it is important that

students master the basic information and communication technologies, which will enable them to actively participate in the teaching process and adopt new content.

References

- Bakia, M., Shear, L., Toyama, Y., & Lasseeter, A. (2012). Understanding the Implications of Online Learning for Educational Productivity. Office of Educational Technology, US Department of Education.
- Berbović, M. (2020). Online nastava za vrijeme koronavirusa: analiza primjene računalnih programa u online nastavi u RH [Online teaching during coronavirus: analysis of the application of computer programs in online teaching in the Republic of Croatia]. Masters thesis. Filozofski fakultet. Sveučilište u Rijeci.
- Berge, Z. L. (1995). Facilitating computer conferencing: Recommendations from the field. *Educational technology*, 35(1) 22-30.
- Bogdandy, B., Tamas, J., & Toth, Z. (2020.). Digital Transformation in Education during COVID-19: a Case Study. *IEEE*. DOI: 10.1109/CogInfoCom50765.2020.9237840
- Braš Roth, M., Markočić Dekanić, A., & Ružić, D. (2013). ICILS, Priprema za život u digitalnom dobu, međunarodno istraživanje računalne i informacijske pismenosti [Preparing for life in the digital age, international research on computer and information literacy]. Zagreb: ITG d.o.o.
- Brumini, G., Mavrinac, M., Brumini, M., Špalj, S., & Blagović, B. (2012). Development and Validation of a Questionnaire Measuring Attitudes towards e-learning among University Students. *Medicina Fluminensis*, 40(1), 48-56.
- Chung Q. B. (2005). Sage on the Stage in the Digital Age: The Role of Online Lecture in Distance learning, *The Electronic Journal of e-Learning*, 3(1).
- Dukić, D. (2012). E-učenje: percepcija studenata Sveučilišta Josipa Jurja Strossmayera u Osijeku [E-learning: the perception of students of the Josip Juraj Strossmayer University in Osijek]. *Informatologia*, 44(2). 94-100.
- Ellis, A. E. (2001). Student-centered collaborative learning via face to face and asynchronous online communication: what's the difference? Faculty of Information Technology. Australia: Monash University.
- Earle, R. S. (2002). The Integration of Instructional Technology into Public Education: Promises and Challenges. *Educational Technology*, 42(1), 5-13.
- Grimes, E. B. (2002). Student perceptions of an online dental terminology course. *Journal of Dental Education*. 66(1), 100-107.
- Holder, B. (2007). An investigation of hope, academics, environment and motivation as predictors of persistence in higher education online programs. *The Internet and higher education*, 10(4), 245-260.

- Hugger, K. U, & Walber, M. (2010). *Digitale Lernwelten. Konzepte, Beispiele und Perspektiven*. Wiesbaden: VS Verlag.
- Jukić, D. (2017). Tehnička pripremljenost i motiviranost studenata hrvatskih sveučilišta za online oblik nastave [Technical readiness and motivation of students of Croatian universities for online teaching]. *Life and school: journal for the theory and practice of education*, 63(1), 93-102.
- Kalamković, S., Halaši, T., & Kalamković, M. (2013.). *Distance Learning Applied in Primary School Teaching*. *Croatian Journal of Education*, 15(3), 251-269.
- Katavić, I. (2015). Online učenje: jeftiniji i jednostavniji način za stjecanje novih znanja i vještina [Online learning: a cheaper and easier way to acquire new knowledge and skills]. *Lider*.
- Katavić, I., Milojević, D. & Šimunković, M. (2018). Izazovi i perspektive online obrazovanja u Republici Hrvatskoj [Challenges and perspectives of online education in the Republic of Croatia]. *Education for Entrepreneurship - E4E: International Journal of Education for Entrepreneurship*, 8(1), 95-107.
- Kolić-Vehovec, S., Vuković, A. & Mehić, N. (2020). Uvođenje suvremenih tehnologija u učenje i poučavanje [Introduction of modern technologies in learning and teaching]. In: S. Kolić-Vehovec (Ed.) *Uvođenje suvremenih tehnologija u učenje i poučavanje: istraživanje učinaka pilot-projekta e-Škole* [Introduction of modern technologies in learning and teaching: research of the effects of the e-School pilot project]. Rijeka: Sveučilište u Rijeci.
- Ladan, A. (2017). *Web 2.0 alati u razrednoj nastavi* [Web 2.0 tools in the classroom]. Učiteljski fakultet. Sveučilište u Zagrebu.
- Marciuš Logožar, K. (2021). *Nastava na daljinu (online nastava) usmjerena na učenika* [Distance learning (online teaching) aimed at students]. *Napredak : Journal of Interdisciplinary Research in Education*, 162(3-4), 345-369.
- Marinac, A. (2020). *Active learning by using information and communication technologies as a part of modern teaching*. Mauritius: GlobeEdit.
- Martinac Dorčić, T., Kalebić Maglica, B., & Miletić, I. (2020). Uvođenje suvremene tehnologije u učenje i poučavanje učenika s teškoćama u razvoju [Introduction of modern technology in learning and teaching students with disabilities]. In: S. Kolić-Vehovec (Ed.) *Uvođenje suvremenih tehnologija u učenje i poučavanje: istraživanje učinaka pilot-projekta e-Škole* [Introduction of modern technologies in learning and teaching: research of the effects of the e-School pilot project]. Rijeka: Sveučilište u Rijeci.
- Matijević, M., & Topolovčan, T. (2017). *Multimedijska didaktika* [Multimedia didactics]. Zagreb: Školska knjiga.
- McBrien, J. L., Cheng, R., & Jones, P. (2009). Virtual spaces: Employing a synchronous online classroom to facilitate student engagement in online learning. *The International Review of Research in Open and Distributed Learning*, 10(3).

- Mendenhall, A. (2009). Distance-Learning. *Journal of Natural Resources and Life Sciences Education*, 38, 82-86.
- Mihaljević, J. (2016). E-learning and the Croatian language. *Croatian language*, 3, 24-27.
- Mishra, L., Gupta, T., & Shree, A. (2020.). Online teaching-learning in higher education during lockdown period of COVID-19 pandemic. *International Journal of Educational Research Open*, 1. DOI: 10.1016/j.ijedro.2020.100012
- Mujić, N. (2007). Education as the most significant substruction on the path to knowledge society. *Informatologia*, 40(4), 289-294.
- Naderifar, M., Goli, H & Ghaljaie, F. (2007). Snowball sampling: A Purposeful Method of Sampling in Qualitative Research. *Strides of Development in Medical Education*, 14(3), 1-4.
- National Council for Higher Education (2013). Kriteriji za vrednovanje online studija [Criteria for evaluating online studies]. http://www.unizg.hr/fileadmin/rektorat/Studiji_studiranje/Studiji/e-ucenje/kriteriji_online/kriteriji_za_vrednovanje_online_kolegija_doneseno.pdf
- National standards for quality online teaching (2019). www.nsqol.org.
- Požgaj, Ž., & Knežević, B. (2007). E-Learning: Survey on Students' Opinions. 29th International Conference on Project: Innovations in Supply Chains in Conditions of Retail Internationalization (UNI-ZG) (pp. 381-386).
- Perraton, H. (1987). Theories, generalisation and practice in distance education. *Open learning*, 2(3), 3-12.
- Rončević Zubković, B., Kolić-Vehovec, S., & Pahljina-Reinić, R. (2020). Odnos s motivacijskim i emocionalnim čimbenicima [Relationship with motivational and emotional factors]. In: S. Kolić-Vehovec (Ed.) *Uvođenje suvremenih tehnologija u učenje i poučavanje: Istraživanje učinaka pilot-projekta e-Škole* [Introduction of modern technologies in learning and teaching: Research of the effects of the e-School pilot project]. Rijeka: Sveučilište u Rijeci.
- Rudić, V. (2021). *Odvijanje online nastave u uvjetima pandemije* [Conducting online classes in a pandemic]. University in Zagreb.
- Sit, J. W., Chung, J. W., Chow, M. C. & Wong, T. K. (2005). Experiences of online learning: student's perspective. *Nurse education today*, 25(2), 140-147.
- Sunara, M. E. (2021). *Digitalne kompetencije učitelja za primjenu e-učenja u osnovnoj školi* [Digital competencies of teachers for the application of e-learning in primary school]. Masters thesis. Odsjek za pedagogiju. Sveučilište u Splitu.
- Šejtanić, S. (2018). Digitalne kompetencije nastavnika razredne nastave [Digital competencies of primary school teachers]. In: E. Dedić Bukvić & S. Bjelan-Guska (Eds.) *Ka novim iskoracima u odgoju i obrazovanju: Zbornik radova s 2. međunarodne znanstveno-stručne konferencije* (pp. 554-565). Sarajevo: Filozofski fakultet Univerziteta u Sarajevu.
- Tejedor, S., Cervi, L., Pérez-Escoda, A., & Jumbo, F. T. (2020.). Digital Literacy and Higher Education during COVID-19 Lockdown: Spain, Italy, and Ecuador. *Publications 2020*, 8(4), 48.

- Zenović, I., & Bagarić. I. (2014). Trendovi u otvoreno učenju na daljinu u svetu i kod nas [Trends in open distance learning in the world and in our country]. Paper presented at Sinteza 2014 – Impact of teh Internet on Business Activities in Serbia and Worldwide.
- Zhang, D., Zhao, L., Zhou, L., & Nunamaker, J. J. (2014.). Can E-Learning replace Classroom Learning? *Communications of the ACM*, 47(5), 74-79.
- Yaghoubi, J., Malekmohammadi, I., Iravan, H., Attaran, M., & Gheidi, A. (2008). Virtual student's perceptions of e-learning in Iran. *TOJET: Turkish Online Juornal od Educational Technology*, 7(3), 89-95.

Online Administration and Psychometric Characteristics of the Croatian Version of the 7C Vaccination Readiness Scale and The Attitudes Against Socializing With (Non-) Vaccinees Scale

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Abstract

The Croatian version of the 7C vaccination readiness scale and the new Attitudes Against Socializing with (Non-) Vaccinees Scale have been applied online. The aim of this study was to explore their psychometric properties and whether online application is justified. The study involved 1806 participants (76.3% female) with an average age of 35.95 years ($SD = 11.66$). In order to examine the psychometric characteristics of the 7C vaccination readiness scale, a confirmatory factor analysis was conducted with the assumption of a bifactor model. Based on the modification indices, the final model suggests the measurement error covariances for the first two Complacency items, which both address the need for vaccination, and for the first and third Compliance items, which both address the need to punish non-vaccinees. This final model has a satisfactory fit ($\chi^2 = 1728.24$; $p < .001$; GFI = 0.910; CFI = 0.958; TLI = 0.951; RMSEA = 0.069 (0.066-0.072)). The reliabilities of the factors are satisfactory (.73 to .97) with the exception of the reliability for the Calculation (.60), which will be further commented on in the paper. An exploratory factor analysis was performed for the Attitudes Against Socializing with (Non-)Vaccinees Scale, which had 13 items in its original form. The analysis suggested a version with 11 items distributed in Attitudes against socializing with non-vaccinees (eight items; $\alpha = .93$) and Attitudes against socializing with vaccinees (three items, $\alpha = .70$) and explained 66.89% of the variance. The data suggest satisfactory psychometric characteristics of these scales and the appropriateness of their online application. The challenging items and the possibilities of eliminating these challenges will be discussed thoroughly.

Keywords: online administration, vaccination, psychometric properties

Introduction

The worldwide occurrence of the COVID-19 disease at the end of 2019 and the declaration of the pandemic on March 11, 2020 (WHO, 2020) have greatly changed the way of life. Over six million people have died in just over two years, and over 400 million have recovered (Worldmeters, n.d.). During 2020, people have adhered to measures known for decades, and even centuries, to be effective in the fight against infectious diseases - quarantine, lockdown, maintaining physical distance, maintaining hygiene, and wearing medical masks. At the same time, hope was expressed that the vaccine would be found and people would return to their normal way of life. The first vaccines in the EU were approved on December 21, 2020 (Mehzer, 2020), and in Croatia, vaccination began on December 27, 2020 (HZJZ, n.d.). Until January 6, 2022, the date when our research began, 66.50% of the adult population in Croatia was vaccinated, i.e. only 55.83% of the total population (Koronavirus, n.d.). Two months later, on March 6, 2022, the number of vaccinated people increased by just over 1% of both adults and the total population. After a correction due to a decrease in the total population according to the 2021 census, the vaccination rate was adjusted to 59.34% of the total population (Koronavirus, n.d.). During 2020, it was assumed that, in order to establish herd immunity, about 67% of the population should be protected (Fontanet & Cauchemez, 2020). It is evident that vaccination coverage in Croatia is well below that level.

With the advent of the vaccine, the Decision on the establishment of a national system for issuing EU digital COVID certificates (NN 60/21) was declared, and on June 1, 2021, this certificate was introduced in Croatia. Although it was primarily introduced for the purpose of facilitated travel, due to the worsening of the epidemiological situation, in November 2021, The Civil Protection Headquarters has issued a decision on the mandatory Covid-19 certificate for those employed in health and social care, as well as for the users of their services (NN 121/21). These decisions caused significant dissatisfaction among the population, which resulted in protests ("Great protest against", 2021), filing lawsuits with the Constitutional Court (NN 25/22) and a referendum initiative ("Most declared...", 2022).

Given all of the above, it is clear that the issue of vaccination is important, but also controversial. The SAGE Working Group on Vaccine Hesitancy was founded in 2012 to promote vaccination, and they recognized that the term hesitancy itself has a negative connotation (MacDonald, 2015). However, as they determined that the term was already in wide use, they kept it. They pointed out that vaccine hesitancy is a continuum, not a dual division between the opponents and the supporters of vaccination. Accordingly, they

recognized that people who accept all vaccines and those who refuse all vaccines are at the ends of the continuum. On the fringe of a group that accepts all vaccines is a subgroup that, although it accepts vaccines, is not sure about vaccination. Accordingly, on the fringe of a group that refuses all vaccines is a subgroup that, while refusing vaccination, is unsure about its decision. In the central part of the continuum are people who accept some, while rejecting other vaccines.

Models of vaccination readiness components have been developed over the last decade. The first version is the 3C model (WHO EURO Working Group on Vaccine Communications, 2011). This model emphasizes the significance of the components *confidence*, that the vaccine is effective and safe including trusting the system that develops and creates the vaccines, and to policy creators' benevolent motives, *complacency*, which refers to situations in which a person estimates that it is unlikely to be infected and therefore considers the vaccine unnecessary, while *convenience* refers to the perception of availability and accessibility of the vaccine. Then *calculation* or the assessment of the benefit and risk of vaccination is added (Betsch et al., 2015; 4C model). A few years later, *collective responsibility* was included in the model, i.e. the willingness to protect others by getting the vaccine, and the name was changed for convenience to *constraints* (Betsch et al., 2018; 5C model). Geiger et al. (2021) created the 7C model by adding *conspiracy*, i.e. the belief in conspiracy theories and false news, and *compliance* or acceptance of societal vaccination monitoring with certain consequences for non-vaccination.

Despite the previously mentioned indication that attitudes towards vaccination are a continuum, it is clear that the introduction of administrative provisions such as vaccine certificates stresses the difference between groups that have extreme attitudes towards vaccination. While most research focuses on the antecedents and correlates of vaccination, there is a lack of research that studies how these divisions have affected the interactions of different groups with opposing attitudes toward vaccination. Based on the Social Identity Theory (Tajfel, 1978; Tajfel & Turner, 1979), we can expect that in situations of salient group affiliation, this aspect of social identity and group norms associated with that group will be more significant. There will be more pronounced conflicts with the "out-group" (a group that we perceive as opposing us). Henkel et al. (2022) showed that clear identification with a group of vaccinees or non-vaccinees contributes to polarization in vaccination readiness. According to the Social Identity Theory, the preference of our own group is expected, and less liking of the out-group. Still, we have not found research that explores this in the context of groups of (non-)vaccinees.

Therefore, in this study we wanted to test the possibilities of online application of the translated version of the 7C Vaccination Readiness Scale and the newly developed Attitudes

Against Socializing with (Non-)Vaccinees Scale. We hypothesized that the 7C Vaccination Readiness Scale would confirm the factor structure determined in the German sample (Geiger et al., 2021) and have satisfactory psychometric characteristics, while the Attitudes Against Socializing with (Non-) Vaccinees Scale and its psychometric characteristics were approached exploratory. Also, we wanted to explore whether groups with different vaccination statuses (both previous behavior and behavioral intention for future vaccination) differ in terms of vaccination readiness (overall score) and attitudes against socializing with (non-)vaccines. In accordance with the 7C model, and the Social Identity Theory, we expected that groups with more vaccines received and groups with higher intent to receive vaccines in the future will have higher vaccination readiness, and will be more against socializing with non-vaccinees. Those who did not get vaccinated and refuse vaccination will be more against socializing with vaccinated people.

Method

Participants

The study involved 1806 participants (76.3% women, 23.0% men and 0.7% who choose others) with an average age of 35.95 years ($SD = 11.66$, age range 14 to 77 years). Participants came from all counties in Croatia and the most represented participants were from Osijek-Baranja County (27.1%), the City of Zagreb (19.6%) and the Primorje-Gorski Kotar County (12.5%). The sample is dominated by participants with higher levels of education (only 0.9% of participants have completed elementary school, 32.5% have completed high school, while 13.1% have completed undergraduate studies, 4.9% have completed vocational studies, 39.2% have completed graduate studies, and 9.1% completed postgraduate studies). Almost half (46.5%) of the participants are married, and slightly more than 70% of the participants are employed (permanently, temporarily or part-time).

Instruments

Socio-Demographic Measures and General Data

Participants provided information on their sex, gender, age, county in which they live, religious and political preferences, employment status, self-assessed socio-economic status, Covid-19 recovery status, vaccination status, motives for (non)vaccination. Vaccine status was used for this study. It included informations about previous vaccinations (behavior) and (behavioral) intentions for future vaccination against Covid-19 and was measured at eight levels (see Appendix A and Appendix B)

The 7C of Vaccination Readiness Scale

The 7C of Vaccination Readiness Scale (Geiger et al., 2021) has been adapted and extended from the 5C Scale (Betsch et al., 2018). According to its name, it strives to measure the components which are assumed to increase or decrease the likelihood of a person agreeing to vaccination. Each component was measured using three items (21 items in total). Components derived from the 5C Scale are Confidence, Complacency, Constraints, Calculation, and Collective Responsibility, and Geiger et al. (2021) added Compliance, and Conspiracy. Answers are given on a seven-point Likert scale (1 - *strongly disagree*, 7 - *strongly agree*), and some answers were recoded so the higher results always indicate greater vaccination readiness. The scale was adapted to specifically focus on COVID-19 vaccination. Croatian translation was performed by two native Croatian speakers individually, after which a consensus meeting took place. The Croatian version was translated back to English.

Attitudes Against Socializing with (Non-)Vaccinees Scale

Attitudes Against Socializing with (Non-)Vaccinees Scale is an attitudes scale prepared for the purposes of this research. It was designed by the authors of this research, who designed 13 items that measure attitudes against socializing with vaccinated and unvaccinated people. Participants responded on a five-point response scale (1 - *not applicable to me at all*, 5 - *fully applicable to me*). The higher result indicate higher attitude against socializing with the target group.

Procedure

The research was conducted online and all questionnaires were prepared in a Google form. The link to the research was published as a social media post by the researchers. The sampling method was convenience sampling. For the purposes of this manuscript, data from The 7C of Vaccination Readiness Scale, Attitudes Against Socializing with (Non-) Vaccinees Scale and Data on vaccination against COVID-19 were used. At the beginning of the research, the participants gave their informed consent to participate. The survey was conducted from January 6 to January 13, 2022.

Results

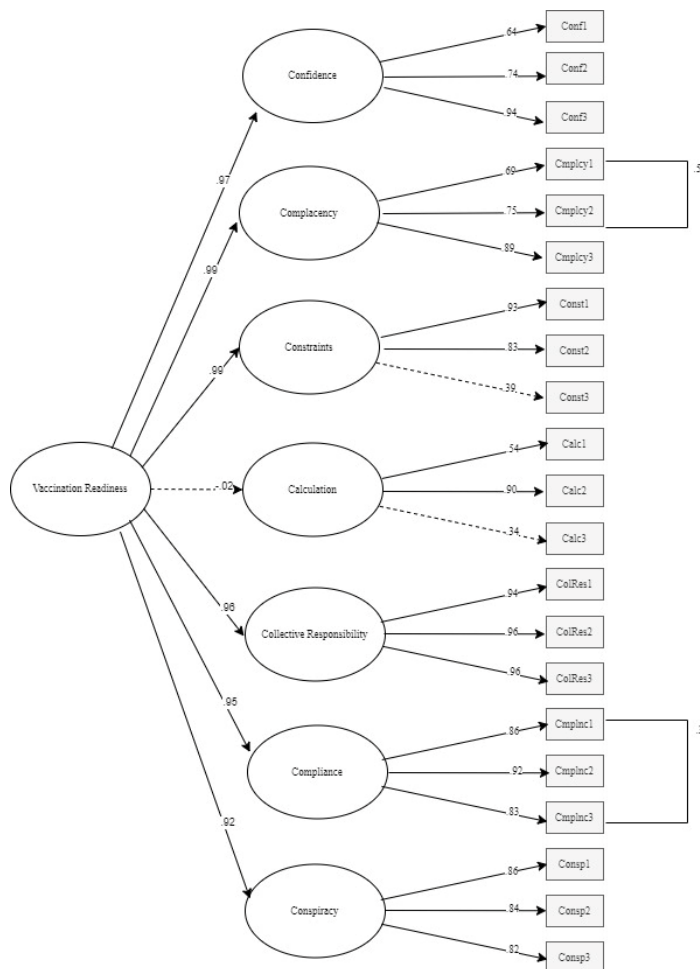
To verify that the factor structure of The 7C of Vaccination Readiness Scale found in previous studies (Geiger et al., 2021), a confirmatory factor analysis (CFA) was performed. The results are shown in Figure 1.

The initial model is $\chi^2 = 2607.55$; $p < .001$; GFI = 0.866; CFI = 0.934; TLI = 0.923; RMSEA = 0.086 (0.083-0.089), ie χ^2 and GFI values indicated an unsatisfactory fit model.

Based on modification indices and insignificant loading of Calculation on the general factor, additional CFAs were conducted. First, a CFA without Calculation was conducted, but then the fit model was even weaker. Therefore, this factor is retained in the final model. Furthermore, the measurement errors for the items Complacency 1 and Complacency 2, and Compliance 1 and Compliance 3 were related. Two Complacency items both address the need for vaccination, and two Compliance items both address the need to punish non-vaccinees. The fit model for this final model was satisfactory ($\chi^2 = 1728.24$; $p < .001$; GFI = 0.910; CFI = 0.958; TLI = 0.951; RMSEA = 0.069 (0.066-0.072)).

Figure 1

Results of Confirmatory Factor Analyses



Note: Factor loadings are shown on the arrows, and correlations among items whose measurement errors were connected on right side. Dotted lines are used for non-significant loadings or loadings below .40.

According to the CFA results, descriptive statistics for individual factors were calculated and shown in Table 1. The results of the Kolmogorov-Smirnov test are significant and indicate that the distribution deviates from normal. Skewness and kurtosis values are within

the range -3 to +3 for skewness, and -10 to +10 for kurtosis. According to Brown (2006), these results indicate the possibility of using parametric statistics. Except for factor calculation, the reliability of the factors is satisfactory. The reliability for the Calculation is lower than the recommended value of .70.

Table 1*Descriptive Statistics for 7C Factors*

Factor	N of items	M	SD	Min-max	Alpha	K-S test	Skewness	Kurtosis
Confidence	3	10.71	5.59	3-21	.81	.10**	.08	-1.23
Complacency	3	14.04	5.90	3-21	.87	.13**	-.42	-1.09
Constraints	3	12.86	5.53	3-21	.74	.16**	-.08	-1.16
Calculation	3	11.67	4.81	3-21	.60	.08**	.10	-0.72
Collective responsibility	3	12.70	7.33	3-21	.97	.16**	-.20	-1.64
Compliance	3	9.79	6.66	3-21	.93	.19**	.41	-1.38
Conspiracy	3	13.31	5.75	3-21	.88	.11**	-.33	-1.11

Note: ** $p < .01$

Furthermore, Table 2 shows the correlations between the factors. Except for the Calculation factor, whose correlations with other factors are low, all other factors are highly correlated with each other. Therefore, it would be justified to calculate the total result. Although the CFA confirmed the distribution by factors, the high correlation of the factors indicates that these factors measure probably the same occurrence – Vaccination Readiness.

Table 2*Correlations Between 7C Factors*

Factor	1	2	3	4	5	6	7
Confidence	-	.79**	.04	.80**	.80**	.80**	.74**
Constraints		-	.11**	.82**	.84**	.79**	.81**
Calculation			-	.11**	.03	.10**	.04
Compliance				-	.84**	.74**	.76**
Collective responsibility					-	.80**	.82**
Conspiracy						-	.80**
Complacency							-

Note: ** $p < .01$

Furthermore, an exploratory factor variance (Principal Axis Components) was performed on the Attitudes Against Socializing with (Non-) Vaccinees Scale. Table 3 shows the Eigenvalues and the percentage of explained variance for the isolated components for the

two versions (with 13 and with 11 items). Table 4 shows the factor loads for two factors separately for versions with 13 and 11 items. It can be seen from the table that the two items were distributed on two factors and were therefore ejected and a version with 11 items was created.

Table 3

Extracted Principal Components with Eigenvalues, Percentage of Explained Variance, and Parallel Analysis Criterion

Component	13 items version			11 items version		
	Initial Solution	Eigenvalue	Parallel Analysis	Initial Solution	Eigenvalue	Parallel Analysis
	% of Variance Explained		95th Percentile of Random Eigenvalues	% of Variance Explained		95th Percentile of Random Eigenvalues
	1	47.45%	6.17	1.17	51.10	5.62
2	15.80%	2.05	1.13	15.79	1.74	1.12

Table 4

Pattern Matrix for Attitudes Against Socializing with (Non-) Vaccinees Scale Factor Analyses

Items (Croatian/English)	Components in 13 items version		Components in 11 items version	
	1	2	1	2
	Izbjegavam druženje s prijateljima koji nisu cijepljeni./ I avoid hanging out with friends who haven't been vaccinated.	.88		.89
Razmišljam o tome hoću li pristati na neku aktivnost s drugim ljudima ovisno o tome jesu li oni cijepljeni ili ne./ I think about whether I will agree to some activity with other people depending on whether they are vaccinated or not.	.86		.87	
Ne želim se družiti s necijepljenim ljudima./ I don't want to hang out with unvaccinated people.	.85		.85	

Table 4 -continued

Pattern Matrix for Attitudes Against Socializing with (Non-) Vaccinees Scale Factor Analyses

Svoje uobičajene aktivnosti (npr. odlazak na kavu) odrađujem samo sa cijepljenim ljudima./ I only do my usual activities (eg going for coffee) with vaccinated people.	.84		.85	
Dijelim ljude na cijepljene i necijepljene./ I divide people into vaccinated and unvaccinated.	.82		.82	
Jako sam opterećen/opterećena time je li neka osoba iz moje okoline cijepljena./ I am very burdened by whether a person from my environment has been vaccinated.	.80		.80	

Prekinuo/prekinula sam neka prijateljstva zbog toga što te osobe nisu bile cijepljene./ I broke off some friendships because those people weren't vaccinated.	.73	.74
Podjela ljudi na cijepljene i necijepljene može pomoći u smanjenju pandemije COVID 19./ Dividing people into vaccinated and unvaccinated can help reduce the COVID pandemic 19.	.64	.65
Ne želim se družiti s cijepljenim ljudima. (R)/ I don't want to hang out with vaccinated people. (R)	.63	.67
Izbjegavam druženje s prijateljima koji potiču druge na cijepljenje (R)/ I avoid hanging out with friends who encourage others to get vaccinated (R)	.69	.75
Izbjegavam druženje s ljudima koji su cijepljeni i imaju Covid potvrde. (R)/ I avoid hanging out with people who are vaccinated and have Covid certificates. (R)	.73	.76
<i>Nije mi važno je li netko cijepljen ili ne./ I don't care if someone is vaccinated or not.</i>	-.58	-.30
<i>Prekinuo/prekinula sam neka prijateljstva jer su se te osobe cijepile. (R)/ I broke off some friendships because those people got vaccinated. (R)</i>	-.52	.58

The total results on the factors were calculated as the average of the results on the items belonging to each factor. In order to perform factor analysis, the items from Table 4 that have (R) behind were recoded. The correlation between the factors is $-.21$, which indicates that there is no basis for calculating the total result. Therefore, the result for factor 2 (attitudes against socializing with vaccinated people) was calculated on original results (non-recoded) and this result was used in further analyses (higher result means lower willingness to socialize with vaccinees). A higher score on factor 1 (attitudes against socializing with non-vaccinees) indicates less willingness to socialize with unvaccinated people. Table 5 shows descriptive statistics for these two factors. It can be seen that the normality of the distribution for the first factor is satisfactory, while it is significantly impaired for the second factor. The first factor also has a high reliability while the reliability of the second factor is low.

Table 5

Descriptive Statistics and Reliability Coefficients for Attitudes Against Socializing with (Non-) Vaccinees Scale

Attitudes against socializing with (non-) vaccinees	N of items	M	SD	Min-max	Alpha	K-S test	Skewness	Kurtosis
(non-) vaccinees	8	1.56	0.87	1-5	.93	.26**	1.82	2.60
vaccinees	3	1.25	0.56	1-5	.62	.39**	3.35	13.92

Note: ** $p < .01$

In order to explore whether groups with different vaccination statuses (both previous behavior and behavioral intention for future vaccination) differ in terms of vaccination readiness (overall score) and attitudes against socializing with (non-)vaccinees, a series of univariate ANOVAs was conducted. All resulted in significant *F*-ratios, and Appendix B shows the significant result of the post-hoc analysis (Bonferroni test, which was chosen since there were multiple comparisons) and the direction of the differences. It can be seen that the vaccination readiness increases with the increase in the number of doses that the participants received, but also depending on whether they intend to receive the next dose(s). Thus, for example, a group that has received one dose and intends to receive the next two doses has a higher result in vaccination readiness than a group that has received two doses and does not plan to receive a booster. Also, participants who have not been vaccinated but intend to do so have higher results in vaccination readiness than those who have been vaccinated once and do not intend to receive the next vaccines.

All participants disagree (low scores indicate that this 1 - *does not apply to them at all* or 2 - *mostly does not apply to them*) that they should avoid socializing with (non-) vaccinees. Yet participants who received the booster were somewhat more willing than other groups to avoid socializing with non-vaccinees. Participants who received two doses and plan to receive a booster are slightly more willing to avoid socializing with non-vaccinees than the two groups who have not been vaccinated and the other two groups who have been vaccinated once or twice and do not intend to take the vaccine in the future. Participants who weren't vaccinated and don't intend to get vaccinated were slightly more willing to avoid socializing with vaccinees than the group that received the booster and the group that received two doses and plan to receive the booster.

Discussion

This study explored if the factor structure of the 7C Scale was consistent with that obtained by Geiger et al. (2021). The CFA has confirmed the factor structure, however the factor Calculation is not related to the general factor and has low reliability. Geiger et al. (2021) found that items were connected with associated factors even after controlling for association with the general factor vaccination readiness. On the other hand, in our research we obtained an extremely high correlation of factors (with the exception of Calculation), which is why it is justified to continue to use the overall result (i.e., different factors measure very similarly or the same, that is, they measure general readiness for vaccination). The two items proved to be unrelated to their factors (Constraints and Calculation). These are "Sometimes I miss the

COVID-19 vaccination because vaccination is bothersome" and "For each vaccine I think carefully about whether I need it or not." The first item was pointed out by the participants during the research. They pointed out that vaccination is not a routine action like brushing their teeth and the wording might be inappropriate "sometimes". Accordingly, Rees et al. (2021), as can be seen from their additional materials, changed this item to "I might miss out on getting vaccinated against COVID-19 because vaccination is bothersome" (although the official version of the questionnaire contains the original version used in research).

The scale of attitudes against socializing with (non-) vaccinees was shortened through exploratory factor analysis to 11 items distributed in two factors, with the second factor showing lower reliability and distribution of data that deviates from the normal distribution. Additional analyses showed that people who received a booster dose and those who received two doses and have the intention to receive a booster were slightly more willing to avoid socializing with non-vaccinees. However, it should be noted that "somewhat more willing" means that their response to such rejection behaviors was that it "mostly did not apply to them" while other groups felt that it did "not apply to them at all". Similarly, those who have not been vaccinated are somewhat more willing to reject socializing with vaccinees than those who have received two doses and intend to receive a booster and than those who have received a booster.

Regarding the differences in vaccination readiness between eight groups with different vaccination status and different intentions for future vaccinations, both proved to be important. In general, those who received more doses and those who expressed an intention to receive the next dose also had a higher score on the vaccination readiness scale compared to the non-vaccinated or less vaccinated groups, and the groups that have lower intention to receive the next dose or don't want the vaccine at all.

This research has certain limitations. Primarily challenging is the sampling and autoselection of participants. Namely, the fact that in eight days 1806 people decided to participate in the research, as well as that in the first five hours of the research (from 19:00 to midnight on January 6, 2022) 647 participants filled out questionnaires speaks of the great motivation of the participants to participate in this research. It is to be expected that the most motivated were those participants who have extreme attitudes towards vaccination. Therefore, it would be important to repeat this research on a representative sample. Problems with some items and factors were already mentioned, and before future administration, additional effort should be done to improve these questionnaires.

Nevertheless, the results showed that it is appropriate to conduct this research online, and it would be important in the future to provide a representative sampling.

In conclusion, the online application of the questionnaire proved to be adequate. Furthermore, the factor structure obtained on the original questionnaire by Geiger et al. (2021) was confirmed, although it is preferable to use only the overall score due to the high correlation of factors. The Attitudes Against Socializing with (Non-)Vaccinees Scale indicated that there is (mild) willingness for less socializing with the out-group which is in accordance with the Social Identity Theory (Tajfel & Turner, 1979).

References

- Betsch, C., Böhm, R., & Chapman, G. B. (2015). Using behavioral insights to increase vaccination policy effectiveness. *Policy Insights from the Behavioral and Brain Sciences*, 2(1), 61-73. <https://doi.org/10.1177/2372732215600716>
- Betsch, C., Schmid, P., Heinemeier, D., Korn, L., Holtmann, C., & Böhm, R. (2018). Beyond confidence: Development of a measure assessing the 5C psychological antecedents of vaccination. *PloS One*, 13(12), e0208601. <https://doi.org/10.1371/journal.pone.0208601>
- Brown, T. A. (2015). *Confirmatory factor analysis for applied research*. Guilford Publications.
- Fontanet, A., & Cauchemez, S. (2020). COVID-19 herd immunity: where are we?. *Nature Reviews Immunology*, 20(10), 583-584. <https://doi.org/10.1038/s41577-020-00451-5>
- Geiger, M., Rees, F., Lilleholt, L., Santana, A.P., Zettler, I., Wilhelm, O., Betsch, C., & Böhm, R. (2021). Measuring the 7Cs of vaccination readiness. *European Journal of Psychological Assessment*. <https://doi.org/10.1027/1015-5759/a000663>
- Henkel, L., Sprengholz, P., Korn, L., Betsch, C., & Böhm, R. (2022). Understanding the trouble spot: Does vaccination status identification fuel societal polarization?. <https://doi.org/10.31234/osf.io/mgqk5>
- HZJZ. (n.d). Počelo cijepljenje protiv koronavirusa (Coronavirus vaccination started). <https://www.hzjz.hr/priopcenja-mediji/pocelo-cijepljenje-protiv-koronavirusa/>
- Koronavirus. (2022, 6.1.). Izvješće o cijepljenju. (Vaccination report). https://www.koronavirus.hr/uploads/Izvjestaj_o_cijepljenju_0601_docx_0c1b3bd6f7.pdf
- Koronavirus. (2022, 6.3.). Izvješće o cijepljenju. (Vaccination report). https://www.koronavirus.hr/uploads/Izvjestaj_o_cijepljenju_0603_docx_b0be9f675d.pdf
- MacDonald, N. E. (2015). Vaccine hesitancy: Definition, scope and determinants. *Vaccine*, 33(34), 4161-4164. <https://doi.org/10.1016/j.vaccine.2015.04.036>
- Mezher, M. (2020, 21.12) EU authorizes Pfizer-BioNTech COVID vaccine, <https://www.raps.org/news-and-articles/news-articles/2020/12/ema-recommends-pfizer-biontech-coivd-vaccine>
- Most objavio koliko potpisa su prikupili za referendum, Petrov: ‘Ovo je pobjeda građana!’ (Most announced how many signatures they had collected for the referendum, Petrov: ‘This is a victory

- for the citizens!'). <https://www.jutarnji.hr/vijesti/hrvatska/most-objavio-koliko-potpisa-su-prikupili-za-referendum-petrov-ovo-je-pobjeda-gradana-15148934>
- Odluka i Rješenje Ustavnog suda Republike Hrvatske broj: U-II-7149/2021 i dr. od 15. veljače 2022. i pet izdvojenih mišljenja sudaca (Decision and Ruling of the Constitutional Court of the Republic of Croatia No. U-II-7149/2021 and others of 15 February 2022 and five separate opinions of judges). NN 25/22. https://narodne-novine.nn.hr/clanci/sluzbeni/2022_03_25_322.html
- Odluka o uspostavi nacionalnog sustava za izdavanje EU digitalne COVID potvrde (Decision on the establishment of a national system for issuing EU digital COVID certificates). NN 60/21. https://narodne-novine.nn.hr/clanci/sluzbeni/2021_05_60_1161.html
- Odluka o uvođenju posebne sigurnosne mjere obveznog testiranja dužnosnika, državnih službenika i namještenika, službenika i namještenika u javnim službama, službenika i namještenika u lokalnoj i područnoj (regionalnoj) samoupravi te zaposlenika trgovačkih društava i ustanova. (Decision on the introduction of a special security measure of mandatory testing of officials, civil servants and employees, civil servants and employees in public services, civil servants and employees in local and regional self-government and employees of companies and institutions.). NN 121/20. https://narodne-novine.nn.hr/clanci/sluzbeni/2021_11_121_2087.html
- Održan veliki prosvjed protiv covid potvrda: Palile se i baklje, među okupljenima Raspudić, Hasanbegović, Bulj...(A large protest was held against covid certificate: Torches were lit, among those gathered Raspudić, Hasanbegović, Bulj ...). <https://www.vecernji.hr/vijesti/veliki-prosvjed-protiv-covid-potvrda-u-zagrebu-stizu-busevi-iz-cijele-hrvatske-1540888>
- Rees, F., Geiger, M., Lilleholt, L., Zettler, I., Betsch, C., Böhm, R., & Wilhelm, O. (2021). Measuring parents' readiness to vaccinate themselves and their children against COVID-19. <https://doi.org/10.31234/osf.io/wrgce>
- Tajfel, H. (1978). The achievement of inter-group differentiation. In H. Tajfel (Ed.), *Differentiation between social groups* (pp. 77–100). Academic Press.
- Tajfel, H., & Turner, J. C. (1979). An integrative theory of inter-group conflict. In W. G. Austin & S. Worchel (Eds.), *The social psychology of inter-group relations* (pp. 33–47). Brooks/Cole.
- WHO EURO Working Group on Vaccine Communications. Istanbul, Turkey October 13–14. 2011.
- WHO. (2020, 11.3.). WHO Director-General's opening remarks at the media briefing on COVID-19 - 11 March 2020. <https://www.who.int/director-general/speeches/detail/who-director-general-s-opening-remarks-at-the-media-briefing-on-covid-19---11-march-2020>
- Worldmeters. (n.d.) Coronavirus Cases. <https://www.worldometers.info/coronavirus/>

Appendix A – Descriptive Statistics for Vaccination Readiness, Attitudes Against Socializing with (Non-)Vaccinees by Groups Formed Based on the Vaccination Status

Variable	Vaccination status group	<i>M</i>	<i>SD</i>	<i>Min</i>	<i>Max</i>
Vaccination Readiness	1.00 No, I don't intend to get vaccinated	2.33	0.59	1.00	4.71
	2.00 No, but I intend to get vaccinated	3.73	0.99	1.43	6.48
	3.00 Yes, one dose and I do not intend to take any more	3.02	1.02	1.48	5.81
	4.00 Yes, one dose and I intend to take only the second dose	3.61	0.81	2.24	5.10
	5.00 Yes, with one dose and I intend to take the next two doses as well	4.92	0.79	3.62	6.29
	6.00 Yes, with two doses and I do not intend to take any more	3.94	1.08	1.57	6.24
	7.00 Yes, with two doses and I intend to receive a third (booster) dose	5.28	0.83	2.19	7.00
	8.00 Yes, with the third (booster) dose	5.81	0.69	2.19	7.00
	Total	4.05	1.62	1.00	7.00
	Attitudes against socializing with non-vaccinees	1.00 No, I don't intend to get vaccinated	1.13	0.44	1.00
2.00 No, but I intend to get vaccinated		1.35	0.71	1.00	5.00
3.00 Yes, one dose and I do not intend to take any more		1.26	0.53	1.00	3.25
4.00 Yes, one dose and I intend to take only the second dose		1.17	0.29	1.00	2.13
5.00 Yes, with one dose and I intend to take the next two doses as well		1.24	0.38	1.00	2.25
6.00 Yes, with two doses and I do not intend to take any more		1.31	0.59	1.00	4.25

7.00	Yes, with two doses and I intend to receive a third (booster) dose	1.78	0.87	1.00	5.00
8.00	Yes, with the third (booster) dose	2.41	1.10	1.00	5.00
Total		1.56	0.87	1.00	5.00

Variable	Vaccination status group	<i>M</i>	<i>SD</i>	<i>Min</i>	<i>Max</i>	
Attitudes against socializing with vaccinees	1.00	No, I don't intend to get vaccinated	1.37	0.67	1.00	5.00
	2.00	No, but I intend to get vaccinated	1.27	0.66	1.00	5.00
	3.00	Yes, one dose and I do not intend to take any more	1.25	0.53	1.00	3.00
	4.00	Yes, one dose and I intend to take only the second dose	1.12	0.20	1.00	1.67
	5.00	Yes, with one dose and I intend to take the next two doses as well	1.29	0.54	1.00	2.33
	6.00	Yes, with two doses and I do not intend to take any more	1.23	0.56	1.00	4.33
	7.00	Yes, with two doses and I intend to receive a third (booster) dose	1.16	0.42	1.00	4.67
	8.00	Yes, with the third (booster) dose	1.18	0.48	1.00	5.00
	Total		1.25	0.56	1.00	5.00

Appendix B – Significant Differences in Vaccination Readiness, Attitudes Against Socializing with (Non-)Vaccinees for Groups Formed Based on the Vaccination Status

Vaccination Readiness	2	3	4	5	6	7	8
1 No, I don't intend to get vaccinated	1<2**	1<3**	1<4**	1<5**	1<6**	1<7**	1<8**
2 No, but I intend to get vaccinated	-	2>3**		2<5**		2<7**	2<8**
3 Yes, one dose and I do not intend to take any more		-		3<5**	3<6**	3<7**	3<8**
4 Yes, one dose and I intend to take only the second dose			-	4<5**		4<7**	4<8**
5 Yes, with one dose and I intend to take the next two doses as well				-	5>6**		5<8**
6 Yes, with two doses and I do not intend to take any more					-	6<7**	6<8**
7 Yes, with two doses and I intend to receive a third (booster) dose						-	7<8**
8 Yes, with the third (booster) dose							-
Attitudes against socializing with (non-)vaccinees	2	3	4	5	6	7	8
1 No, I don't intend to get vaccinated						1<7**	1<8**
2 No, but I intend to get vaccinated	-					2<7**	2<8**
3 Yes, one dose and I do not intend to take any more		-				3<7*	3<8**
4 Yes, one dose and I intend to take only the second dose			-				4<8**
5 Yes, with one dose and I intend to take the next two doses as well				-			5<8**
6 Yes, with two doses and I do not intend to take any more					-	6<7**	6<8**
7 Yes, with two doses and I intend to receive a third (booster) dose						-	7<8**
8 Yes, with the third (booster) dose							-
Attitudes against socializing with vaccinees	2	3	4	5	6	7	8
1 No, I don't intend to get vaccinated						1>7**	1>8**
2 No, but I intend to get vaccinated	-						
3 Yes, one dose and I do not intend to take any more		-					
4 Yes, one dose and I intend to take only the second dose			-				

5	Yes, with one dose and I intend to take the next two doses as well	-
6	Yes, with two doses and I do not intend to take any more	-
7	Yes, with two doses and I intend to receive a third (booster) dose	-
8	Yes, with the third (booster) dose	-

Note: * $p < .05$; ** $p < .01$

Relationships of depression, anxiety, and stress with committing and experiencing cyber-violence

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Abstract

Previous research shows how depression, anxiety, and stress correlate with committing and experiencing cyber-violence. However, the nature of the relationship between these variables is not conclusive due to a lack of longitudinal research. In this research, we have collected data on the committing and experiencing cyber-violence, depression, anxiety, and stress (DAS) from 293 adolescents in two waves. The research objective was to compare the contributions of DAS predictors measured in the first wave to cyber-violence in the first and second waves (and vice versa) while controlling gender and age. The results of hierarchical regression analyses show that DAS explained 14.5% of the variance of experiencing cyber-bullying in the first wave and 12% of the variance in the second wave. DAS and gender predictors explained a smaller portion of the variance of committing cyber-bullying (6% in the first wave and 7% in the second wave). Cyber-violence explained 12.8% of depression variance in the first wave and 9.3% in the second wave. Concerning anxiety, cyber-violence contributed to 9.8% of the variance in the first wave and 9.2% in the second wave. Finally, cyber-violence explained 8.3% of stress variance in the first wave and 6.2% in the second wave. Depression, anxiety, and stress explained more variance of experiencing cyber-violence than committing it. The percentage of explained variance for committing cyber-violence in the second wave increased slightly compared to the first wave. Additional analyses showed that girls' anxiety slightly increases their cyber-violent behavior two months later indicating the need to address it through school prevention programs.

Keywords: cyber-violence, depression, anxiety, stress, adolescents

Introduction

The development of information and communication technology and the digital world had great impetus in last decades and has encouraged new forms of risky behaviors. These risky

behaviors attract the attention of researchers and experts, as well as parents and youth. One such behavior is cyber-violence. Some scholars refer to cyber-bullying as similar to traditional bullying. So, the cyber-bullying is often presented as a version of bullying that takes place in the digital world and is assumed to be determined by the same criteria (difference in power, frequency and intent to cause harm and inability to attack) (Olweus, 2012; Smith et al., 2008).

Olweus (2012) and Olweus and Limber (2018) critically review the research of cyber-bullying and declare the very phenomenon of cyber-bullying overrated. They emphasize that traditional bullying is more important and should be prevented by appropriate programs. Menesini (2018) points out that, although there are many common determinants of these two types of bullying, neglecting specific features of cyber-bullying such as the role of anonymity and publicity and abandoning research on cyber-bullying as a phenomenon related to bullying, but different, may cause losing important data. To Olweus' (2012) remark that the additional contributions of cyber-bullying in young people exposed to both traditional and cyber-bullying are negligible, Smith (2012) points to research indicating that there are independent contributions of both types of bullying to depressive symptoms. Campbell et al. (2012) showed that, although participants have a subjective experience that traditional bullying is more severe than cyber-bullying, the latter has more serious correlates which indicate impaired psychological functioning such as more pronounced anxiety. Accordingly, Menesini (2018) points to papers indicating that cyber-bullying is associated with depressive-anxiety-type symptoms. However, in line with Smith's (2012) assertion that cyber-bullying shows less prevalence than traditional bullying, as well as lower intensity, it seemed appropriate to use cyber-violence instead of cyber-bullying, as the former is more comprehensive and does not necessarily indicate repetitive behaviors. Repetitive behavior was defined by Olweus (1993) as one of main criteria for traditional bullying.

Smith (2012) has already pointed out the link between cyber-violence and depression and anxiety. Some of our previous research, in addition to this connection, pointed to the role of stress, especially in relation to committing cyber-violence (Šincek et al., 2017). Depression, anxiety and stress are indicators of impaired psychological functioning - depression is marked by feelings of sadness and pessimism, anxiety is a constant fear that something negative will happen, while stress is caused by an event that we assume we will not be able to adequately deal with (Lovibond & Lovibond, 1995).

In their model of antisocial behavior, Patterson and Capaldi (1990) indicate that early difficulties manifested in a child's aggressive behavior result in rejection from peers and ultimately an increase in depressive symptoms. Evans and Fite (2018) indicate that this failure

model has not been over-researched, but research under this approach has focused more on crime and delinquency. In their study, exploring reactive and proactive aggression, peer rejection and academic success, and consequent depressive symptoms, they found only limited support for the assumptions of this model and indicated that the effects of aggressive behavior may have effects if they occur in early childhood, while they found no support for such effects of aggression in middle childhood. Contrary to that, Gámez-Guadix et al. (2013) comparing the failure model (aggression predicts depression); the acting – out model (depression predicts aggression), and a reciprocal model (there are reciprocal effects of aggression and depression), found support for the failure model. In their seven year long longitudinal study participants were ten years old at the start of the study (study followed them from preadolescence to middle adolescence), and still findings support failure model's hypothesis.

Above mentioned studies were conducted on traditional aggression. However, research shows that depression is associated with both cyber-victimization and cyber-bullying (Bonanno & Hymel, 2013). Pabian and Vanderbosch (2016) explored whether social anxiety was a predictor of cyber-victimization and cyber-bullying, and only for cyber-victimization they determined the predictiveness of social anxiety. Yang et al. (2013) found that depression in 12-year-olds was also associated with experiencing and committing both traditional and cyber-bullying, while anxiety predicted committing cyber-bullying. Šincek et al. (2017) found that perpetrators / victims had the most unfavorable indicators of psychological functioning, followed by victims, while perpetrators had significantly higher levels of stress than participants who were not involved in cyber-violence.

Encouraged by the mixed results of the research on the failure model, as well as the need to test the acting-out model and the reciprocal model in the field of cyber-violence, we conducted a short-term longitudinal study. The study aimed to test whether the assumptions of these models are limited to depression as an indicator of psychological functioning or not. Also, it aimed to test if the propositions may be extended to anxiety and stress, as can be inferred from research suggesting a positive correlation between anxiety and stress with cyber-violence. Specifically, the main goal of the study is to test the appropriateness of three models of the relationship between indicators of impaired mental health and cyber-violence. If the failure model is applicable to cyber-violence, committing cyber-violence is expected to predict depression, anxiety, and stress two months later. According to the acting-out model, depression, anxiety and stress would predict committing cyber-violence two months later, while the reciprocal model predicts that there will be mutual connections, ie that mental health indicators

will predict cyber-violence two months later and that cyber-violence will predict depression, anxiety and stress after two months.

Methodology

Participants

The study involved 293 participants (20.1% or 59 participants were male) aged 15 to 19 years ($M = 17.28$; $SD = 1.29$). The sampling method used was convenience sampling. Participants responded to social media posts by researchers and participated in the first wave. Participants interested in participating in the continuation of the research left contact information. Of the 1725 participants in the first wave, 824 participants left contact details (47.77%). An invitation with a link to the second measurement was sent to the e-mails of all 824 participants and the response rate was 35.56% of participants who left data, or 16.99% of the initial sample.

Measures

The Committing and Experiencing Cyber-Violence Scale – 2021

The Committing and Experiencing Cyber-Violence Scale—2021 (CECVS-2021; Šincek, 2021) was used to measure cyber-violence (CV). The scale consists of 68 items (34 in both committing and experiencing subscale). Participants answer how often they committed/experienced cyber-violence on a five-point scale (1-never; 5-always). Items in both subscales (committing and experiencing CV) are divided into five factors: Shaming, Information manipulation, Hate speech, Technology abuse, and Information sharing. For the purpose of this study, only totals on two subscales were used. The reliability for subscales in two waves was: $\alpha_{\text{experiencing1}}=.94$; $\alpha_{\text{experiencing2}}=.94$; $\alpha_{\text{committing1}}=.87$; $\alpha_{\text{committing2}}=.83$.

The Depression Anxiety Stress Scale

The Depression Anxiety Stress Scale (DASS—21, Lovibond & Lovibond, 1995) measures depression, anxiety, and stress. It consists of 21-item (seven per every subscale). Participants answer how much item content is applicable to themselves on a 4-point scale (1 = does not apply to me at all, 4 = applies to me very much or most of the time) in the week before the assessment. A higher score represents more depression, anxiety, and stress. The reliability (Cronbach's α) were .89 and .91 for depression, .83 and .83 for anxiety, and .81 and .86 for stress (for two waves respectively).

Procedure

This study is done as a part of a larger project named “Positive and negative experiences on the Internet - the digital world in the context of a pandemic”. The project consists of a qualitative and longitudinal quantitative part with three measurement waves (February and April 2021 and February 2022). This manuscript will show some of the results from the first two measurement points (DASS-21 and CECVS). At the moment, only validation study (Šincek, 2021) based on quantitative data from first measurement point is published. Currently, qualitative data considering childrens and youth perception of internet is under review, and we presented trough poster presentation parental involvement in adolescents’ online activities (Milić et. al., 2022). Beside DASS-21 and CECVS, we collected data about problematic gaming and internetu use, and we plan to explore and publish longitudinal effects of these variables in future. Prior to the research, the approval of the Ethics Committee of the Faculty of Humanities and Social Sciences in Osijek was obtained. An invitation to participate in the research was published on social networks and it was noted that there are prizes for participation. In each measurement point (first, second, and third) one participant was selected and awarded a prize. The prize in the first wave was 400,00 kn, 600,00 kn in the second wave, and 800,00kn in the third wave, in accordance with the efforts made by the participants in the previous participation in the research and as a motivation to participate. The research was conducted online in all three waves. In the first wave, the link was part of the invitation published on social networks, and then the participants who left their contact information to mark that they wanted to participate in the rest of the research were sent an e-mail with invitation to participate in the second measurement point. Prior to participating in each wave of the survey, participants gave informed consent.

Results

A series of two-step regression hierarchical analyzes (HRA) were conducted to explore goal of the study. To control the contributions of the gender and age of the participants, they are always introduced in the first step of the analysis. When the criteria were committing and experiencing cyber-violence, in the second step, depression, anxiety and stress measured in the first wave were introduced. When the criteria were depression, anxiety and stress, in the second step, committing and experiencing cyber-violence (from the first wave) were introduced. HRAs were conducted for five criteria (committing and experiencing cyber-violence, depression, anxiety and stress) measured in the first wave and for the same criteria measured in the second

wave. In the following text, suffix 1 or 2 indicates wave of measurement (1 for the first wave, and 2 for the second wave)

Table 1 contains descriptive statistics for relevant variables. As can be observed, although the results of Kolmogorow-Smirnof test are significant for all variables, skewness and kurtosis are in range -3 to +3 for skewness, and -10 to +10 for kurtosis which allows using parametric statistics (Brown, 2006).

Table 3

Descriptive statistics for main variables (N=293)

	M	SD	K-S test	Skewness	Kurtosis
Age	17.28	1.29	.20**	-.34	-.96
Experiencing CV1	1.47	.45	.15**	1.93	5.38
Committing CV1	1.22	.23	.12**	2.42	9.43
Depression 1	13.05	5.22	.17**	1.06	.34
Anxiety 1	13.47	4.79	.08**	.79	.05
Stress 1	15.58	4.82	.13**	.36	-.47
Experiencing CV2	1.51	.46	.14**	1.59	3.95
Committing CV2	1.23	.20	.19**	1.21	1.27
Depression 2	13.18	5.51	.11**	1.12	.44
Anxiety 2	13.52	4.76	.20**	.86	.33
Stress 2	15.76	5.21	.49**	.46	-.57

** p<.01

Prior to HRA correlation analysis among predictor and criteria was done and the results are shown in Table 2. In addition to gender and age, measures from the first and second waves are shown for all variables. As can be seen, age was not correlated with either variable, while gender was correlated with anxiety in the first wave and stress in both waves in a way that they both were more pronounced in girls. Committing cyber-violence in the second wave was correlated with gender in a way that was more pronounced in young men (however, all correlations, although significant, are very small). With exception of the insignificant correlation between committing cyber-violence in the first wave and anxiety in the second wave, all other correlations are significant and positively directed (a higher score in one variable indicates a higher score in the second variable).

Table 2

Correlations among main variables (N=293)

	2	3	4	5	6	7	8	9	10	11	12	
1. Age	-	-.03	-.07	-.01	.005	-.008	.04	-.03	-.05	-.03	-.01	-.002
2. Gender		-	-.03	.09	.000	.12*	.12*	-.02	-.13*	-.03	.09	.15*
3. Experiencing CV1			-	.30**	.36**	.15*	.27**	.83**	.34**	.31**	.30**	.24**
4. Committing CV1				-	.54**	.31**	.61**	.47**	.76**	.66**	.11	.74**
5. Depression 1					-	.57**	.64**	.29**	.18**	.83**	.53**	.56**
6. Anxiety 1						-	.67**	.32**	.20**	.55**	.83**	.63**
7. Stress 1							-	.25**	.16**	.57**	.61**	.81**
8. Experiencing CV2								-	.51**	.29**	.34**	.29**
9. Committing CV2									-	.17**	.17**	.15*
10. Depression 2										-	.66**	.67**
11. Anxiety 2											-	.74**
12. Stress 2												-

** p<.01, *p<.05; gender – 1= male; 2=female

In Table 3, Table 4 and Table 5 the results of the ten HRA are shown. As can be seen from Table 3, the introduction of variables that are indicators of impaired mental health (depression, anxiety and stress - DAS) in the second step of HRA (after controlling gender and age in the first step) are more important predictors for experiencing CV than for committing CV. This is evident in the overall explained variance of criteria - 15% for experiencing in the first and 12% for experiencing in the second wave, and only 6% for committing CV in the first wave, and 7% for this criterion in the second wave. Indeed, only anxiety was shown to be significant predictor with the risk level of 10% for committing CVs only at the second measuring point. For committing CVs, the gender of the participants is more important than for experiencing CV, in the sense that young men commit more CVs. For experiencing CV depression and anxiety are important predictors and participants who show higher levels of anxiety and depression in the first wave of measurement, experience more CV in the first and second wave of measurement. However, there is a slightly larger amount of explained variance in the first than in the second wave. It is interesting to compare the beta coefficients in these two measurements - the beta coefficient for depression is higher when the criteria is experiencing CV in the first than when criteria is experiencing CV in the second wave, while anxiety is a more significant predictor of experiencing CV in the second wave than in the first. In other words, participants' anxiety measured in February 2021, better predicts experiencing CV measured in April 2021.g. than experiencing CV measured in February 2021.

Table 3

Results of the hierarchical regression for cyber-violence measured in two waves as criteria

Variable	Experiencing CV1				Committing CV1				Experiencingm CV2				Committing CV2			
	β	R ²	ΔR ²	F	β	R ²	ΔR ²	F	β	R ²	ΔR ²	F	β	R ²	ΔR ²	F
Step1		.006	.006	.82		.02	.02	3.59*		.001	.001	.21		.02	.02	2.69
Age	-.07				.002				-.03				-.05			
Gender	-.03				-.16*				-.02				-.13*			
Step 2		.151	.145	16.33**		.06	.04	4.13**		.121	.12	13.05**		.07	.05	5.26**
Age	-.07				-.003				-.03				-.05			
Gender	-.05				-.18*				-.02				-.15*			
Depression 1	.26**				.02				.17*				.06			
Anxiety 1	.16*				.07				.23**				.15			
Stress 1	.01				.13				-.01				.04			

** p<.01, *p<.05, 'p<.1; gender – 1= male; 2=female

As can be seen in Table 4 and Table 5, only the experiencing CV measured in the first wave was a predictor of depression, anxiety, and stress measured in both the first and second waves, while contribution of the committing CV was insignificant. Gender predicts anxiety in the first wave of measurement, and stress in both waves of measurement (females reporting higher anxiety and higher stress). Insight into the percentage of the explained variance of the various criteria shows that it is very similar, it ranges from 8% to 13% of the variance of the criteria.

Table 4

Results of the hierarchical regression for depression, anxiety and stress measured in first wave as criteria

Variable	Depression 1				Anxiety 1				Stress 1			
	β	R ²	ΔR ²	F	β	R ²	ΔR ²	F	β	R ²	ΔR ²	F
Step1		.00	.00	.003		.01	.01	2.21		.02	.02	2.43
Age	.005				-.005				.04			
Gender	.00				.12*				.12*			
Step 2		.13	.13	21.11**		.11	.10	15.95**		.10	.08	13.25
Age	.03				.01				.06			
Gender	.009				.14*				.14*			
Experiencing CV1	.37**				.30**				.24**			
Committing CV1	-.02				.03				.08			

Variable	Depression 1				Anxiety 1				Stress 1			
	β	R ²	ΔR^2	F	β	R ²	ΔR^2	F	β	R ²	ΔR^2	F
Step1		.00	.00	.003		.01	.01	2.21		.02	.02	2.43
Age	.005				-.005				.04			
Gender	.00				.12*				.12*			
Step 2		.13	.13	21.11**		.11	.10	15.95**		.10	.08	13.25
Age	.03				.01				.06			
Gender	.009				.14*				.14*			
Experiencing CV1	.37**				.30**				.24**			
Committing CV1	-.02				.03				.08			

Table 5

Results of the hierarchical regression for depression, anxiety and stress measured in second wave as criteria

Variable	Depression 2				Anxiety 2				Stress 2			
	β	R ²	ΔR^2	F	β	R ²	ΔR^2	F	β	R ²	ΔR^2	F
Step1		.002	.002	.22		.01	.01	1.16		.02	.02	3.15*
Age	-.03				-.01				.002			
Gender	-.03				.09				.15*			
Step 2		.09	.09	14.76**		.10	.09	14.80**		.08	.06	9.79**
Age	-.01				.01				.02			
Gender	-.02				.10				.16**			
Experiencing CV1	.32**				.32**				.25**			
Committing CV1	-.03				-.02				.00			

Discussion

In order to test which of the models (failure model, acting-out model and reciprocal model) best describe the relationship between cyber-violence and indicators of impaired mental health (depression, anxiety and stress), a series of HRAs were conducted. Research design was a short longitudinal study with two waves in an interval of two months between the waves. Data on experiencing and committing cyber-violence (CV), as well as depression, anxiety and stress (DAS, as indicators of mental health) were collected in February and April 2021. In a series of HRAs it was examined how mental health indicators predict CV in two waves of measurements. It was also explored how the CV measured in February predict depression, anxiety and stress measured in both February and April 2021. Gender and age was always entered in first step of HRAs, to control their effects.

Patterson and Capaldi's (1990) hypothesized that the aggression deteriorates peer relationships and school success, and that the development of depression is a consequence of rejection and school failure. Contrary to that, the committing CV measured in February was not a significant predictor of either depression or anxiety or stress measured at the same time and two months later. On the other hand, experiencing CV predicted mental health indicators even when measured simultaneously and two months later. Participants who reported experiencing more CV were shown to exhibit higher levels of depression, anxiety, and stress in that wave of measurement and two months later. Beta coefficients of experiencing CV for criteria measured simultaneously with this predictor, equal to or slightly higher than those beta predictors measured two months later. Correlations between these indicators measured in February and April (depression 1 and depression 2, anxiety 1 and anxiety 2 and stress 1 and stress 2) are high (.83 or .81) and share 65% of the variance,. Also, insight into the arithmetic means of above mentioned indicators in two waves of measurements indicate stable levels, and therefore it seems as an exaggeration to say that experiencing CV in February increased levels of depression, anxiety and stress in April (compared to levels at which depression, anxiety and stress were in February).

Our results that indicators of impaired mental health are predictive for experiencing CV are consistent with the findings of Campbell et al. (2013) on an Australian sample that included, however, a wider age range than in our study (9 to 19 years). On a sample of young adult Pakistanis, Musharraf and Anis-ul-Haque (2018) had results that are consistent with ours - while cyber-victimization was a predictor of depression, anxiety and stress, cyber-aggression was not.

In this study, the predictability of depression and anxiety for CV was determined measured simultaneously and after two months. Stress as a reaction to situations that we perceive as threatening proved to be insignificant. On the other hand, deep feelings of sadness and hopelessness (depression), and fears of adverse outcomes whose sources are unclear and unspecified (anxiety) have proven important. As said earlier, Menesini (2018) stands out that distinguishing features of cyber-bullying compared to traditional bullying are anonymity and greater publicity. Anonymity is something that probably contributes to the importance of anxiety - we experience an unpleasant event, and the source of that experience is often not visible and not known to us (contrary to traditional bullying). Also, the wide audience, much wider than is possible with traditional bullying, as well as the inability of a person to predict everyone who will witness situations in which it has been a victim of cyber-violence, is certainly related to anxiety. All these situations in which a person experiences such an attack are associated with feelings of loss and sadness or depression. These explanations go in the

direction that depression and anxiety are the consequences of experiencing CV. Feinstein et al. (2014) have confirmed such a sequence in a short-term prospective study, showing that rumination or repeated and deep analysis of experienced unpleasant events, has a mediating role in relation of prior cyber-victimization and later severity of depression. However, D'Esposito et. al. (2011) indicate anxiety as one of the factors that increases the vulnerability of young people to experience cyber-victimization and in this study anxiety is defined as a predictor (although it is a study in which data are collected at one point and anxiety may have other roles - consequences or correlate). Given that the beta coefficient for anxiety is higher when it predicts experiencing CV is two months later than experiencing CV in February 2021, our results also give some support to the findings of D'Esposito et al. (2014). On the other hand, beta coefficients for depression are in accordance with the results of Feinstein et al. (2014).

It should be emphasized again that the percentage of explained variances is small and indicates that in addition to these phenomena, many others factors affect the monitored criteria. Furthermore, it has again been shown that young men are more inclined to commit CV, consistent with earlier results (e.g. Šincek et al., 2017).

This study also has certain limitations. As can be seen from the description of the methodology, it was conducted online on a convenient sample with a large dropout of participants that we cannot claim to have been by chance (e.g., the proportion of young men in this sample is lower than in the initial sample). Although method was largely determined by the pandemic circumstances at the time conducted research, it would be of interest to explore the effects on a more representative sample and, with additional effort, ensure that dropouts are kept to a minimum. The two-month interval itself is questionable, and in future analyzes we will compare this data with data from February 2022. However, these data clearly suggest that experiencing and committing CVs are differently related to indicators of impaired mental health, and that those young people who experience CV can be expected to show higher levels of depression and anxiety and need support in this area as well. The high correlations between DASS measures and the CV subscale are certainly a challenge, which makes statistical inference difficult.

Conclusion

This brief longitudinal study did not support that any of the three models explaining relationship of aggression and depression could be applied for explaining the relationship of the committing CV relationship with indicators of impaired mental health indicators as similar

to relationship aggression and depression. Nevertheless, experiencing CV and depression and anxiety have been shown to be interrelated. The results provide limited support for the fact that anxiety is what makes a person more vulnerable to experiencing CV, while experiencing CV is associated with increased levels of depression. Stress did not play a significant role, while young men proved more inclined to commit CV.

References

- Bonanno, R. A., & Hymel, S. (2013). Cyber bullying and internalizing difficulties: Above and beyond the impact of traditional forms of bullying. *Journal of youth and adolescence*, 42(5), 685-697. <https://doi.org/10.1007/s10964-013-9937-1>
- Brown, T. A. (2015). *Confirmatory factor analysis for applied research*. Guilford publications.
- Campbell, M., Spears, B., Slee, P., Butler, D., & Kift, S. (2012). Victims' perceptions of traditional and cyberbullying, and the psychosocial correlates of their victimisation. *Emotional and Behavioural Difficulties*, 17(3-4), 389-401. <https://doi.org/10.1080/13632752.2012.704316>
- D'Esposito, S. E., Blake, J., & Riccio, C. A. (2011). Adolescents' vulnerability to peer victimization: Interpersonal and intrapersonal predictors. *Professional School Counseling*, 14(5), 2156759X1101400502. <https://doi.org/10.5330/PSC.n.2011-14.299>
- Evans, S. C., & Fite, P. J. (2019). Dual pathways from reactive aggression to depressive symptoms in children: Further examination of the failure model. *Journal of abnormal child psychology*, 47(1), 85-97. <https://doi.org/10.1007/s10802-018-0426-6>
- Feinstein, B. A., Bhatia, V., & Davila, J. (2014). Rumination mediates the association between cyber-victimization and depressive symptoms. *Journal of interpersonal violence*, 29(9), 1732-1746. <https://doi.org/10.1177/0886260513511534>
- Gómez-Guadix, M., Orue, I., Smith, P. K., & Calvete, E. (2013). Longitudinal and reciprocal relations of cyberbullying with depression, substance use, and problematic internet use among adolescents. *Journal of adolescent health*, 53(4), 446-452. <https://doi.org/10.1016/j.jadohealth.2013.03.030>
- Lovibond, P. F., & Lovibond, S. H. (1995). The structure of negative emotional states: Comparison of the Depression Anxiety Stress Scales (DASS) with the Beck Depression and Anxiety Inventories. *Behaviour research and therapy*, 33(3), 335-343. [https://doi.org/10.1016/0005-7967\(94\)00075-u](https://doi.org/10.1016/0005-7967(94)00075-u)
- Menesini, E. (2012). Cyberbullying: The right value of the phenomenon. Comments on the paper "Cyberbullying: An overrated phenomenon?". *European journal of developmental psychology*, 9(5), 544-552. <https://doi.org/10.1080/17405629.2012.706449>
- Musharraf, S., & Anis-ul-Haque, M. (2018). Impact of cyber aggression and cyber victimization on mental health and well-being of Pakistani young adults: The moderating role of gender. *Journal*

- of aggression, maltreatment & trauma, 27(9), 942-958.
<https://doi.org/10.1080/10926771.2017.1422838>
- Olweus, D. (1993). Bullies on the playground: The role of victimization. In C. H. Hart (Ed.), *Children on playgrounds: Research perspectives and applications* (pp. 85–128). State University of New York Press.
- Olweus, D. (2012). Cyberbullying: An overrated phenomenon?. *European journal of developmental psychology*, 9(5), 520-538. <https://doi.org/10.1080/17405629.2012.682358>
- Olweus, D., & Limber, S. P. (2018). Some problems with cyberbullying research. *Current opinion in psychology*, 19, 139-143. <https://doi.org/10.1016/j.copsyc.2017.04.012>
- Pabian, S., & Vandebosch, H. (2016). An investigation of short-term longitudinal associations between social anxiety and victimization and perpetration of traditional bullying and cyberbullying. *Journal of youth and adolescence*, 45(2), 328-339. <https://doi.org/10.1007/s10964-015-0259-3>
- Patterson, G. R., & Capaldi, D. M. (1990). A mediational model for boys' depressed mood. Risk and protective factors in the development of psychopathology, 141-163. <https://doi.org/10.1017/CBO9780511752872.010>
- Smith, P. K. (2012). Cyberbullying: Challenges and opportunities for a research program—A response to Olweus (2012). *European journal of developmental psychology*, 9(5), 553-558. <https://doi.org/10.1080/17405629.2012.689821>
- Smith, P. K., Mahdavi, J., Carvalho, M., Fisher, S., Russell, S., & Tippett, N. (2008). Cyberbullying: Its nature and impact in secondary school pupils. *Journal of child psychology and psychiatry*, 49(4), 376-385. <https://doi.org/10.1111/j.1469-7610.2007.01846.x>
- Šincek, D. (2021). The Revised Version of the Committing and Experiencing Cyber-Violence Scale and its relation to psychosocial functioning and online behavioral problems. *Societies*, 11(3), 107. <https://doi.org/10.3390/soc11030107>
- Šincek, D., Duvnjak, I., & Milić, M. (2017). Psychological outcomes of cyber-violence on victims, perpetrators and perpetrators/victims. *Hrvatska revija za rehabilitacijska istraživanja*, 53(2), 98-110. <https://doi.org/10.31299/hrri.53.2.8>
- Yang, S. J., Stewart, R., Kim, J. M., Kim, S. W., Shin, I. S., Dewey, M. E., ... & Yoon, J. S. (2013). Differences in predictors of traditional and cyber-bullying: a 2-year longitudinal study in Korean school children. *European child & adolescent psychiatry*, 22(5), 309-318. <https://doi.org/10.1007/s00787-012-0374-6>

Appendix 1

Table 6.

Descriptive statistics for measured variables divided by gender.

	All				<i>n</i>	Female				<i>n</i>	Male		
	<i>N</i>	range	<i>M</i>	<i>SD</i>		range	<i>M</i>	<i>SD</i>	range		<i>M</i>	<i>SD</i>	
Experiencing CV1	293	1-3.75	1.47	.451	234	1-3.75	1.46	.437	59	1-3.66	1.50	.509	
Committing CV1	293	1-2.87	1.22	.232	234	1-1.97	1.20	.191	59	1-2.87	1.29	.341	
Depression 1	293	7-28	13.05	5.218	234	7-28	13.05	5.141	59	7-28	13.05	5.557	
Anxiety 1	293	7-28	13.47	4.786	234	7-28	13.76	4.838	59	7-28	12.30	4.422	
Stress 1	293	7-28	15.58	4.818	234	7-28	15.88	4.717	59	7-28	14.42	5.076	
Experiencing CV2	293	1-4.00	1.51	.457	234	1-4.00	1.51	.448	59	1-2.88	1.53	.494	
Committing CV2	293	1-2.06	1.23	.202	234	1-1.87	1.21	.185	59	1-2.06	1.28	.256	
Depression 2	293	7-28	13.18	5.509	234	7-28	13.10	5.418	59	7-28	13.49	5.894	
Anxiety 2	293	7-28	13.52	4.765	234	7-28	13.73	4.795	59	7-28	12.68	4.584	
Stress 2	293	7-28	15.76	5.214	234	7-28	16.14	5.078	59	7-28	14.25	5.510	

Exploring perceptions and experiences of choir singers on their online choir rehearsals

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Abstract

The aim of this study was to investigate the effects of participating in online choir rehearsals. Sixty seven choir singers from across the Serbia were invited via email and took part in the study voluntarily. The results showed that the Zoom, Viber, and Skype platforms are most commonly used for online choir rehearsals. The singers believe that not all the technical conditions for holding online choir rehearsals have been provided and that they cannot make the same progress in online choir rehearsals as in classical rehearsals. Members of professional choirs more often than members of amateur choirs emphasize the feeling of belonging and connection with other singers and the opportunity to improve their vocal skills and musical knowledge through online rehearsals of the choir.

Keywords: online choir rehearsals, professional singers, amateur singers

Introduction

As one of the most accessible forms of collective music-making, choral singing has, historically speaking, always been woven into the life of society and man. Although it is primarily focused on the development of singing-technical ability, adoption, and interpretation of artistic choral repertoire, and subsequently on musical-aesthetic development, the activity of choral music-making, through joint action and cooperation, creates a sense of belonging and responsibility. Therefore, in addition to creating a sense of belonging, responsibility through joint action and cooperation of singers (Mirović and Ristivojević 2019), according to numerous scientific confirmations, choral music has a beneficial effect on his mental, emotional and physical condition (Beck et al. 1999; Reis and Berschied, according to Deci and Ryan 2000; Clift and Morrison 2011; Kreutz et al. 2004; Kreutz et al. 2004; Vickhoff et al. 2003). As such, choral singing can enrich an individual's life in many ways, especially in situations of unfavorable life events (Von Lob, Camic and Clift 2010) such as the global Covid-19 pandemic.

Producing multiple consequences for people's lives, such as adversely affecting their well-being and mental health (Huang and Zhao 2020; Sønderkov et al. 2020; Wang et al. 2020; Xiong et al. 2020), The Covid-19 virus, among other things, has caused an adverse impact on the field of culture and art throughout the world, including the Republic of Serbia. In this regard, in Serbia, the competent institutions have issued orders and decisions on anti-epidemic measures, including the abolition of choral singing. News coming from other parts of the world, such as the case of the Amsterdam choir in which 102 members contracted Covid-19, and the results of research that indicated that choral music activity carries a high risk of infection with the Covid-19 virus because, among other things, respiratory aerosol particles and droplets emit the most when singing louder and intonationally high tones (Alsved et al. 2020), choral singing has gained a reputation as an activity that must be avoided during a pandemic. However, choral singing activity has shown its vitality and adaptability to the epidemiological situation, so the virtual choir in the world experienced remarkable growth during isolation during the Covid-19 virus pandemic. This universal concept, using digital technology, connects choral singers from around the world, compiling and recombining their individual audio-visual recordings of the melodic sections they send from their locations, into a single collective performance. However, the possibility of choral music-making with other singers in real-time, especially in the period of choir rehearsals, where in addition to adopting a certain musical repertoire and working on its interpretation, perfecting the vocal skills and potential of each singer is currently not possible. In this regard, we often encounter the realization of online choir rehearsals through video conferencing, such as Zoom, but singers, in addition to the conductor, must turn off their microphone, because the transmission of audio signals of all participants will burden the connection and create a cacophony. This means that the realization of "joint singing" at online choir rehearsals is impossible, and the singer, while singing, in most cases can only hear himself and the conductor. However, despite such current limitations, but also the lack of face-to-face social interaction, virtual choral music, according to research by certain authors, no less than a classical choir, provides numerous benefits such as combating feelings of social isolation and disconnection from others (Fancourt and Steptoe 2019) now already current, among the population prevalent pandemic effects.

The benefits of virtual choral singing are determined not only by the technical equipment, but also by the choir singer's ability to understand the mechanisms of communication in the online choir community, and to adapt to its norms for successful cooperation with other members. In this regard, having in mind the social and cultural prejudices in Serbia regarding digital culture, partly responsible for the digital divide regarding

inequality in access to digital technologies (which is ultimately seen if, according to certain authors, we see a low level of ICT- and in education (Ivanović and Antonijević 2020), and the pandemic situation in which choral singers, in order to continue their activity, found themselves facing a great vocal and technical challenge, we wanted to see how choral music activity in Serbia functioned. In this regard, we intended to identify all the challenges and limitations that choir singers from Serbia encountered in the online choir environment.

Research

Research objective and research questions

The current study aimed to investigate the effects of participating in online choir rehearsals at the time of the COVID-19 pandemic. In addition, the purpose of this research was to find out whether professional singers do better in such work compared to amateur singers. The guiding questions are:

1. What online platforms are used to conduct online choir rehearsals?
2. Are all the necessary technical conditions for the realization of online rehearsals of the choir provided?
3. What are the positive effects of online choir rehearsals according to respondents/choir singers?
4. Can singers improve their vocal skills and musical skills through online rehearsals as well as in classical choir rehearsals according to respondents/choir singers?
5. Do the opinions of professional and amateur singers differ on the possibilities of improving vocal skills and musical knowledge in online choir rehearsals?

It should be stressed that the study reported below did not attempt to obtain data from a representative sample of a wider population of choristers. For these reasons, it is necessary to be very careful in the conclusions and to recognise that the findings may not be generalisable beyond the sample studied. Nevertheless, we believe that this survey represent an important contribution to an underresearched area, and provide a valuable stimulus to the development of further research.

Participants

In the research was used a random sample (Cohen, Manion and Morrison 2000) comprised of sixty seven choir singers of which 26 were professional singers employed in theaters as

members of opera choirs and 41 were amateur singers, members of amateur city choirs. The gender structure of the corresponding sample of surveyed singers consists of 34 women and 33 men (information on age was not requested). Singers come from 16 different cities. Most of them are from Belgrade (N = 31), Novi Sad (N = 11), and Kruševac (N = 8). The study involved those singers who had online choir rehearsals during the Covid-19 pandemic. Since we decided to use a random sample, the conclusions cannot be generalized to the entire population of Serbian singers. Nevertheless, we could draw some conclusions from the research.

Methodology

The survey was conducted during March 2021 using appropriate data collection procedures and instruments. For the purposes of the research, a survey questionnaire was constructed that contained 13 open and closed questions. The first part of the questionnaire asked questions about the socio-demographic characteristics of the research participants: gender, and place, or city where the singers live. The second part contained questions about the platforms that choirs use in online choir rehearsals, about the conditions that choirs have for holding online choir rehearsals, and about the possibility of improving vocal skills and musical knowledge of singers. Assessments were made by singers using a five-point Likert-type scale (1 = *strongly disagree*, 2 = *disagree*, 3 = *neither agree nor disagree*, 4 = *agree*, 5 = *completely agree*).

We used qualitative and quantitative analysis for data processing. For the purposes of qualitative analysis, we coded the obtained data, then converted them into categories and into a specific result. Based on the obtained results, we calculated the basic descriptive parameters: arithmetic mean (*M*), standard deviation (*SD*) and the percentage of obtained answers (%), and certain procedures of inferential statistics were used. We used the Mann-Whitney U (*z*) test to determine the differences between two independent groups within a single measurement (to compare responses with respect to the type of choir in which the singers are employees or members). The SPSS Statistics V26 program was used for statistical data processing (Petz 2007; Suzić 2007; Opić 2010) with statistical significance at the level of .05.

Results

The results showed that choirs use different platforms for online choir rehearsals, most often Viber, Zoom, and Skype. Viber was used to send recordings, and Zoom was used for choir rehearsals. The relationship in the answers is similar when singers are divided according to the type of choir in which they sang (professional choir or amateur choir) (Table 1).

Table 1.*Platforms for online choir rehearsals*

	Professional singers		Amateur singers	
	<i>f</i>	%	<i>f</i>	%
<i>Viber</i>	11	42.31	15	36.59
<i>Zoom</i>	10	38.46	13	31.71
<i>Skype</i>	5	19.23	7	17.07
<i>Google meet</i>	0	0	4	9.76
<i>Google duo</i>	0	0	2	4.88

Half of the singers (N = 37; 55.22%) stated that they did not have all the necessary technical conditions for the online rehearsals of the choir. When we divided the singers into two groups according to the type of choir in which they sing, the results showed that in both groups half of the singers think that they do not have good technical conditions, but such answers are slightly less in the group of professional singers (No - 53.85%) than in the group of amateur singers (No - 56.10%). The result of the Mann-Whitney U test ($z = -.015$, $p = .988$) showed that this difference is not statistically significant.

When it comes to the effects of participating in choir rehearsals at a distance, the singers did not show a strong agreement for any of the offered statements, and for the last statement "I think I can improve my vocal skills and musical knowledge just as I did before the period of home isolation" respondents expressed great disagreement. Also, the data on the total dispersion of responses indicate large individual differences in respondents' responses (Table 2).

Half of the singers ("4 + 5" = 56.72%) pointed out an advantage of holding choir rehearsals at a distance that sick singers could, by listening and watching, participate in these choir rehearsals. There is a smaller number of singers ("4 + 5" = 31.34%) who stated that the rehearsals were much more efficient because there was no conversation between the choir members that would disrupt the work during the choir rehearsal. Slightly more singers ("4 + 5" = 38.81%) stated that they focused more on their singing and how they could improve it thanks to the choir's rehearsals, and that they saw and understood the conductor better than on the classical choir rehearsals ("4 + 5" = 37.31%). Half of the singers ("4 + 5" = 46.27%) stated that

holding choir rehearsals at a distance was beneficial because by participating in them, they had a sense of belonging and connection with other singers. For some of the singers, long-distance choir rehearsals were helpful because they were not lonely ("4 + 5" = 41.79%), and felt better ("4 + 5" = 41.79%) at a time when they had to stay at home much longer. Half of the singers ("1 + 2" = 49.25%) disagreed with the statement that vocal skills and musical knowledge could be improved through remote choir rehearsals just as they had before when rehearsals were held in a classical way (Table 2).

Table 2

Singers' statements on the issue of the effects of participating in online choir rehearsals

Thanks to online choir singing ...	<i>N</i>	1 %	2 %	3 %	4 %	5 %	<i>M</i>	<i>SD</i>
I focus more on my singing and how I can improve it.	67	26.87	4.48	29.85	25.37	13.43	2.94	1.39
I can see and understand the conductor better since the camera is close to his face.	67	28.36	10.45	23.88	29.85	7.46	2.78	1.35
Rehearsals are much more efficient because there are no conversations between choir members that disrupt the work.	67	26.87	4.48	37.31	16.42	14.93	2.88	1.38
Those who have fallen ill can, by listening and watching, participate in online choir rehearsals.	67	14.93	4.48	23.88	38.81	17.91	3.40	1.27
I have a sense of belonging and connection.	67	25.37	8.96	19.40	29.85	16.42	3.03	1.45
I am not lonely while staying in home isolation.	67	28.36	4.48	25.37	28.36	13.43	2.94	1.42
It helps me feel better while in home isolation.	67	26.87	4.48	26.87	25.37	16.42	3.00	1.44
I think I can improve my vocal skills and musical knowledge just as I did before the period of home isolation.	67	40.30	8.95	25.37	22.39	2.98	2.39	1.30

Note. *M* = average values; *SD* = standard deviation

When we divided the singers into two groups according to the type of choir in which they sang, the results showed no major differences in the singers' responses regarding their focus on singing during the online rehearsal, visibility and comprehensibility of the conductor,

participation of sick singers in the online rehearsal and with a feeling of loneliness during isolation. Members of professional choirs more often emphasized a sense of belonging and connection with other singers ($z = -1.906, p = .057$) and the opportunity to improve vocal skills and musical knowledge ($z = -1.905, p = .057$), but here the difference was of borderline statistical significance. The results of the Mann-Whitney U test showed that responses differed statistically significantly ($z = -2.983, p = .003$) only for the statement that choir rehearsals were much more efficient because there was no conversations between choir members that would disrupt rehearsal work (Table 3). Therefore, we can say that distance choir rehearsals are more efficient in that sense for members of professional choirs.

Table 3

Singers' statements on the issue of the effects of participating in online choir rehearsals, in relation to the type of ensemble

Thanks to online choir singing ...	Type of singing	N	M	SD	z	p
I focus more on my singing and how I can improve it.	Professional singers	26	3.08	1.35	-.532	.595
	Amateur singers	41	2.85	1.42		
I can see and understand the conductor better since the camera is close to his face.	Professional singers	26	3.08	1.35	-1.437	.151
	Amateur singers	41	2.59	1.32		
Rehearsals are much more efficient because there are no conversations between choir members that disrupt the work.	Professional singers	26	3.54	1.14	-2.983	.003
	Amateur singers	41	2.46	1.36		
Those who have fallen ill can, by listening and watching, participate in online choir rehearsals.	Professional singers	26	3.62	1.17	-1.060	.289
	Amateur singers	41	3.27	1.32		
I have a sense of belonging and connection.	Professional singers	26	3.46	1.30	-1.906	.057
	Amateur singers	41	2.76	1.48		
I am not lonely while staying in home isolation.	Professional singers	26	3.23	1.39	-1.383	.167
	Amateur singers	41	2.76	1.43		
It helps me feel better while in home isolation.	Professional singers	26	3.19	1.39	-.882	.378
	Amateur singers	41	2.88	1.47		
I think I can improve my vocal skills and musical knowledge just as I did before the period of home isolation.	Professional singers	26	2.77	1.34	-1.905	.057
	Amateur singers	41	2.15	1.24		

Note. *M* = average values; *SD* = standard deviation; *z* = Mann-Whitney U test

We were also interested in what problems the singers encountered during the online choir rehearsals. These data were obtained by an open-ended question. The singers, first of all, pointed out the bad technical conditions, especially the bad Internet and the impossibility of singing at the same time (Table 4).

Table 4

Individual answers of singers about problems related to technical conditions

Professional singers	I often have problems with the Internet, so sometimes I can't join the rehearsal.
	When the sound stops, it's my worst. Definitely, live rehearsals are the best, nothing can be done like this. - professional singer
	To me, this is torture. While we normally had rehearsals, it was great, and this way we neither see nor hear each other. As soon as my signal weakens, I can't follow anything. - professional singer
	I love when we all hear each other nicely when my voice drowns in the whole sound. - professional singer
Amateur singers	The image often freezes, the video stops, and the sound is sometimes a disaster. - amateur singer
	It means to me when the conductor explains to me how to breathe while singing, she often corrected me at rehearsals, told me that sometimes I sing louder than others. Those remarks were important to me because that's how I learned to control my voice. So, how can she give me feedback when the whole choir is not heard? How can she judge whether I stand out again or not? - amateur singer

Some singers pointed out the lack of digital skills of older singers as a problem. Their answers are given in Table 5.

Table 5

Individual answers of singers about problems related to the lack of digital skills of older singers

Professional singers	Two or three older people are present at the rehearsals because their family helps them, they would never be able to cope on their own in such conditions.
	I feel sorry for them because some older people are alone, they have no contact, the question of how they function at all. So I would put everything back to normal
Amateur singers	Well, a few singers from the band who are older don't participate in rehearsals at all, I guess they don't do well on the computer.
	Mostly, most singers are digitally literate, but the older ones have resistance, they are not interested in that.

When it comes to sending their own recordings, the singer's opinions differ. Some singers stated that it was an opportunity for them to enjoy their voice and show their vocal abilities, and some singers stated that they do not like this way of singing because they are used to being surrounded by other singers. This is how they felt insecure (Table 6).

Table 6

Individual answers of singers about sending their own recordings

Professional singers	It's really great for me! I can relax and show my vocal abilities without endangering others. I shoot several times, I'm a perfectionist. I want to show how much I really can.
Amateur singers	Finally, I can also stand out in singing. I don't know, I feel "naked", I'm uncomfortable when I sing. I usually like to be surrounded by great singers, they draw my average. I sound bad when I sing alone, everything is heard. I don't like when I sing alone, I didn't even like when only a few of us have to sing something at these regular rehearsals ... I'm insecure.

Discussion and conclusion

Given the social and cultural prejudices in Serbia regarding digital culture and the Covid-19 pandemic, thanks to which virtual space has replaced physical contact with people, choir ensembles, in order to continue their activity, faced a great vocal and technical challenge. In this regard, we were interested in the opinions of professional and amateur choir singers on whether and how their online choir community functioned during the pandemic.

The results of this study show that singers, especially amateurs, believe that the necessary conditions for the realization of an online rehearsal of the choir are not fully provided. Since the rehearsals were held via video conferencing, the synchronization of its essential component - image and sound, was hampered by a poor internet connection. Also, there is a problem of lack of technical skills of older choir singers, and programs for educating the elderly in the field of using modern technologies in everyday life are not so present in Serbia. In addition, the pandemic has imposed social isolation, which can cause depression and a lack of emotional support for others, especially among the elderly. The development of digital competencies of singers can contribute to their active participation in virtual choral music-making, which can help them suppress feelings of social isolation (Fancourt and Steptoe 2019)

and emotional tension. Namely, it is known that during choral music-making, certain processes take place in the brain, as a result of which the neurotransmitter dopamine, responsible for lowering emotional tension, is often released (Diener and Biswass-Diener 2008; Salimpoor et al. 2011). In addition to the lack of digital skills, there are problems with the shortage of technical equipment such as microphones, headphones, cables, and so on, as well as the potential cost of buying it, which limits the singer's ability to be involved in online choir rehearsals. Thus, they also deny the enjoyment of the benefits that the virtual choir provides. However, what frustrates singers the most are the limitations of the platform they use because they are not able to hear each other when singing at choir rehearsals. Namely, we see that to hold an online rehearsal of the choir, the Zoom application is most often used, which in addition to its advantages has the main drawback, which is the impossibility of collective live singing, ie singers do not hear each other in real-time. They have to turn off their microphone because the transmission of audio signals of all participants can burden the connection and thus cause cacophony. Thanks to such limitations, most professional and amateur choir singers believe that the realization of group work in this way is impossible and that the development of musical knowledge and musical skills is impossible in this way. For example, professional singers state that rehearsals lack a sense of group music and that they lack the overall harmonious context built by the voices of the collective within which the singer as an individual functionally fits, based on which he adjusts the fineness of his tone, intonationally equalizes and so on. Amateur singers, on the other hand, refer to the lack of classical work on the correct setting of voice and breathing, because, while the online rehearsal is being realized, everyone has the microphone turned off, so the conductor has no idea how the choir currently sounds as a whole. Based on that, he cannot provide adequate advice or any other feedback at a given time. However, the testimonies of the singers of both groups testify to the presence of a strong affinity for improving vocal potentials, as well as harmonizing all aspects of their own performance with other choir singers. In this regard, the musical and social coordination of members, in addition to the musical abilities of individuals, is an important condition for successful performance. However, in addition to the presence of a strong affinity for co-creation of music, collaborative practice can still be a source of various problems (Lehmann et al. 2007) such as discipline. In this regard, professional singers especially point out that, thanks to online rehearsals, a conversation between choir members that could interfere with the realization of rehearsal work is not possible. This attitude of professional choir singers, regardless of their observation of online choral music-making, speaks of a serious approach to work, no matter how effective it was.

In addition to discipline, from the aspect of favorable influence on well-being and mental health, almost half of the singers, due to "some" online choral music, felt better and connected with other singers in the period when they had to stay at home much longer. Moreover, during the period of isolation, some singers focused even more on their singing, especially when, to edit the final collective performance of the repertoire, they sent their audio-visual recordings of the learned melodic sections. In this regard, the choir singer in this situation moves to the position of the solo performer because, when recording his own section, social and musical coordination with other members of the choir in real-time does not exist. It is interesting that some singers, especially professional ones, viewed independent singing as an opportunity to express their vocal abilities in the best way, and in that sense, they recorded their melodic part several times until they found a satisfactory version of their performance. We assume that professional singers (especially those who have also been engaged in solo singing) are generally more restrained when it comes to adapting their performance to a group. Lehmann and co-workers believe that it can be a blow to "musical vanities" that initiates certain types of problems (Lehmann et al. 2007). On the other hand, most amateur singers, performing their part independently at home, ie without the sound support of the entire choir, felt a lack of self-confidence because, as they say, they exposed their vocal shortcomings. They are forced, as they say, to sing their own part, without the sound of other safer singers who could cover their vocal imperfections or mistakes with their voices. Considering that amateur singers, unlike professional ones, need musical support more, the project "Digital Choir Treasury" has started to be realized in Serbia. Within that project, matrices were placed on the website of the Serbian Choir Association (national choir organization), that is, audio files with the voices of singers, samples of how to sing compositions and pronounce the text. Recognizing the need for educational guidelines and tools for learning choral compositions that this project offers, conductor Tamara Adamov Petijević points out the following: „Users of these files are even able to go through two levels of singing training: performing their voice with a matrix - accompanied by the sound of a piano or choral score, as well as performing with a quartet of singers, composed of all the voices from the composition.“ (<https://svilara.kulturnestanice.rs/hor-sveti-stefan-decanski-digitalna-horska-riznica/>). Considering that none of the respondents stated that they use any of the matrices as musical support when recording their vocal part, we believe that the reason for this is the fact that the Digital Choir Treasury is in its infancy and that the matrix database probably does not contain compositions that make our respondents' repertoire.

There are certain limitations to this research that may affect the interpretation and context of the results. Although an effort was made to distribute the questionnaire to multiple addresses, it could only be accessed by those who have good technical conditions, but also the skill to answer online. Also, the next limitation is the small sample and the small number of people in the subsamples, and we consider the fact that virtual choirs are not widely represented in Serbia as the reason for the lower response of respondents. Having in mind the social and cultural prejudices in Serbia regarding digital culture, and on the other hand technological permanent development, it would be interesting to examine whether, in conditions that do not include pandemic measures, choirs would continue to work in a virtual environment. If they continued, how would their further progress flow?

Despite seeing the positive aspects of online choral music-making, choir singers are most frustrated because they cannot hear each other when singing at choir rehearsals. They are generally dissatisfied with the current situation and accordingly unanimously believe that musical knowledge and musical skills cannot be developed in this way. We think that the obtained results represent, on the one hand, information on how choral ensembles in Serbia are coping with the challenges imposed by the Covid 19 pandemic, and on the other hand, an appeal to the competent institutions of the Republic of Serbia to technologically support virtual choirs, but also choirs that did not have the opportunity to function virtually. In this regard, special state support is needed in developing the choir singer's ability to understand the mechanisms of communication in the online choir community and to adapt to its norms to successfully collaborate with other members. By providing adequate support and assistance from state institutions, but also by the unstoppable development of new technologies that would more closely mimic real-time choral music making, virtual choral activities will reach even greater social and cultural significance in Serbia and will be involved in the musical and comprehensive development of each individual with their wide range of possibilities.

References

- Alsved, M., Matamis, A., Bohlin, R., Richter, M., Bengtsson, P. E., Fraenkel, C. J., Medstrand, P., & Löndahl, J. (2020). Exhaled respiratory particles during singing and talking. *Aerosol Science and Technology*, 54, 1245-1248.
- Beck, R. J., Cesario, T. C., Yousefi, A., & Enamoto, H. (1999). Choral singing, performance perception, and immune system changes in salivary immunoglobulin A and cortisol. *Music Percept*, 18, 87-106.

- Clift, S. M., Morrison, I., Vella-Burrows, T., Hancox, G., Cauldon, E., Perry, U., Holden, P., Parsons-West, C., Hesketh Moore, K., Rowland-Jones, C., & Hayes, S. (2011). Singing for mental health and wellbeing: community initiatives in England. In A. Brader (Ed.), *Songs of Resilience* (pp. 121-144). Cambridge: Cambridge Scholars Publishing.
- Cohen, L., Manion, L., & Morrison, K. (2000). *Research methods in education* (5th ed.). London: Routledge.
- Diener, E., & Biswas-Diener, R. (2008). *Happiness: Unlocking the Mysteries of Psychological Wealth*. Oxford: Blackwell.
- Fancourt, D., & Steptoe, A. (2019). Present in body or just in mind: differences in social presence and emotion regulation in live vs. virtual singing experiences. *Frontiers in Psychology*, 10, 778. Available at: <https://doi.org/10.3389/fpsyg.2019.00778>
- Huang, Y., & Zhao, N. (2020). Generalized anxiety disorder, depressive symptoms and sleep quality during COVID-19 outbreak in China: a web-based cross-sectional survey. *Psychiatry Res*, 288, 112954. Available at: <https://doi.org/10.1016/j.psychres.2020.112954>
- Huang, Y., & Zhao, N. (2020). Generalized anxiety disorder, depressive symptoms and sleep quality during COVID-19 outbreak in China: a web-based cross-sectional survey. *Psychiatry Research*, 112954. Available at: <https://doi.org/10.1016/j.psychres.2020.112954>
- Ivanović, Đ., & Antonijević, M. (2020). E-učenje-stanje i perspektive u Republici Srbiji. In V. Katić (ed) *Inovacije u modernom obrazovanju [Innovations in modern education]*. Novi Sad: Fakultet tehničkih nauka, 187-190.
- Kreutz, G., Bongard, S., Rohrman, S., Hodapp, V., & Grebe, D. (2004). Effects of choir singing or listening on secretory immunoglobulin A, cortisol, and emotional state. *Journal of Behavioural Medicine*, 27, 623-635.
- Lehmann, A. C., Sloboda, J. A., & Woody, R. H. (2007). *Psychology for musicians: understanding and acquiring skills*. Oxford: Oxford University Press.
- Opić, S. (2010). Korištenje neparametrijskih testova u istraživanjima odgoja i obrazovanja [Using non-parametric tests in education research]. In A. Jurčević Lozančić, (Ed.), *11. dani Mate Demarina - Očekivanja, postignuća i perspektive u teoriji i praksi ranog i primarnog odgoja i obrazovanja* (pp. 307-317). Zagreb: Učiteljski fakultet Sveučilišta u Zagrebu.
- Petz, B. (2007). *Osnovne statističke metode za nematematičare [Basic statistical methods for non-mathematicians]*. Jastrebarsko: Naklada Slap.
- Ristivojević, A., & Mirović T. (2019). Kako učenici muzičkih škola i amaterski pevači vide dobit od horskog pevanja [How music school students and amateur singers saw the benefits of choral singing]. In M. Petrović (Ed.), *Zbornik radova dvadeset drugog pedagoškog foruma scenskih umetnosti [Proceedings of the twenty-second pedagogical forum of performing arts]*, Beograd: Fakultet muzičke umetnosti (pp. 155-164). Beograd: Fakultet muzičke umetnosti.

- Reis, H. T., Collins, W., & Berscheid A. E. (2000). The relationship context of human behavior and development. *Psychological Bulletin*, 126(6), pp. 844-872.
- Sønderskov, K. M., Dinesen, P. T., Santini, Z. I., & Østergaard, S. D. (2020). The depressive state of Denmark during the COVID-19 pandemic. *Acta Neuropsychiatrica*, 32, 226-228. Available at: <https://doi.org/10.1017/neu.2020.15>
- Salimpoor, V.N., Benovoy, M., Larcher, K., Dagher, A., & Zatorre, R.J. (2011). Anatomically distinct dopamine release during anticipation and experience of peak emotion to music. *Nature Neuroscience*, 14, 257-262.
- Suzić, N. (2007). *Primijenjena pedagoška metodologija [Applied pedagogical methodology]*. Banja Luka: XBS.
- Vickhoff B., Malmgren, H., Rickard, A., Nyberg, G., Seth-Reino, E., Engwall, M., Snygg, J., Nilsson, M., & Jörnsten, R. (2013). Music determines heart rate variability of singers. *Frontiers in Neuroscience*. Available at: <https://doi.org/10.3389/fpsyg.2013.00334>
- Von Lob, G., Camic, P., & Clift, S. (2010). The Use of Singing in a Group as a Response to Adverse Life Events. *International Journal of Mental Health Promotion*, 12(3), 45-53. Available at: <https://doi.org/10.1080/14623730.2010.9721818>
- Wang, H., Xia, Q., Xiong, Z., Li, Z., Xiang, W., Yuan, Y., et al. (2020). The psychological distress and coping styles in the early stages of the 2019 coronavirus disease (COVID-19) epidemic in the general mainland Chinese population: a web-based survey. *PLOS ONE*, 15(5), e0233410. Available at: <https://doi.org/10.1371/journal.pone.0233410>
- Xiong, J., Lipsitz, O., Nasri, F., Lui, L. M., Gill, H., Phan, L., et al. (2020). Impact of COVID-19 pandemic on mental health in the general population: a systematic review. *Journal of Affective Disorders*, 277, 55-64. Available at: <https://doi.org/10.1016/j.jad.2020.08.001>

Attitudes of Music Teachers towards organizing Distance Learning in the Context of Lifelong Education

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Abstract

At the time of the Covid-19 virus pandemic, all teaching, including music, underwent sudden and unexpected changes. The focus on technology and its use have emerged as a major challenge for educators. Teacher competencies have always been crucial in educational work, but they have been particularly pronounced during distance learning. Distance learning is characterized by physical distance and complete digitalization of the teaching process. This paper is aimed at determining the attitudes of teachers of Music Culture and Music Arts regarding the conduct of distance learning and their self-assessment of their own knowledge and skills for its realization. Data was collected through an online survey during the 2021/22 school year. 83 teachers of Music Culture and Music Arts were included in the research. The results showed that teachers believe that they receive satisfactory support from the school in the implementation of distance learning, that they have access to tools for organizing such classes, and that they are satisfied with their quality and role. At the same time, only a quarter of teachers believe that there are a sufficient number of courses and workshops in this area organized by the school, and a third also think about courses in the environment in which they live. Also, the respondents are of the opinion that they have competencies for conducting distance learning, but they believe that they did not acquire these competencies during their academic studies. Furthermore, most teachers believe that students do not acquire the same knowledge as in the classroom, and that grades are not a true reflection of their knowledge, so they grade them milder than usual. Finally, the results showed that none of the sociodemographic variables (gender, years of service, and school location) were statistically significantly related to their attitudes and assessments of their own competence ($p > 0.05$). The results of this research indicate the need for lifelong learning so that teachers can respond to the challenges of contemporary pedagogical reality.

Keywords: teachers of Music Culture and Music Arts, distance learning, lifelong learning

Introduction

Teacher competencies have always been crucial in educational work. During their academic studies, teachers should acquire competencies in the fields of subject matter and pedagogy, competencies needed to guide and support students, to understand the social and cultural significance of education, to work with information, technology, and knowledge, and to work with people – students, associates, and others. partners in education, for work in society and with society, at the local, regional, national, European and wider global level (Lončarić Pejić & Papak, 2009). Given the rapid development of all aspects of modern society, the competencies of 21st century teachers that are of particular importance are digital literacy, creativity and imagination, cooperation and communication, civic awareness, critical thinking and problem solving, and training students to manage their own learning. In modern times, it is important that the teacher has first and foremost digital literacy, which proved to be crucial during 2020, 2021, and 2022 distance learning due to the COVID-19 pandemic. It is digital competence that has taken on a whole new importance for the normal functioning of the teaching process (MZO, 2019a). In 2017, the joint research center of the European Commission designed the Digital Competence Framework for Educators – DigCompEdu⁵⁶. In this framework, the competencies that the teacher should possess in the fields of ICT and learning are proposed. The European framework of DigCompEdu consists of six areas, and they are: 1) professional engagement: the application of technology to support one's own profession; 2) digital resources: handling and use of digital content for learning and teaching; 3) digital learning and teaching: didactic use of technology; 4) evaluation and assessment: use of technology for the field of evaluation and assessment; 5) support for students: help for weaker students; 6) teaching digital competencies: guiding students in the acquisition of digital knowledge and skills. DigCompEdu helps guide the implementation of regional and national training tools and programs targeting teachers at all levels, from early childhood to higher and adult education, including general and vocational education, special needs education, and the non-formal learning context (Redecker, 2017).

Distance learning

Distance learning is not new and is described as a special type of teaching process in which students and teachers are spatially and/or temporally distant from each other (Miražić-Nemet & Surdučki, 2020). Distance learning has existed for many years and has historically

⁵⁶ Digital Competence Framework for Educators (DigCompEdu). https://joint-research-centre.ec.europa.eu/digcompedu_en

been used to educate people who are prevented from actively and physically attending classes. Before the technological revolution, distance learning took place by mail, while with the advent of the first technologies, the first media appeared that enabled new technological solutions in a very short time. Thus, distance learning in its beginnings of technology took place through radio and television programs. Today, distance learning takes place in the virtual world and there are many tools and aids for the purpose of education (Simonson & Berg, 2016), i.e., formal and non-formal learning. Distance learning is characterized by the use of educational media for the purpose of presenting educational content and communication; ensuring two-way communication between teachers and students; and placing emphasis on controlling the acquisition of teaching content via the Internet (Budić & Hak, 2014). Čubrić (2021) discusses the benefits and drawbacks of distance learning, emphasizing the development of personal skills through continuous learning, the safety of introverted students, the availability of materials and lectures on the Internet, and the ability to watch them again and develop the ability to process data independently. In addition to the positive characteristics according to Čubrić (2021), distance learning also has negative characteristics such as lack of physical contact that affects younger students, reduced classical educational task of teachers, more difficult individual commitment to students, poor student motivation caused by poor computer literacy and mandatory technology. He also points out that it is almost impossible to conduct distance learning in lower grades. Švelec (2020) states that in distance learning the lesson should have a different organization than the usual one present in a traditional classroom and that the reverse classroom model is more appropriate for this way of working, requiring activities of both students and teachers before, during and after class. Before the lesson, the student gets acquainted with the topic and applies reading and writing techniques for critical thinking, followed by a self-assessment of additional needs for the implementation of activities.

Distance learning around the world began to be actively applied in 2020 due to the COVID-19 pandemic, which, with its rapid spread, marked the implementation of physical education as risky. Despite these shortcomings, distance learning has enabled the organization of primary, secondary, and higher education. Distance learning in Croatia began on March 16, 2020. The coordination process led by the Ministry of Science and Education involved the Croatian Academic and Research Network (CARNET), the University Computing Center, the Agency for Education, the Agency for Vocational and Adult Education, and the Agency for Mobility and EU Programs. The Ministry of Science and Education has published an Action Plan for the Implementation of Distance Learning (MZO, 2020), i.e., a document with a list of the most important steps and procedures carried out during distance learning in schools and

universities. The action plan lists the technical solutions available through the AAI@Edu.Hr platform recommended to schools for distance learning, which are Moodle, Teams, Yammer, Google Classroom, and Edmodo. On the Distance Teaching⁵⁷ subpage, CARNET published information, advice, recommendations, and instructions on the selection and use of technological solutions for distance learning and published the document Online systems for the organization and conduct of distance learning (CARNET, 2020), which explains the most important features, advantages, and disadvantages of recommended tools such as Google Classroom (and related Google Meet tool), MS Teams, Yammer, CARNET Loomen, and Zoom. It is recommended that each school choose the platform on which it will work and that all teachers or students work on it (Politiscope, 2021). The framework annual implementation subject curricula and the accompanying video lectures for primary and secondary education were continuously published on the School for Life⁵⁸ website, and then on the website of the Ministry of Science and Education (video lectures⁵⁹; implementation curricula⁶⁰). During the COVID-19 pandemic, television classes were organized for lower primary school students in the Republic of Croatia, while distance learning classes were organized for upper primary and secondary school students and university students through various platforms for such classes. Miražić-Nemet and Surdučki (2020) believe that distance learning is a great challenge for all participants in the educational process – teachers, students and their parents. The new roles in which teachers, students, and their parents find themselves, with additional aggravating circumstances such as isolation, limited movement, stress, and altered family dynamics, has raised the question of how to ensure adequate distance learning in current conditions, given the insufficient readiness of the education system for this type of teaching.

Distance music teaching

Music teaching in the Republic of Croatia was also organized as distance learning, i.e., teaching music culture in primary schools, teaching music art in grammar schools, teaching in music schools, and teaching music at higher education institutions. Due to its specificity, music teaching was a challenge in the transition to distance learning due to the impossibility of physical presence and contact between students and teachers (Ambruš-Kiš, 2020). The specificity of music teaching is reflected in the fact that in music teaching, most musical

⁵⁷ CARNET – Distance Teaching (Nastava na daljinu). <https://www.carnet.hr/usluga/udaljenoucenje/>

⁵⁸ School for Life (Škola za život). <https://skolazazivot.hr/e-ucenje/>

⁵⁹ Video lectures (Videolekcije). <https://mzo.gov.hr/vijesti/nastava-na-daljinu-raspored-3629/3629>

⁶⁰ Framework annual performance curricula (Okvirni godišnji izvedbeni kurikulumi).

<https://mzo.gov.hr/rezultati-pretrazivanja/49?pojam=Okvirni+godisnji+izvedbeni+kurikulumi+za+nastavnu+godinu>

knowledge and skills are acquired by students through teachers because their adoption requires constant feedback. The teacher is, therefore, the only person who can supervise the process of multiple repetitions as a necessary condition for acquiring a skill, often based on a trial-and-error mechanism (Rojko, 2012). This statement refers primarily to the acquisition of knowledge and skills related to the contents of solfeggio, i.e., musical literacy, but also to learning to sing songs, play instruments and engage in musical creativity. In the teaching of Music Culture and Music Arts, a mitigating circumstance related to distance learning is that in general education schools, according to the Curriculum of Music Culture for Primary Schools and Music Art for Gymnasiums (MZO, 2019b), listening to and getting to know music is the predominant domain of music teaching. Therefore, teachers in general education schools mainly focused online classes on organizing active listening to music, because other activities such as singing, playing, and creativity were difficult or almost impossible to implement. Jurkić Sviben and Jambrošić (2021) point out that with the declaration of the pandemic in March 2020, almost all singing activities were suspended for a long time in music lessons, as well as singing activities in ensembles and choirs, or were organized much less often and in very limited conditions and circumstances. If they were organized, video communication platforms did not provide quality singing due to the problem of sound synchronization, which prevented simultaneous group singing (Grushka et al., 2021), but also any other group music (Hash, 2021). Wallace et al. (2020) believe that it should be possible to engage in music despite the global pandemic because singing and playing are widespread human activities and are lacking in those who engage in them. The results of the research (Moscardini & Rae, 2020) show that about two thirds of teachers are considered insufficiently competent to teach music at a distance or are estimated to be averagely competent (Kibici & Sarikaya, 2021). Rucsanda, Belibou and Cazan (2021) believe that more educational initiatives are needed to promote distance teaching methods in distance music teaching because research results (Parkes et al, 2021) showed that organizing distance music teaching for two thirds of teachers caused stress. Kaleli (2020) believes that future music teachers should acquire competencies for working with software and computer programs during their studies. Hash (2021) believes that the success of distance music teaching in the future will depend on how much music educators develop curricula, create work materials, build infrastructure, and prepare students for online and offline teaching. He emphasizes the importance of lifelong learning for music teachers in the areas of technology, teaching, assessment and motivation of students, and helping students with disabilities. These findings were the impetus for the research that we will present in this paper, which was aimed

at determining the attitudes of teachers of Music Culture and Music Arts in relation to the teaching of music at a distance.

Methodology

Aim and research hypotheses

The aim of the research was to determine the attitudes of teachers of Music Culture and Music Arts towards distance learning and their self-assessment of their own knowledge and skills for its realization. The research was based on the following hypotheses:

H1: Teachers are of the opinion that they have sufficient support from the school and the local community to organize distance music lessons.

H2: Teachers are not considered competent enough to teach music at a distance.

H3: Teachers are of the opinion that in distance music teaching, the evaluation of students' knowledge and students' acquisition of their knowledge is the same as in classroom teaching.

H4: Teachers positively assess the quality and role of the tools they use to teach music at a distance.

H5: There is a statistically significant difference in teachers' attitudes about distance music teaching with regard to sociodemographic variables (gender, years of service, school location).

The hypotheses are based on assumptions derived from the results of other research (Kaleli, 2020; Kibici & Sarikaya, 2021; Moscardini & Rae, 2020; Parkes et al., 2021; Rucsanda, Belibou & Cazan, 2021).

Sample and data collection

The research took place during the school year 2021-2022 and included 83 teachers of Music Culture and Music Arts from 16 Croatian counties. Data was collected through an online survey. The research was funded by the authors of the paper. The sample of respondents is visible in Table 1.

Table 1

Sample description (N = 83)

Sex	Male	17 (20,5%)
	Female	66 (79,5%)
	In total	83 (100%)
Years of service	0-5	19 (22,9%)
	6-10	11 (13,3%)
	11-20	27 (32,5%)
	21 and more	26 (31,3%)
	In total	83 (100%)
School location	City	51 (61,4%)

Village	17 (20,5%)
Combined	15 (18.1%)
In total	83 (100%)

As can be seen from Table 1, 83 teachers participated in the study, one-fifth of whom were male. Considering the length of service, most teachers have more than 10 years of experience (almost two thirds of them). Also, almost two-thirds of respondents work in schools located in urban areas.

Instrument and statistical procedure

The anonymous online questionnaire that the teachers filled out consisted of questions and statements that sought to find out their socio-demographic characteristics (gender, age, school location). At the same time, we wanted to find out what the teachers' attitudes were about teaching music at a distance. The survey questionnaire contained a total of 25 items.

Teachers' attitudes about the support they receive from the school and the local community were examined with an instrument consisting of five particles, three of which were dichotomous (answers offered were yes / no) and two in the form of the Likert scale (example: On a scale of 1 to 5 indicate the extent to which you agree with the statement that the school where you work by organizing courses / workshops contributes to the quality organization of distance learning where 1 means that you do not agree with the statement, 2 that you do not agree, 3 that you have no opinion, 4 that agree, and 5 to fully agree with the above statement). Self-assessment of competencies for distance learning was tested with an instrument consisting of three particles in the form of the Likert scale. Furthermore, the opinion of teachers on the evaluation of student knowledge and the acquisition of student knowledge was examined by an instrument that also consisted of three particles in the form of the Likert scale. Teachers' attitudes about distance learning tools were examined with an instrument containing seven particles of different types (Likert scale, single choice questions, multiple choice questions, open type questions). To test the H5 hypothesis, a t-test was used to determine possible statistically significant differences in teachers' attitudes about distance learning music with respect to sociodemographic variables, where the attitudes of the respondents were treated as a dependent variable. Quantitative data were processed by the computer program SPSS.

Results and discussion

Assess the support of the school and the local community in teaching music at a distance

At the beginning of the questionnaire, teachers wanted to find out how they assessed the support of the school and the local community in teaching music at a distance (Tables 2 and 3).

Table 2

Teachers' opinion on school support

Question / answers	yes	not	total
Do you think that the school provides you with sufficient support in the organization of distance learning?	72 (86,7%)	11 (13,3%)	83 (100%)
Do you have the tools you need to conduct distance learning?	80 (96,4)	3 (3,6%)	83 (100%)
Is the internet connection good enough for the uninterrupted realization of distance learning?	65 (78,3%)	18 (21,7%)	83 (100%)

As can be seen in Table 2, every eighth respondent believes that the school does not have enough support for the implementation of distance learning music, and only every thirtieth stated that distance learning tools are not available. More than three-quarters of teachers believe that the Internet connection for teaching is satisfactory.

Table 3

Teachers' opinion on courses

Claim / answers	I don't agree at all	I disagree	I have no opinion	I agree	I totally agree
The school where I work by organizing courses / workshops contributes to the quality organization of distance learning	17 (20,5%)	19 (22,9%)	25 (30,1%)	11 (13,3%)	11 (13,3%)
In the environment in which I live, there are a sufficient number of courses/workshops to improve the use of digital tools needed for distance learning	17 (20,5%)	13 (15,7%)	23 (27,7%)	16 (19,3%)	14 (16,9%)

From Table 3, it can be seen that only a quarter of teachers believe that there are a sufficient number of courses and workshops in this area organized by the school, and a third also think about courses in the environment in which they live. On the contrary, Parkes et al. (2021) report that music teachers are generally satisfied with the number and quality of courses and workshops offered. Given the results obtained, and in order to test the H1 hypothesis, which read Teachers are of the opinion that they have sufficient support from the school and the local community to organize distance music lessons, the hypothesis was partially accepted. Namely, teachers are satisfied with the support of the school and the conditions for teaching music at a distance, but believe that the school and the local community do not organize enough courses and workshops to develop their digital pedagogical competencies in lifelong learning.

Self-assessment of competencies for distance learning

Furthermore, teachers were asked whether they were assessed as competent enough to conduct distance learning (Table 4).

Table 4

Self-assessment of competencies

Claim / answers	I don't agree at all	I disagree	I have no opinion	I agree	I totally agree
I am competent to organize and implement distance learning	-	3 (3,6%)	11 (13,3%)	28 (33,7%)	41 (49,4%)
During the study, I acquired sufficient competencies for the implementation of distance learning	51 (61,4%)	12 (14,5%)	10 (12%)	6 (7,2%)	4 (4,8%)
Independent work and learning help me in the design and implementation of distance learning	-	-	2 (2,4%)	22 (26,5%)	59 (71,1%)

The data from Table 4 indicates that only every thirtieth respondent is assessed as competent enough to teach music at a distance. The results of other research (Moscardini & Rae, 2020) show that as many as 62% of music teachers believe that they are not competent enough to teach music at a distance, and Kibici and Sarıkaya (2021) state that music teachers in upper primary and secondary schools are assessed as competent for distance learning. However, only one in every eight respondents in our survey believes they have acquired the necessary skills to teach such classes during their academic studies. Future music teachers should attend courses during their studies to develop the necessary competencies for working with computer programs and software (Kaleli, 2020) and be of the opinion that individual work and learning contribute to the better realization of distance learning. Therefore, hypothesis H2 Teachers are not considered competent enough to teach music at a distance, is not accepted.

Teachers 'attitudes about the evaluation and acquisition of students' knowledge

Teachers were also asked to find out what they thought about the evaluation of students' knowledge and the students' acquisition of knowledge during distance learning music (Table 5).

Table 5*Attitudes about the evaluation and acquisition of knowledge*

Claim / answers	I don't agree at all	I disagree	I have no opinion	I agree	I totally agree
When conducting distance learning, students acquire the same knowledge that they would acquire in regular classes	21 (25,3%)	26 (31,3%)	26 (31,3%)	8 (9,6%)	2 (2,4%)
Student grades that are the result of distance learning are a reflection of students' actual knowledge	22 (26,5%)	27 (32,5%)	23 (27,7%)	9 (10,8%)	2 (2,4%)
When grading students, I am milder than usual	1 (1,2%)	6 (7,2%)	19 (22,9%)	32 (38,6%)	25 (30,1%)

As can be seen from Table 5, only every ninth teacher considers that students acquire the same knowledge during distance learning as in classroom teaching. At the same time, more than half of the teachers are of the opinion that the grades resulting from distance learning do not reflect the actual knowledge of students. Moscardini and Rae (2020) point out that students are just as active and acquire the same knowledge as in classroom teaching, and the only disruptive factor is technical prerequisites. More than two-thirds of respondents say they rate students more leniently during distance learning music. Given the above results, hypothesis H3 Teachers are of the opinion that in distance music teaching the evaluation of students' knowledge and the student acquisition of knowledge is the same as in classroom teaching, which is not accepted.

Teachers' opinions on distance learning tools

Furthermore, the teachers wanted to know how they assess the quality and role of the tools they use to conduct distance learning. For this purpose, they were asked seven different questions or claims. The first statement was: distance learning tools contribute to the quality of music teaching. 55 (66.2%) respondents fully agreed with this statement. Twenty-one (25.3%) respondents did not have an opinion, while only two respondents (2.4%) disagreed with this statement. To the next question, which was which tool for distance learning did you prefer? Most respondents, 51 (61.4%), prefer MS Teams, then 14 (16.9%) teachers prefer video conferencing tools such as Zoom and Google Meet, and only a few teachers use Yammer, Google Classroom, Skype, and digital textbooks, while no respondent marked Loomen. To the question, what tools do you use for distance learning? Respondents were able to choose multiple answers. Most teachers, 61 of them (73.5%), voted for MS Teams, followed by 48 (57.8%) for

digital textbooks, and a total of 35 (42.2%) for Zoom and Google Meet. Among other things, some teachers cited Wizer and Kahoot. Similar tools are cited by respondents from another study (Moscardini & Rae, 2020): Zoom, Microsoft Teams, Google Suite, Facetime, and Skype. The next question was: "Are you satisfied with the tools you use to conduct distance learning?" Almost all respondents, 79 of them (95.2%), expressed satisfaction with the tools available to them. One respondent stated that he felt uncomfortable and insecure when using them, and another stated that the tools were not adapted to the classroom. The next question in the questionnaire wanted to find out the reason why teachers choose a particular tool. The answers offered were: at the school level, the tool we use was selected; personally, I decided on a certain tool because I think it is better than others; and the rest. A total of 70 (84.3%) teachers stated that they use a certain tool because it was decided at the school level, while 13 (15.7%) choose the tools themselves. The results of some other research are similar (Parkes et al., 2021). Teachers then had to answer the question, "Do you think that without the tools intended for distance learning, the realization of distance learning would not be possible?" The vast majority of teachers, 82 of them (98.8%), said yes. The last question in the questionnaire was: "Whose materials do you use in the implementation of distance learning?" Teachers could, if they combined different materials, circle more answers. Most teachers (80, or 96.4%) cited their own materials, which is to be commended. Namely, during the pandemic, music teachers show their creativity by finding different ways to reach out to their students and how to help them (Thornton, 2020). The materials of publishing houses were cited by 58 of them (69.9%), the video lectures of the ministry by 36 (43.4%), and the materials of colleagues by a total of 27 (32.5%). The above results show that the vast majority of teachers are satisfied with the tools for teaching music at a distance, that they contribute to the quality of teaching, and that distance learning without these tools would not be possible. Therefore, hypothesis H4, which was stated by teachers and positively assesses the quality and role of the tools they use to teach music at a distance, is accepted.

Sociodemographic variables and teacher attitudes

In order to test hypothesis H5, which reads: There is a statistically significant difference in teachers' attitudes about distance music teaching with regard to sociodemographic variables (gender, years of service, school location), the obtained results were compared. The T-test for independent samples examined possible statistically significant differences in teachers' attitudes towards distance music teaching with respect to sociodemographic variables. The results showed that there was no statistically significant difference in teachers' attitudes towards distance music teaching with respect to sociodemographic variables ($p > 0.05$). Kibici and

Sarıkaya (2021) report differently, pointing out that male teachers and teachers with less work experience are assessed as more competent to teach music at a distance. Therefore, Hypothesis H5 There is a statistically significant difference in teachers' attitudes about distance music teaching with regard to sociodemographic variables (gender, years of service, school location) is not accepted.

Finally, one question was to find out whether teachers think that teaching music at a distance requires additional effort and stress for them. Two-thirds of respondents responded positively, which is in line with the results of other research (Parkes et al., 2021).

Conclusion

The results of this research showed that music teachers believe that they receive satisfactory support from the school in the implementation of distance learning in music and that they have access to tools for organizing such classes and are satisfied with the quality and choice of tools. At the same time, only a quarter of teachers believe that there are a sufficient number of courses and workshops in this area organized by the school, and a third also think about courses in the environment in which they live. It is therefore up to education and local authorities to pay more attention to the current needs of teachers in order to respond effectively to today's challenges through lifelong learning. Also, music teachers are of the opinion that they have the competencies for teaching music at a distance, but they believe that they did not acquire these competencies during their studies. For this reason, academies that educate future teachers should also prepare students for various situations, such as the current pandemic, in order to successfully overcome the obstacles that may arise in the realization of music teaching. At the same time, most teachers believe that students do not acquire the same knowledge as in the classroom, and that grades are not a true reflection of their knowledge, so they grade them more gently than usual. This result is, in a way, in contrast to the very high self-assessment of teachers' competencies for teaching music at a distance, because it is to be expected that a competent teacher conducts effective teaching. The main limitation of this study follows from this conclusion. Namely, in order to get a more objective picture of the success of distance music teaching in primary schools and gymnasiums, as well as a more complete insight into the research issues, future research should include students and possibly parents of students.

The results of the research indicate the need for lifelong learning so that music teachers can respond to the challenges of contemporary pedagogical reality. Namely, according to Jurčić (2012), the job of a teacher accompanies lifelong learning through a formal and informal way. It is important because it nurtures and improves the competencies that are needed when

performing teaching processes. Science, theory and innovation are a completely changeable part of everyday life, and in every aspect, it is necessary to maintain the pace of learning so that new, modern knowledge can be transferred and connected with old teachings (Jurčić, 2012). Distance learning imposed due to the global state of health was the only way to continue the educational process in times of crisis. Thanks to the lifelong education of teachers in the context of digitalization and the many opportunities brought by the virtual world, but also the various reactions of publishers who have greatly facilitated this process by digitizing textbooks, distance music teaching has mostly been successfully mastered.

References

- Ambruš-Kiš. R. (2020). Izazovi nastave glazbe na daljinu [Challenges of teaching music at a distance]. Profil Klett. <https://www.profil-klett.hr/izazovi-nastave-glazbe-na-daljinu>
- Budić, H., & Hak, M. (2014). Primjena suvremene obrazovne tehnologije u nastavi [Application of modern educational technology in teaching]. In: B. Katalinić and D. Zima (Eds.), International Conference “Vallis Aurea” (pp. 65-73). Požega: Veleučilište u Požegi.
- CARNET (2020). Online sustavi za organizaciju i provođenje nastave na daljinu [Online systems for organizing and conducting distance learning]. Zagreb: CARNET.
- CARNET – Nastava na daljinu [Distance Teaching]. <https://www.carnet.hr/usluga/udaljenoucenje/>
- Čubrić, M. (2021). Nastava na daljinu [Distance learning]. Hrvatski jezik, 8(1), 12-14.
- Digital Competence Framework for Educators (DigCompEdu). https://joint-research-centre.ec.europa.eu/digcompedu_en
- Framework annual performance curricula [Okvirni godišnji izvedbeni kurikulumi]. <https://mzo.gov.hr/rezultati-pretrazivanja/49?pojam=Okvirni+godisnji+izvedbeni+kurikulumi+za+nastavnu+godinu>
- Grushka, K., Lawry M., Sutherland, K., & Fergusson, C. (2021). A Virtual Choir Ecology and the Zoom-machinic: Visual Technologies as a Panacea for Social Isolation. Video Journal of Education and Pedagogy, 1-16. <http://doi:10.1163/23644583-bja10013>
- Hash, P. M. (2021). Remote Learning in School Bands During the COVID-19 Shutdown. Journal of Research in Music Education, 68(4), 381-397. <http://doi.org/10.1177/0022429420967008>
- Lončarić, D., & Pejić Papak, P. (2009). Profiliranje učiteljskih kompetencija [Profiling teacher competences]. Odgojne znanosti, 11(2), 479-497
- Jurčić, M. (2012). Pedagoške kompetencije suvremenog učitelja [Pedagogical competencies of a modern teacher]. Zagreb: Recedo.
- Jurkić Sviben, T., & Jambrošić, N.S. (2021). (Ne)Pjevanje za vrijeme pandemije bolesti COVID-19 – mišljenja i emocionalni doživljaj učenika od 5. do 8. razreda osnovnih škola u Republici

- Hrvatskoj [(Non) Singing During The COVID-19 Pandemic - Opinions and Emotional Experience of Students From 5th to 8th Grade of Primary Schools in The Republic of Croatia]. *Školski vjesnik*, 70(2), 245-268. <https://doi.org/10.38003/sv.70.2.11>
- Kaleli, Y. S. (2020). The effect of computer-assisted instruction on piano education: An experimental study with pre-service music teachers. *International Journal of Technology in Education and Science (IJTES)*, 4(3), 235-246.
- Kibici, V. B., & Sarikaya, M. (2021). Readiness levels of music teachers for online learning during the COVID 19 pandemic. *International Journal of Technology in Education (IJTE)*, 4(3), 501-515. <https://doi.org/10.46328/ijte.192>
- Miražić-Nemet, D., & Surdučki, T. (2020). Učenje na daljinu iz ugla nastavnika, učenika i roditelja [Distance learning from the angle of teachers, students and parents]. *Pedagoška stvarnost*, 66(2), 169-178. <https://doi.org/10.19090/ps.2020.2.169-178>
- Moscardini, L., & Rae, A. (2020). We make music online: A report on online instrumental and vocal teaching during the COVID-19 lockdown. Music Education Partnership Group. <https://doi.org/10.13140/RG.2.2.20242.89289>.
- MZO (2020). Akcijski plan za provedbu nastave na daljinu [Action plan for the implementation of distance learning]. Zagreb: Ministarstvo znanosti i obrazovanja.
- MZO (2019a). Razvoj kompetencija učitelja za 21. stoljeće [Development of teacher competencies for the 21st century]. Zagreb: Ministarstvo znanosti i obrazovanja.
- MZO (2019b). Kurikulum nastavnog predmeta Glazbena kultura za osnovne škole i Glazbena umjetnost za gimnazije [Curriculum of the subject Music Culture for Primary Schools and Music Art for Gymnasiums]. Zagreb: Ministarstvo znanosti i obrazovanja.
- Parkes, K. A., Russell, J. A., Bauer, W. I., & Miksza, P. (2021). The Well-being and Instructional Experiences of K-12 Music Educators: Starting a New School Year During a Pandemic. *Frontiers in psychology*, 12, 701189. <https://doi.org/10.3389/fpsyg.2021.701189>
- Poliscope (2021). Analiza aplikacija za učenje na daljinu iz perspektive zaštite privatnosti djece [Analysis of distance learning applications from the perspective of protecting children's privacy]. Zagreb: Poliscope.
- Redecker, C. (2017). European Framework for the Digital Competence of Educators: DigCompEdu. Luxembourg: Publications Office of the European Union.
- Rojko, P. (2012). Metodika nastave glazbe. Teorijsko-tematski aspekti (Drugo izmijenjeno i dopunjeno izdanje – elektroničko) [Methods of teaching music. Theoretical and thematic aspects (Second amended edition - electronic)]. Osijek: Sveučilište J. J. Strossmayera-Pedagoški fakultet Osijek.
- Rucsanda, M. D., Belibou, A., & Cazan A-M. (2021). Students' Attitudes Toward Online Music Education During the COVID 19 Lockdown. *Frontiers in Psychology*, 12, 753785. <https://doi.org/10.3389/fpsyg.2021.753785>
- School for Life [Škola za život]. <https://skolazazivot.hr/e-ucenje/>

- Simonson, M., & Berg, G. (2016). Distance learning. Encyclopedia Britannica. <https://www.britannica.com/topic/distance-learning>
- Švelec, S. (2020). Rad u nastavi fizike u nastavi na daljinu [Physics teaching distance learning]. Osijek: Elektrotehnička i prometna škola Osijek. <http://elpros.net/2020/rad-u-nastavi-fizike-u-nastavi-na-daljinu/>
- Thornton, L. (2020). Music Education at a Distance. *Journal of Music Teacher Education*, 29(3), 3-6. <https://doi.org/10.1177/1057083720928615>
- Video lectures [Videolekcije]. <https://mzo.gov.hr/vijesti/nastava-na-daljinu-raspored-3629/36>
- Wallace, J., Moscardini, L., Rae, A., & Watson, A. (2020). Following the science: a systematic literature review of studies surrounding singing and brass, woodwind and bagpipe playing during the COVID-19 pandemic. Music Education Partnership Group Scotland.

Attitudes of future primary education teachers about the application of information and communication technology in music teaching in primary schools

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Abstract

This paper presents the results of research conducted to determine the opinions of future teachers on the importance and possibilities of applying information and communication technology in music teaching. According to the results of the research, the largest number of students believe that the application of information and communication technology is important in the areas of music listening, music games and teaching music in general. They also think that students are glad to participate in activities that use information and communication technology. This makes the contents in music teaching easier to master, and it is easier to achieve an interdisciplinary approach in music teaching. Future teachers feel that their competencies for conducting music activities in which information and communication technology is applied are not sufficient. Therefore, it is necessary to further educate teachers and students to carry out such activities in music teaching. Primary education teachers need to keep pace with the development of technology, but it is important to ensure that the usage of information and communication technology is effective and age-appropriate.

Keywords: future teachers, information and communication technology, music teaching, primary school

Introduction

In the last few years, digital technology has experienced rapid development, which is why we cannot imagine modern teaching without the use of computers, projectors, speakers, smart boards, tablets or mobile phones. In addition to digital technology, music teaching also uses information and communication technology (hereinafter ICT), which means “the technical basis for the systematic collection, storage, processing, dissemination and exchange of information of various forms, i.e. characters, text, sound and images” (Hrvatska enciklopedija, n.d.).

In Croatia, the interest in the use of computers for teaching began in the 1970s. Mužić (1973, p. 7) predicted the implementation of computers into the teaching process by stating the following: “Computers are at the door of our school system, ... Therefore, not only the younger but also the middle generation of teachers and other workers at our school will come across at least some aspect of the practical application of computers in their work, not only experimental but also everyday”. Unlike other media devices used in teaching at the time (tape recorder, film projector, etc.), computers were starting to be regarded as a machine which is a source of knowledge and exercises, a source of various information, but also their recipient (Mužić & Rodek, 1987, p. 46). The authors understand the computer as an active participant in all parts of the teaching lesson, all the while not diminishing the importance of teachers in the educational process. “In the *man and machine* system, which appears during teaching, the teacher retains his role, but it is changed and enriched” (Mužić & Rodek, 1987, p. 60). In addition, emphasis is put on the importance of educating teachers on the application of information technology and the inclusion of “computer-based teaching” in the overall educational vertical (Šoljan, 1988, pp. 83-105).

Vrkić Dimić (2010, p. 114) points out that the use of computers in the educational process is conditioned by the development of technology, the postmodernist context and the change of the learning and teaching paradigm. The initial lethargy and slowness in the communication and information transfer was replaced by a higher speed and a usage simplicity, which enabled their easier implementation into the educational process. The postmodern society is a result of the emergence of highly developed industrial societies. According to Bognar (2003), school in times of the industrial society was characterized by student obedience and teaching according to the curriculum. In the post-industrial society, the aim is to encourage and develop the creative and critical thinking skills of students, as well as a greater independence of both students and teachers. It is the student who, with the help of the teacher, constructs his own knowledge, and “the initiator of development is innovation based on advanced technologies” (Bognar, 2003, p. 10). Vrkić Dimić (2010) emphasizes that the third factor which affected the use of computers in teaching is the change in the didactic understanding of the educational process, which is now focused on the students themselves and the achievement of subject outcomes.

The use of digital technology in teaching gave rise to the four paradigms of learning and teaching (Koschmann, 1996, according to Vrkić Dimić, 2010) in the second half of the 20th century, and they differ according to the role of computers in the educational process. Computer Assisted Instruction (CAI) dates back to the 1960s, when the computer was a tool for teaching

and information delivery. In the 1970s, the Intelligent Tutoring System (ITS) emerged, in which the computer was given more importance and it served as a feedback to the student. In the 1980s, the LOGO paradigm emerged. Further development increased the role of the computer in the learning process, and the computer created content according to the idea of the student. In 1989, the Computer Supported Collaborative Learning (CSCL) paradigm emerged, emphasizing the importance of collaborative learning, in which the computer played a motivating role.

Matijević (2010) believes that future teachers and educators are not competent enough to apply new technologies while working with children, and recommends changing the teacher education programme, which must be enriched with methodological scenarios for the development of the aforementioned competencies. It is important to integrate ICT into the education of future teachers in order to acquaint them with the possibilities of such teaching before the educational work done directly with the students (Bauer & Dammers, 2016, p. 2). Prensky (2001) differentiates among the population with regard to the time of birth and the use of digital technology and ICT. He calls all those born in the age of computers, video games and the Internet *digital natives*, while those born before the digital revolution he calls *digital immigrants*. According to this theory, today's students are natives and teachers are digital immigrants (Prensky, 2001, pp. 2-4).

The use of information and communication technology in music teaching

The National Curriculum Framework (Ministarstvo znanosti i obrazovanja, 2011, p. 17) emphasizes the importance of digital competencies, the main elements of which are “the use of computers to find, evaluate, store, create, display and exchange information and develop collaborative networks via the Internet”. The Curriculum for Music Culture in the Compulsory School and Music Art in Gymnasiums in the Republic of Croatia (Ministarstvo znanosti i obrazovanja, 2019a, p. 10) points out that ICT permeates through all three curriculum domains, and its implementation includes the students’ introduction and work with music computer programmes, learning the music script through various programmes and applications, working in a digital studio (audio processing, experimenting with sound, designing and structuring one's own musical ideas, etc.).

Rodek (2010, p. 10) explains the more intensive use of technologies in teaching by emphasizing that they facilitate the learning and teaching process, enable the application of modern methods and increase the learning motivation. In addition, by using this technology

“students get the opportunity to express their creativity and innovation by presenting their ideas and creating new content, and to express their originality by combining and rearranging existing knowledge and content” (Ministarstvo znanosti i obrazovanja, 2019b). Dobrota (2015, p. 4) emphasizes the individualized aspect of learning and teaching by mentioning that “the introduction of teaching technology in music teaching ensures different learning opportunities and helps students develop their creative thinking, problem solving, communication and teamwork skills.”

Recent literature highlights the lack of knowledge of didactic strategies when talking about the use of ICT in teaching (Matijević & Topolovčan, 2018; Vidulin Orbančić & Duraković, 2012). Technology can enrich and modernize the teaching process, however “digital media do not directly raise the quality of teaching, but their role is indirect or mediative” (Matijević & Topolovčan, 2018, p. 95).

Vidulin Orbančić and Duraković (2012, p. 91) point out the inappropriate application “primarily by those who, out of ignorance or lack of pedagogical and methodological competencies, believe that it is enough to use it in any way - which is completely wrong, because the use of new technology is not an end in itself”. ICT is a teaching tool that enables a faster and easier transfer of information, and its use must be in accordance with the educational goals and for the purpose of achieving the subjects’ outcomes. The teacher, student, teaching content and technology are all in a mutual interaction, which forms the didactic quadrangle (Matijević & Topolovčan, 2017). There is an evident paradigm of multimedia didactics that advocates a constructivist approach to learning and teaching by using different technologies in the teaching process. The teacher is the leader, motivator, organizer of various teaching activities, who (co-)constructs his students’ knowledge through his interaction with them, while the student is the one who actively researches and finds solutions (Matijević & Topolovčan, 2018).

Mishra and Koehler (2006) integrated ICT into Shulman’s PCK (Pedagogical Content Knowledge) model and thus emphasized the importance of content knowledge, teaching methods and technology. All elements of this model are in mutual interaction.

“TPCK is the basis of good teaching with technology and requires an understanding of the representation of concepts using technologies; pedagogical techniques that use technologies in constructive ways to teach content; knowledge of what makes concepts difficult or easy to learn and how technology can help redress some of the problems that students face; knowledge of students’ prior knowledge and theories of epistemology; and knowledge of how technologies

can be used to build on existing knowledge and to develop new epistemologies or strengthen old ones.” (Mishra & Koehler, 2006, p. 102)

Bauer (2020) researched the application of this model in music teaching and offered solutions and possibilities for the application of ICT in music teaching and the methods of evaluation using technology.

Technology as such will not contribute to a better quality of the teaching process, but it will make it more interesting and accessible. Students, digital natives (Prensky, 2001), will be more motivated because the teaching aids are tailored to their needs and social environment. There is a noticeable lack of understanding of the use of technology in the educational process, since teachers most often use it for the purpose of presenting teaching content. Thus, they solely achieved a modernization of the frontal way of teaching. The agenda of teaching music with ICT is still not sufficiently developed in the field of didactics and music methodology.

Research

Research objective and research questions

The aim of this research was to determine the opinions of future primary education teachers on the importance and possibilities of applying information and communication technology into music teaching in primary schools. The research should also answer the following research questions:

1. How important is information and communication technology for the implementation of individual musical activities into music teaching in primary schools according to respondents/ future primary education teachers?

2. How successful is learning in the music teaching in primary schools which uses information and communication technology according to respondents/ future primary education teachers?

3. What is the attitude of future primary education teachers about acquiring the knowledge and skills needed for music teaching in primary schools which uses information and communication technology?

4. Do students in different years of the teacher education programme have different attitudes on the acquisition of the knowledge and skills needed for music teaching in primary schools which uses information and communication technology?

Research participants

The research was conducted from February 2022 to March 2022. The research involved 107 students (103 female students - 96.26% and 4 male students - 3.74%) who are studying to become teachers at two Croatian universities, the Josip Juraj Strossmayer University in Osijek (Faculty of Education) (n = 56, 52.34%) and at the University of Slavonski Brod (Department of Social Sciences and Humanities) (n = 51, 47.66%). Participation in this research was completely voluntary. Most students are in the fourth (n = 33, 30.84%) and first academic year (n = 29, 27.10%). There is a slightly smaller number of students in the fifth (n = 21, 19.63%) and the third academic year (n = 16, 14.95%), while the least students are in the second year of the teacher education programme (n = 8, 7.48%).

The students were divided into two groups according to the academic year in which they were enrolled at the time of the research. In one group there were students who are in the first, second and third year of study, i.e. the students who have not yet taken the course Methodology of Music Culture and have not had the opportunity to teach a music lesson as part of the methodological exercises. The second group consisted of fourth- and fifth-year students. At the time of the research, fourth-year students had already taken the course Methodology of Music Culture I, and fifth-year students had taken the course Methodology of Music Culture I as well as Methodology of Music Culture II. In addition, these students had the opportunity to teach music lessons in primary school.

Methodological approach

This research was conducted through surveying and a questionnaire was used as an instrument. The questionnaire consisted of two parts. The first part of the questionnaire asked questions about the socio-demographic characteristics of the research participants: gender, age, place and year of study. The second part included a series of statements for which future teachers needed to express the degree of their agreement. For statements regarding the importance of information and communication technology in the implementation of individual musical activities and in music teaching as a whole, assessments were done by using a five-point Likert-type scale with the following answers: 1 = not important at all, 2 = not important, 3 = neither important nor unimportant, 4 = important, 5 = very important. For the future teachers' statements on the success of learning in music teaching that uses information and communication technology, namely for statements about their competencies regarding teaching music lessons in which information and communication technology is used, a five-point Likert-type scale was applied, in which the following answers were offered: 1 = strongly disagree, 2

= mostly disagree, 3 = neither agree nor disagree, 4 = mostly agree, 5 = completely agree. The results are presented in the tables by merging the categories ("1 + 2", "3" and "4 + 5"). From the obtained results, we calculated the basic descriptive parameters: arithmetic mean (M), standard deviation (SD), and percentage of responses (%) (Mužić 2004; Petz 2007). Quantitative analyses were used for data processing. We also used the Mann-Whitney U (z) test to determine the differences between the two independent groups within each measurement (to compare the answers on the acquisition of knowledge and skills needed to teach music lessons in which information and communication technology is used according to the year of study). The SPSS Statistics V26 program was used for statistical data processing (Opić 2010; Petz 2007; Suzić 2007) with statistical significance at the level of .05.

Research results and discussion

All 107 surveyed students completed the questionnaire in full. After receiving their answers to questions about gender, age, place and year of study, they were asked to express their opinions on the importance of information and communication technology for conducting certain musical activities and teaching music in general. The results are visible in Table 1. In terms of percentages, the largest number of students believe that the application of information and communication technology is important and extremely important in the areas of music listening (M = 4.48), music games (4.14) and teaching music in general (M = 4.21), and a smaller number of teachers assess the use of information and communication technology important for areas of musical-creative activities (M = 3.95), singing (M = 3.47) and playing a musical instrument (M = 3.45).

The very small dispersion in the answers indicates a great agreement of the students with regard to their answers about music listening activities (SD = .69), music games (SD = .75), musical-creative activities (SD = .86) and music teaching as a whole (SD = .69). Data on the total dispersion of the responses on the importance of playing an instrument (SD = 1.16) and singing (SD = 1.05) indicates that students have greater dispersion in their answers.

The students' answers agree with the theory of methodology of the subject Music Culture. Listening to music involves the use of digital technology and information and communication technology, and music games can be conducted in a virtual or real environment. The organization of teaching as a whole also often requires the use of the same technologies and facilitates the teaching process. Singing, playing musical instruments or musical creativity activities are reproductive activities that do not require the use of information and

communication technologies. However, the large dispersion indicates a disagreement in students' responses to the importance of using technology in activities of singing and playing an instrument. We can look for reasons for this in the way the students perceive these activities. In the lower primary education classroom, teachers often conduct singing activities with students with recorded instrumental accompaniment which in turn requires reproduction with the help of digital technology. Activities of playing an instrument and music creativity activities can also be carried out in a virtual environment using various computer software. It is also important to emphasize that not all students involved in this research have had the opportunity to teach Music Culture so far, so they have their own visions of what those classes look like. In addition, it is possible that students who have had the opportunity to conduct musical activities at school in some areas use technology in accordance with their personal interests and experiences.

Table 1

Average values and dispersion of results for statements of future teachers on the importance of information and communication technology for the implementation of individual musical activities and music teaching in general

Teachers' statements on the importance of information and communication technology for the implementation of individual musical activities and music teaching in general	<i>N</i>	1+2	3	4+5	<i>M</i>	<i>SD</i>
		%	%	%		
Singing activity	107	19.62	28.04	52.34	3.47	1.05
Music listening activity	107	1.87	2.80	95.33	4.48	.69
Musical-creative activities	107	4.67	22.43	72.90	3.95	.86
Musical games	107	1.87	15.89	82.24	4.14	.75
Playing an instrument	107	19.63	30.84	49.53	3.45	1.16
Music teaching in general	107	0	14.95	85.05	4.21	.69

Note. *M* = average values; *SD* = standard deviation

The students were also asked to express their opinion on the success of learning in music teaching that uses information and communication technology. The results showed that students think it is easier for pupils to master the content ("4 + 5" = 77.57; *M* = 4.14) and to gladly participate ("4 + 5" = 78.5; *M* = 4.12) in music lessons which use information and communication technology. In addition, they think that the application of information and communication technology makes it easier to achieve an interdisciplinary approach in music teaching ("4 + 5" = 74.77; *M* = 4.07). The majority of the students also agreed with the

statements that pupils are skilled in the use of information and communication technology ("4 + 5" = 64.49; M = 3.78) and that during music lessons at the primary level information and communication technology is currently used more by teachers than students ("4 + 5" = 59.81; M = 3.70) (Table 2).

Table 2

Average values and dispersion of results for statements of future teachers on the success of learning in music lessons which use information and communication technology

Teacher statements on the success of learning in music lessons which use information and communication technology	<i>N</i>	1+2 %	3 %	4+5 %	<i>M</i>	<i>SD</i>
Students gladly participate in activities which use ICT.	107	5.61	15.89	78.50	4.12	.88
Students are skilled in the use of ICT.	107	9.34	26.17	64.49	3.78	.94
It is easier for students to master the contents of music lessons with the use of ICT.	107	3.74	18.69	77.57	4.14	.85
The use of ICT makes it easier to achieve an interdisciplinary approach in music teaching.	107	0	25.23	74.77	4.07	.76
Currently, during music lessons at the primary level, ICT is used more by teachers than students.	107	10.28	29.91	59.81	3.70	.91

Note. *M* = average values; *SD* = standard deviation

Another point of interest was the question whether students of the teacher education programme have sufficient knowledge and skills to teach music lessons in which information and communication technology is used. Half of the students stated that ~~According to the students,~~ their knowledge and skills are sufficient ("4 + 5" = 48.60; M = 3.41). In addition, less than half of the students believe that they are able to use different software solutions in music teaching without much prior preparation ("4 + 5" = 43.92; M = 3.43) and that the teacher education programme includes enough university courses in which students get acquainted with the contents related to the use of information and communication technology in music teaching ("4 + 5" = 43.92; M = 3.24). According to the students, primary education teachers need to be further educated in the use of information and communication technology in music teaching ("4 + 5" = 78.51; M = 4.11) (Table 3).

The slightly smaller dispersion of results for an additional teacher education (*SD* = .96) indicates an overall agreement of the students in their answers, and the greater dispersion in other answers from this group (Table 3) indicates that students do not uniformly agree about

their competence for teaching music lessons in which information and communication technology is used.

Greater dispersion of results is noticeable in the self-assessment of competencies for the use of information and communication technology in music teaching and the self-assessment of the ability to use the same technologies without greater preparation. The reasons for this can be found in the sample because students of all study years are included in the research. First, second and third year students did not have a course in Music Teaching Methodology and did not have the opportunity to get acquainted with music software and the possibility of using technology in music teaching. The obtained data also indicate a greater disagreement of students about the claim that the study program has enough courses within which students learn about the possibilities of using information and communication technology in music teaching. In order to explain these results, further analyzes were performed below.

Table 3

Average values and dispersion of results for statements of future teachers about their competencies in teaching music lessons in which information and communication technology is used

Statements of future teachers about their competencies in teaching music lessons in which information and communication technology is used	<i>N</i>	1+2 %	3 %	4+5 %	<i>M</i>	<i>SD</i>
I have enough knowledge and skills to use ICT in music teaching.	107	20.56	30.84	48.60	3.41	1.12
I find that I am able to use a variety of software solutions in music teaching without much prior preparation.	107	15.89	40.19	43.92	3.43	1.05
The teacher education programme includes a sufficient number of university courses in which students are introduced to content related to the use of ICT in music teaching.	107	28.04	28.04	43.92	3.24	1.20
I consider it necessary to further educate primary school teachers in the use of ICT in music teaching.	107	6.54	14.95	78.51	4.11	.96

Note. *M* = average values; *SD* = standard deviation

The students were divided into two groups according to the academic year in which they were enrolled at the time of the research. In one group there were students who are in the first, second and third year of study, i.e. the students who have not yet taken the course Methodology of Music Culture and have not had the opportunity to teach a music lesson as part of the

methodological exercises. The second group consisted of fourth- and fifth-year students. At the time of the research, fourth-year students had already taken the course Methodology of Music Culture I, and fifth-year students had taken the course Methodology of Music Culture I as well as Methodology of Music Culture II. In addition, these students had the opportunity to teach music lessons in primary school.

We then divided the students into two groups according to the academic year in which they were enrolled at the time of the research and whether they had a course Methodology of Music Culture. In the first group, there were students who are in the first, second and third year of study, and the second group included fourth and fifth-year students. The findings of the Mann-Whitney U-test show a statistically significant difference only for one of the four statements (Table 4). Namely, the research has shown that fourth- and fifth-year students of the teacher education programme believe that it is necessary to further educate primary education teachers in the use of information and communication technology in music teaching ($z = -2.891$, $p = 0.004$). It is also interesting to note that there is a smaller number of fourth- and fifth-year students ($M = 3.04$; "4 + 5" = 45.28%) who agree with the statement that the teacher education programme includes enough university courses in which students are introduced to content related to the use of information and communication technologies in music teaching, than there is among first-, second- and third-year students ($M = 3.45$; "4 + 5" = 50.94%). However, this difference is not statistically significant.

Table 4

Differences in the statements of future teachers on the acquisition of knowledge and skills needed to teach music lessons in which information and communication technology is used - average values, dispersion of results, Mann-Whitney U test

Statements of future teachers on the acquisition of knowledge and skills needed to teach music lessons in which information and communication technology is used	Year of study	N	M	SD	z	p
I have enough knowledge and skills to use ICT in music teaching.	1., 2., 3.	53	3.49	1.19	-.761	.447
	4., 5.	54	3.33	1.06		
I find that I am able to use a variety of software solutions in music teaching without much prior preparation.	1., 2., 3.	53	3.53	1.07	-.973	.331
	4., 5.	54	3.33	1.06		
The teacher education programme includes a sufficient number of university courses in which students are introduced to content related to the use of ICT in music teaching.	1., 2., 3.	53	3.45	1.15	-1.788	.074
	4., 5.	54	3.04	1.21		
I consider it necessary to further educate primary school teachers in the use of ICT in music teaching.	1., 2., 3.	53	3.85	1.03	-2.891	.004
	4., 5.	54	4.37	.81		

Note. *M* = average values; *SD* = standard deviation; *z* = Mann-Whitney U test

Conclusion

The results of this research presented the attitudes of future teachers on the application of information and communication technology in music teaching at the primary level of education. The data shows that students - future teachers – in the biggest percentage place importance on the use of ICT in music listening activities, and the least in singing, instrument playing and musical-creative activities. Students feel that their knowledge and skills in using ICT are not sufficient, and less than half of the students point out that they can independently, without preparation, use different software in music teaching. It is interesting to note the disagreement of students about the representation of courses in the faculty within which they get acquainted with information and communication technology and consider it necessary to educate teachers to use this technology. Students who did not have the Music Teaching Methodology do not recognize this need with the same intensity as final year students, and there is a greater disagreement among students in the first three years of study.

Teaching music with ICT requires the professional and digital competencies which in today's, global world, cannot be viewed in isolation. “Our professional and ethical obligations must thus involve transcending naïve efforts aimed at mere competence with technology and music technology and should strive to engender critical engagement that sees students continuously evaluating if and how various technologies can help them live richer and more rewarding lives in and through music” (Mantie, 2017, p. 12). Rojko (2012, p. 30) claims the same by saying that the most important goal of music teaching is the “education of a competent and critical listener and connoisseur of music”. The Croatian Music Curriculum emphasizes the importance of using ICT throughout all subject domains, and ICT is an important tool which helps us achieve subject goals and outcomes in order to educate students in the field of art in today's global world. It is important to point out that the use of technology should be student-centred, where the student will use various digital tools to upgrade their already acquired knowledge. The teaching lesson which implements this technology goes beyond the characteristics of a traditional teaching lesson if students, digital natives, actively participate and apply ICT in the educational process.

The results of this research have some limitations. The main limitation is the small sample because the questionnaire was filled out by students of the teacher education programme

at only two universities. Due to the small number of respondents, the results obtained cannot be generalized to the general population. Future research should include students of the teacher education programme from all over Croatia. Thus we would be able to receive relevant information on the digital competencies of (future) music teachers. The results of such research could be used to help design contemporary university courses in the field of music art.

References

- Bauer, W. I., & Dammers, R. J. (2016). Technology in Music Teacher Education: A National Survey. *Research Perspectives in Music Education*, 18(1), 2-15. https://www.researchgate.net/publication/310843115_Technology_in_Music_Teacher_Education_A_National_Survey
- Bauer, W. (2020). *Music Learning Today. Digital pedagogy for creating, performing and responding to music*. Oxford University press (2nd ed.).
- Bognar, B. (2003). Škola na prijelazu iz industrijskog u postindustrijsko društvo [School in Transition from Industrial to Post-industrial Society]. *Metodički ogledi*, 10(2), 9–24.
- Dobrota, S. (2015). Glazbena nastava i nastavna tehnologija [Music Education and Education Technology]. *Zbornik radova Filozofskog fakulteta u Splitu*, 6/7, 6-23. <https://hrcak.srce.hr/file/227792>
- Hrvatska enciklopedija (n.d.). Informacijska i komunikacijska tehnologija. Leksikografski zavod Miroslav Krleža. <http://www.enciklopedija.hr/Natuknica.aspx?ID=27406>
- Mantie, R. (2017). Thinking about Music and Technology. *Oxford Handbooks Online*. <http://doi.org/10.1093/oxfordhb/978019937213>
- Matijević, M. (2010). Škola i učenje za budućnost [School and Learning for the Future]. *Učiteljski fakultet, Sveučilište u Zagrebu*, 9-22. <https://www.bib.irb.hr/537944>
- Matijević, M., & Topolovčan, T. (2017). *Multimedijska didaktika [Multimedia didactics]*. Školska knjiga.
- Matijević, M., & Topolovčan, T. (2018). Izazovi i trendovi u multimedijskoj didaktici [Challenges and trends in multimedia didactics]. *Radovi Zavoda za znanstvenoistraživački i umjetnički rad u Bjelovaru*, 11(1), 87-99. <http://doi.org/10.21857/mjrl3uxqz9>
- Ministarstvo znanosti i obrazovanja [Ministry of science and education] (2019a). *Kurikulum nastavnih predmeta Glazbena kultura i Glazbena umjetnost za osnovne škole i gimnazije [Curriculum of music culture and music art for primary schools and gymnasiums]*. Zagreb: MZO. https://skolazazivot.hr/wp-content/uploads/2020/06/GKGU_kurikulum.pdf
- Ministarstvo znanosti i obrazovanja [Ministry of science and education] (2019b). *Kurikulum međupredmetne teme Uporaba informacijske i komunikacijske tehnologije za osnovne i srednje*

- škole [Curriculum of cross-curricular topics Use of information and communication technologies for primary and secondary schools]. Zagreb. Narodne novine, 7/2019. <https://mzo.gov.hr/UserDocsImages/dokumenti/Publikacije/Medupredmetne/Kurikulum%20medupredmetne%20teme%20Uporaba%20informatijske%20i%20komunikacijske%20tehnologije%20za%20osnovne%20i%20srednje%20skole.pdf>
- Ministarstvo znanosti, obrazovanja i športa [Ministry of science, education and sport] (2011). Nacionalni okvirni kurikulum za predškolski odgoj i opće obvezno obrazovanje u osnovnoj i srednjoj školi [National curriculum framework for pre-school and general compulsory education in elementary and secondary schools]. http://mzos.hr/datoteke/Nacionalni_okvirni_kurikulum.pdf
- Mishra, P., & Koehler, M. J. (2006). Technological Pedagogical Content Knowledge: A Framework for Teacher Knowledge. *Teachers College Record*, 108(6), 1017–1054. <https://doi.org/10.1111/j.1467-9620.2006.00684.x>
- Mužić, V. (1973). *Kompjuter u nastavi* [Computer in classroom]. Školska knjiga.
- Mužić, V. (2004). *Uvod u metodologiju istraživanja odgoja i obrazovanja* [Introduction to research methodology in education]. Educa.
- Mužić, V. & Rodek, S. (1987). *Kompjuter u preobražaju škole* [The computer in the contemporary school]. Školska knjiga.
- Opić, S. (2010). Korištenje neparametrijskih testova u istraživanjima odgoja i obrazovanja [Using Non-Parametric Tests in Education Research]. In A. Jurčević Lozančić (Ed.) *11. dani Mate Demarina - Očekivanja, postignuća i perspektive u teoriji i praksi ranog i primarnog odgoja i obrazovanja* (pp. 307-317). Učiteljski fakultet Sveučilišta u Zagrebu.
- Petz, B. (2007). *Osnovne statističke metode za nematematičare* [Basic statistical methods for non-mathematicians]. Naklada Slap.
- Prensky, M. (2001). Digital Natives, Digital Immigrants. Part 1. *On the Horizon*, 9(5), 1-6 <https://doi.org/10.1108/10748120110424816>
- Rodek, S. (2011). *Novi mediji i nova kultura učenja* [New media and a new learning culture]. *Napredak*, 152(1), 9-28. <https://hrcak.srce.hr/file/123127>
- Rojko, P. (2012). *Metodika nastave glazbe: teorijsko - tematski aspekti*. [Methodics of music education. Theoretical and thematic aspects]. Sveučilište J. J. Strossmayera, Pedagoški fakultet Osijek. <https://www.bib.irb.hr/566005>
- Suzić, N. (2007). *Primijenjena pedagoška metodologija* [Applied pedagogical methodology]. XBS.
- Šoljan, N. N. (1988). *Nove informacijske tehnologije – izazov obrazovanju* [New information technologies: a challenge to education]. Školske novine.
- Vidulin Orbančić, S. & Duraković, L. (2012). *Metodički aspekti obrade muzikoloških sadržaja. Mediji u nastavi glazbe* [Didactical aspects of teaching musicological contents: the media in teaching music]. Sveučilište Jurja Dobrile u Puli.

https://www.researchgate.net/publication/340137207_Metodicki_aspekti_obrade_muzikoloskih_sadrzaja_mediji_u_nastavi_glazbe

Vrkić Dimić, J. (2010). Razvoj paradigmi i modela uporabe računala u nastavi: od pomoći u poučavanju prema kreativnom i otvorenom kontekstu učenja [Development of the paradigms and the models of classroom computer use: from the help in the teaching forward the creative and open context of the learning]. *Acta Iadertina*, 7, 113-124. <https://hrcak.srce.hr/190082>

Comparative Analysis of Digital Tools for Online Learning

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Abstract

Nowadays we cannot imagine our lives without information and communication technology which is incorporated into all aspects of our lives. The COVID-19 pandemic accentuated the importance of information and communication technology especially during the lockdown period. This paper gives theoretical insight into the digital transformation of education and recently very employed term of online learning. The aim of this paper is to conduct a comparative analysis of selected digital tools for online learning, which are mostly used from the beginning of the COVID-19 pandemic within the Croatian educational system. The following characteristics of selected digital tools for online learning were analysed and compared: (1) content presentation; (2) content design; (3) communication; (4) evaluation and (5) real time activity monitoring. Special attention was given to the selected videoconferencing digital tools which enable synchronous communication. Also, the following characteristics of selected digital tools for videoconferencing were analysed and compared: (1) chat; (2) video calls; (3) audio calls; (4) group calls; (5) file exchange and (6) screen share. The new possibilities of virtual reality – VR and artificial intelligence - AI in education were recognized as future trends.

Keywords: comparative analysis, digital tools, OER, online learning

Introduction

In recent three decades the tendencies toward digital transformation of education are visible also in the Croatian educational system. The COVID-19 pandemic accelerated these changes toward digital transformation of education. Digital Transformation can be generally defined as “improving the core business processes of a company to effectively fulfill customer expectations through data and technology leveraging and digital transformation in education to enhance student experience may include: (1) enabling students to enter through the mobile app or web application, (2) providing a broad range of choices for online learning, (3) using

technology to track the progress of students and enforce intervention protocols and (4) enabling online class organization faculties”^{*}.

One of many definitions of the distance learning, according to the USDLA - United States Distance Learning Association (Fenton & Watkins, 2010) is that “the distance learning is acquisition of knowledge and skills through information and teaching enabled by all technologies”. However, recently a very employed term is the term of online learning. According to Ally online learning is “the use of the Internet to access learning materials; to interact with the content, instructor, and other learners; and to obtain support during the learning process, in order to acquire knowledge, to construct personal meaning, and to grow from the learning experience.”[†].

According to (Kılıçkaya & Kic-Drgas, 2021) open educational resources – OERs can be considered as useful sources for classes and also a valid replacement for commercial textbooks. Their study indicated “two major findings: (1) when students use OER, they obtain the same learning outcomes as with traditional textbooks while saving money and (2) both students and teachers find OER comparable to traditional learning resources in terms of quality”. In the recent case study in the University System of Georgia (Nagashima & Hrach, 2021) examined motivating factors regarding OER adoption. They conducted an instructor survey with 77 respondents in purpose to contribute to the understanding of what university faculty perceive and experience in adopting OER. They accentuated several common motivating factors that affect OER adoption positively: cost savings, instructional benefits (e.g., flexibility, quality of content) and unrestricted access to materials. However, they pointed out the importance of the contextual factors such as institutional policies and institutional support. According to (Van Allen & Katz, 2020) “the power, and paradox, of OER is that these learning materials are available for everyone globally but adaptable for anyone locally”. Furthermore, they accentuated that “the true power of OER lies in the permissions of the work to be collaboratively adapted and remixed by a global community, resulting in new OER that are more culturally relevant and inclusive for different communities of learners”. The authors highlighted repositories that include a breadth of various learning materials across subject areas and educational contexts to support educators in finding and using OER and provide specific suggestions for finding, personalizing and contextualizing OER. Their work not only provides an overview of OER with particular considerations for educators during the COVID-19

^{*} Digital Transformation in Education: Advantages and Challenges in 2022, 2021, Retrieved from URL: <https://magenest.com/en/digital-transformation-in-education/>, 1-2-2022

[†] Ally, M. Foundations of Educational Theory for Online Learning, Retrieved from URL: <https://read.aupress.ca/read/the-theory-and-practice-of-online-learning/section/8949f723-6904-454a-9704-6c241fb891ab>, 1-2-2022

pandemic but also makes the case that OER should be integrated into classrooms beyond the pandemic. (Zhang et al., 2020) systematically reviewed 31 papers to provide insights about functional diversity within OER. The results they obtained highlighted that “accessibility is still in its infancy within OER and that researchers should focus more on considering the four accessibility principles: perceivable, operable, understandable and robust, when providing OER”. They concluded that “OER adoption can reduce costs, which benefits all students but can be especially beneficial for students with disabilities who may face additional financial pressures”. (Neto, et al., 2020) described the design, implementation and evaluation processes of an accessible version of the particular educational game that integrates educational, playability and accessibility aspects for people with visual impairments. According to (Petrich, 2020) “limited awareness and understanding of OERs are barriers to adoption”. She suggested following factors to encourage OER adoption: compensation, dedicated support services, opportunities for collaboration, dedicated time to convert courses, greater OER standardization, labelling OER courses in catalog. (Shenoda, 2020) concluded that “OER materials, while starting with widely available sources, should evolve to be unique to each course, each instructor, and each student body”.

Augmented and virtual reality - VR and artificial intelligence - AI are growing in education sector extensively. The enhanced reality is “an immersive environment in the physical world where computerized perceptual knowledge improves real-world artifacts”[‡]. According to UNESCO “artificial intelligence - AI has the potential to address some of the biggest challenges in education today, innovate teaching and learning practices”[§].

Method

The aim of this paper was to conduct a comparative analysis of selected digital tools for online learning, which are mostly used from the beginning of the COVID-19 pandemic within the Croatian educational system. The following characteristics of selected digital tools for online learning were analysed and compared: (1) content presentation; (2) content design; (3) communication; (4) evaluation and (5) real time activity monitoring. Real-time activity monitoring refers to the ability of a selected digital tool for online learning to display registered students in the classroom in real-time. Special attention was given to the selected videoconferencing digital tools which enable synchronous communication. Also, the following

[‡] Digital Transformation in Education: Advantages and Challenges in 2022, 2021, Retrieved from URL: <https://magenest.com/en/digital-transformation-in-education/>, 1-2-2022

[§] Artificial intelligence in education, Retrieved from URL: <https://en.unesco.org/artificial-intelligence/education>, 1-2-2022

characteristics of selected digital tools for videoconferencing were analysed and compared: (1) chat; (2) video calls; (3) audio calls; (4) group calls; (5) file exchange and (6) screen share.

Comparative analysis of digital tools for online learning encompassed the following digital tools for online learning: LMS Moodle, Merlin, Loomen, Google Classroom and videoconferencing tools: Microsoft Teams, Big Blue Button, Google Meet and Zoom, which were used within the Croatian educational system at all levels of education and could be accessed through the system of electronic identity AAI@EduHr.

Comparative analysis of digital tools for online learning

LMS Moodle is an acronym for Learning Management System Modular Object-Oriented Dynamic Learning Environment^{**}. The inventor of LMS Moodle was Martin Dougiamas. From its beginning LMS Moodle has been an open source platform. The many advantages of LMS Moodle were recognized, such as users' support, flexibility, philosophy of constructivism, innovation, usability, accessibility, scalability, interoperability, stability and security. Merlin is an open source digital tool for online learning based on LMS Moodle customized by SRCE^{††} - The University Computing Centre / University of Zagreb . Loomen is also an open source digital tool for online learning based on LMS Moodle customized by CARNET – a Croatian academic and research network^{‡‡}. Google Classroom^{§§} is a part of Google Workspace for Education and it is in a cloud accessible through different digital devices. The many advantages of Google Classroom were recognized, such as intuitive easiness of use, connection with Google Docs and Google Meet, but also a disadvantage the inability to show the currently present students in the classroom. . But Google regularly adds new functions to Google Classroom. The following characteristics of selected digital tools for online learning were analysed and compared: (1) content presentation; (2) content design; (3) communication; (4) evaluation and (5) real time activity monitoring. Figure 1 shows that the selected digital tools have almost identical characteristics except for Google Classroom, which at this moment, does not enable real time activity monitoring.

^{**} Moodle, Retrieved from URL: <https://moodle.org/?lang=hr>, 1-2-2022

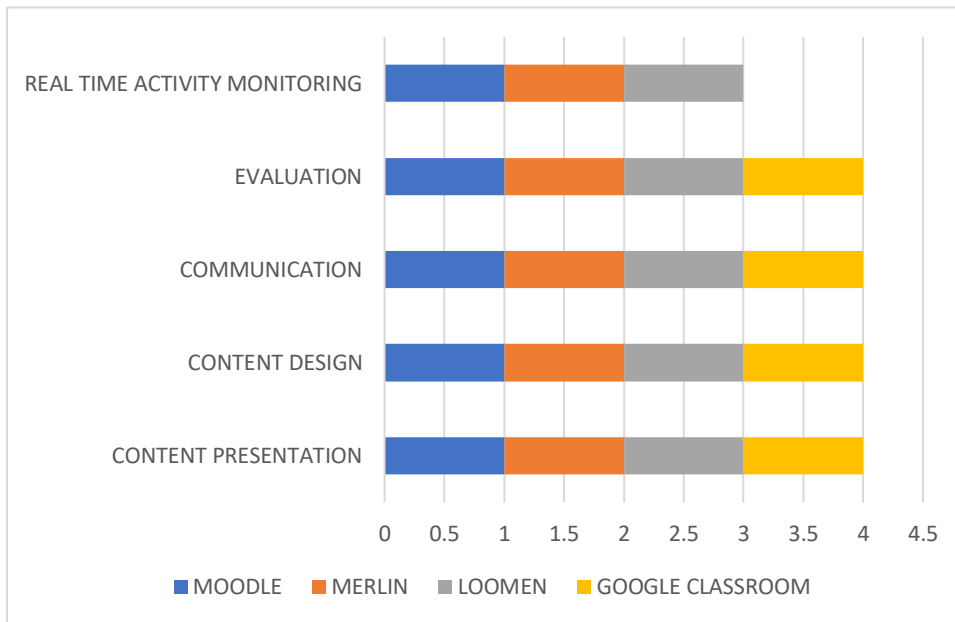
^{††} Srce, Retrieved from URL: <https://www.srce.unizg.hr/>, 1-2-2022

^{‡‡} Carnet, Retrieved from URL: <https://www.carnet.hr/>, 1-2-2022

^{§§} Google Classroom, Retrieved from URL: <https://classroom.google.com/u/0/h>, 1-2-2022

Figure 1

Characteristics of digital tools for online learning



The great advantage of videoconferencing tools is the possibility of online learning and teaching in a real time. Some of the main characteristics of Microsoft Teams^{***} are: integration and connection with other Microsoft 365 tools, file exchange, screen share, reports etc. Big Blue Button (BBB)^{†††} was a Technology Innovation Management – TIM product at Carleton University’s Institute for Technology Entrepreneurship and Commercialization. It was launched in 2007 and is currently available in 65 languages. Google Meet^{‡‡‡} is a part of Google Workspace for Education. Zoom^{§§§} is a commercial videoconferencing tool, and its free version is available with a limited functionality. Eric Yuan invented Zoom in 2011, but Zoom became very popular due to the COVID-19 pandemic in 2020. The following characteristics of selected digital tools for videoconferencing were analysed and compared: (1) chat; (2) video calls; (3) audio calls; (4) group calls; (5) file exchange and (6) screen share. Figure 2 shows that the selected videoconferencing tools have completely equal characteristics.

^{***} Microsoft Teams, Retrieved from URL: <https://www.microsoft.com/hr-hr/microsoft-teams/log-in>, 1-2-2022

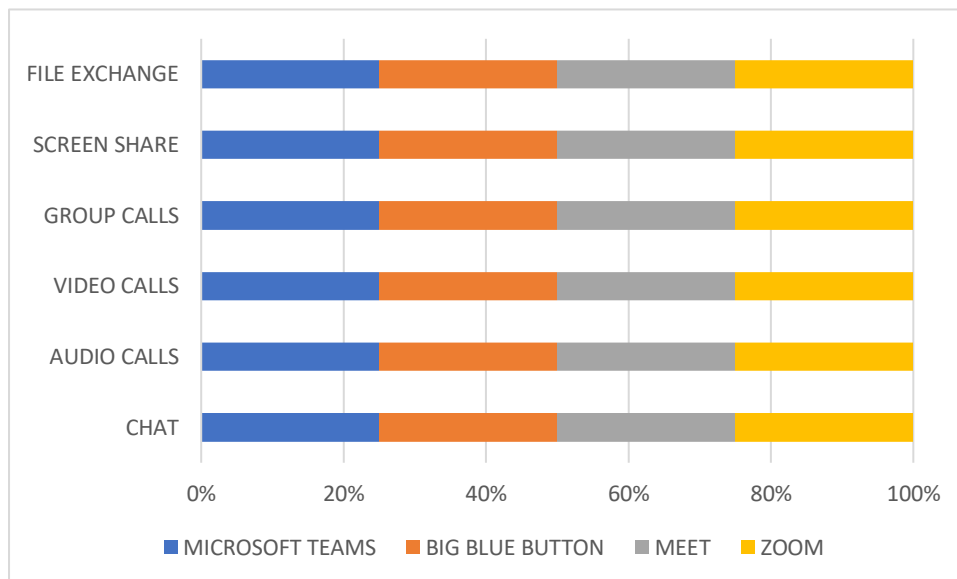
^{†††} Big Blue Button, Retrieved from URL: <https://bigbluebutton.org/>, 1-2-2022

^{‡‡‡} Google Meet, Retrieved from URL: <https://meet.google.com/>, 1-2-2022

^{§§§} Zoom, Retrieved from URL: <https://zoom.us/>, 1-2-2022

Figure 2

Characteristics of videoconferencing tools for online learning



Conclusion

The research results of comparative analysis of digital tools for online learning: LMS Moodle, Merlin, Loomen, and Google Classroom according to the following characteristics: (1) content presentation; (2) content design; (3) communication; (4) evaluation and (5) real time activity monitoring showed that the selected digital tools have almost similar characteristics except for Google Classroom which does not enable real time activity monitoring.

The research results of comparative analysis of videoconferencing tools: Microsoft Teams, Big Blue Button, Google Meet and Zoom according to the following characteristics: (1) chat; (2) video calls; (3) audio calls; (4) group calls; (5) file exchange and (6) screen share showed that the selected videoconferencing tools have completely equal characteristics.

Although all selected digital tools are equally adequate for online learning, there is a lot of space for improvements. Virtual reality - VR and artificial intelligence - AI in education were recognized as trends and need to be explored in the further researches.

References

- Ally, M. Foundations of Educational Theory for Online Learning, Retrieved from URL: <https://read.aupress.ca/read/the-theory-and-practice-of-online-learning/section/8949f723-6904-454a-9704-6c241fb891ab>, 1-2-2022
- Artificial intelligence in education, Retrieved from URL: <https://en.unesco.org/artificial-intelligence/education>

- Big Blue Button, Retrieved from URL: <https://bigbluebutton.org/>, 1-2-2022
- Carnet, Retrieved from URL: <https://www.carnet.hr/>, 1-2-2022
- Digital Transformation in Education: Advantages and Challenges in 2022, 2021, Retrieved from URL: <https://magenest.com/en/digital-transformation-in-education/>, 1-2-2022
- Fenton, C. & Watkins W. B. (2010). Fluency in Distance learning. United States of America: Information Age Publishing Inc.
- Google Classroom, Retrieved from URL: <https://classroom.google.com/u/0/h>, 1-2-2022
- Google Meet, Retrieved from URL: <https://meet.google.com/>, 1-2-2022
- Kılıçkaya, F., & Kic-Drgas, J. (2021). Issues of context and design in OER (open educational resources). Educational Technology Research and Development, 69(1), 401-405. Retrieved from doi:10.1007/s11423-020-09852-8, 1-2-2022
- Microsoft Teams, Retrieved from URL: <https://www.microsoft.com/hr-hr/microsoft-teams/log-in>
- Moodle, Retrieved from URL: <https://moodle.org/?lang=hr>, 1-2-2022
- Nagashima, T., & Hrach, S. (2021). Motivating factors among university faculty for adopting open educational resources: Incentives matter. Journal of Interactive Media in Education, 2021(1). Retrieved from doi:10.5334/JIME.678, 1-2-2022
- Neto, L. V., Fontoura Junior, P. H. F., Bordini, R. A., Otsuka, J. L., & Beder, D. M. (2020). Design and implementation of an educational game considering issues for visually impaired people inclusion. Smart Learning Environments, 7(1). Retrieved from doi:10.1186/s40561-019-0103-4, 1-2-2022
- Petrich, M. (2020). Building an OER program based on stakeholder feedback. Reference Services Review, 48(3), 489-501. Retrieved from doi:10.1108/RSR-03-2020-0013, 1-2-2022
- Shenoda, M. (2020). Evaluation of open educational resources (OER) use in construction management technology courses. Journal of Engineering Technology, 37(2), 8-18. Retrieved from doi:10.18260/1-2—34605, 1-2-2022
- Srce, Retrieved from URL: <https://www.srce.unizg.hr/>, 1-2-2022
- Van Allen, J., & Katz, S. (2020). Teaching with OER during pandemics and beyond. Journal for Multicultural Education, 14(3-4), 209-218. Retrieved from doi:10.1108/JME-04-2020-0027, 1-2-2022
- Zhang, X., Tlili, A., Nascimbeni, F., Burgos, D., Huang, R., Chang, T. -, . . . Khribi, M. K. (2020). Accessibility within open educational resources and practices for disabled learners: A systematic literature review. Smart Learning Environments, 7(1). Retrieved from doi:10.1186/s40561-019-0113-2, 1-2-2022
- Zoom, Retrieved from URL: <https://zoom.us/>, 1-2-2022

Encouraging students to read in the Digital Age: *Palimpsest** eMagazine Case Study

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Abstract

This paper aims to draw attention to the role and support that technology can provide in the process of familiarizing students with new methods of literary studies or literary criticism in general. It highlights the effectiveness of digital magazines regarding these issues, by demonstrating that the speed of communication and overcoming the lack of resources of relevant literature in the Albanian language, makes these kind of journals important alternative sources for promoting reading through critical writing, reviews and interviews with authors and to access contemporary works of foreign and Albanian literature. The paper elaborates specifically the function of this technological assistance during the period of numerous human limitations due to pandemics, likewise the desire to make effective every minute of students' time by encouraging them to read literary and theoretical texts in the *Palimpsest* eMagazine rubrics such as Agora, Albanology, Artefact, Essays, Literary History, Criticism, Book Clubs etc.

Keywords: technology, digital magazine, methods of literary studies, readings, communication.

1. Introduction

Even in the simplest manuals, the question about the kinds of services the internet provides, gets mainly these responses: ease of communication, access to information, improving the quality of education, and birth of social networks.

This is the reason we cannot avoid elaborating on two main issues:

(a) What are the effective ways and methods of learning?

*Gazmend Krasniqi, is the co-founder of the cultural-literary *Palimpsest* (<https://palimpsest.al/>) eMagazine, and Vjollca Osja is a regular contributor.

Learning mechanically, just by memorizing the information the lecturer provides in the auditorium and repeating the same information does not help to acquire skills necessary in a particular profession.

John Bransford, a noted professor of education and psychology at the University of Washington and the co-author of *How People Learn and How Students Learn*, put it this way: “We tell students the same thing a hundred times. On the 101st time, we ask them if they remember what we told them the first hundred times. However, in the 21st century, the true test of rigor is for students to be able to look at material they’ve never seen before and know what to do with it”. (Darling-Hammond 2010:33).

(b) What are the advantages of new information and communication technologies?

Once, being a university professor, or a lecturer, meant (among other things), having such knowledge, gained from reading books in the library, which was effectively inaccessible to students, or to the wider public. Today, in conditions when our technological knowledge doubles almost every two years, a part of this esoteric is found, in the blink of an eye, on Wikipedia, in hundreds of digital libraries such as, JSTOR, JOURNAL, Google Scholar, arXiv, LexisNexis, FUSE, OLYMPIC, or the Internet Archive. Information, simply as information, is no longer an advantage of higher education nor a privilege of educators alone. In fact, an increasing number of teachers and educators today are increasingly insecure about their knowledge and skills and, ipso facto, unable to orient and assist the intellectual and professional development of their students. (Darling-Hammond 2010:136).

In this context, we can say that new information and communication technologies increasingly rival and challenge the outdated methods of teaching in universities, and even threaten the status quo of the latter. It has been suggested that teaching methods for teenagers and young people need to be transformed by taking into account the informal learning opportunities that already exist for almost everyone. (Barron 2006: 193-224).

Authors Clayton M. Christensen and Henry J. Eyring, in their study *The Innovative University*, implement Christensen's theory of disruptive innovation in the field of higher education, where new online institutions and learning tools are challenging the future of traditional colleges and universities. Key concepts include:

- A disruptive innovation brings to market a product or service that isn't as good as the best traditional offerings, but is less expensive and easier to use.
- Online learning is a disruptive technology that is making colleges and universities reconsider their higher education models.

According to them, these technologies have the potential to make universities more enjoyable, more rewarding, and cheaper for students and for society, whereas the universities have the opportunity to integrate new discoveries with the knowledge of the past and show how these discoveries can improve today's practice (Christensen & Eyring, 2011: 397).

According to this analyses, we set the goal of our study: How can these competencies be achieved?

2. In search of communication benefits

It is clear to everyone that constant communication is one of the most efficient ways to circulate the literary product as well as judgement on it. As noted by one of the important critics of Albanian literature, Arshi Pipa, criticism is *the fruit of mature thought*. (Pipa, 1944:5). Literature has been part of this process since its inception and this has made it possible to seek in ages all possible ways to achieve this goal. Geographically located between East and West, Albania has historically been spiritually open to major cultures, creating its own cultural symbiosis.[†]

After Albania's transition to the free market economy, the number of universities increased significantly. Despite the great desire to restore the bridges with Western culture, it can be easily predicted that the translation and publication of the relevant literature proceeded at a slow pace. This fund of literary works was never satisfactorily replenished.

It was very positive that, thanks to some enthusiastic groups of writers and translators with new ideas, the circulation of literary magazines began to seek to make up for lost time, by leaving no room for either the idea of censorship or that of self-censorship. In these magazines – such as: *Mehr Licht*, *Aleph*, *Phoenix* and others - the variety of rubrics was a valuable cultural contribution. They were like an open window to the values that Albanian culture needed. The

[†] A qualitative period of this communication for the Albanian reader involves 1930-s and extends in the first half of the following decade of the XX century. In the newspapers and magazines of the time published writings and critiques the most cultured intellectuals, who studied in the best westerns schools, in countries such as in France, Italy, Austria, etc., writings that not infrequently, nevertheless, were dominated by historicist literary thought, indicating thus the stage of literary thought of the time. As the modern literary thought was consolidated in the West in the 1950s, the Albanian reader lost sight of the most relevant ideas and concepts of modern theoretical approaches, due to the country's isolationist cultural policies. In Albania, during the period of the communist totalitarian system (1944-1990), literary and cultural magazines were administered by the state, which used them to convey its own policy and ideology. The same as in the camp of communist East, such literary terms "formalist", "decadent", and "modernist" were utilized in a hostile manner in critical studies or textbooks of literary terminology. Due to this reason, important critics or writers, local or foreign, could not even be mentioned as names, leaving much room for vulgar sociology.

This is the context existing in cultural Albania after the fall of the Berlin Wall.

flourishing of these magazines lasted several years, and they ceased to be published, mainly due to financial problems and limited market demand.

It was at this time that as a result of the opportunities provided by the rapid technological development, online magazines began to be published in internet. Their main advantage the lower financial cost. Meanwhile, they ensured a wider audience and faster distribution time. One of these magazines is *Palimpsest*, which is the focus of our research.

When the time pandemics occurred, *Palimpsest* magazine was several years old. This is the reason it had created a consolidated heritage consisting of a relatively rich fund of materials. These materials could be easily identified based on the new requirements of the time.

What was the reason that electronic magazines drew special attention during this time?

The same as in many areas of life, the pandemics led to the collapse of students' access to literature, which created a difficult position for all of them. After the confusion in the beginning arising from the unexpected circumstances created, and the successive attempts to find the proper solutions, electronic magazines were taken into consideration.

Could the solution be sought in the facilities they offered? Could it be more clearly specified what they were specifically offering?

At their outset, Albania's electronic magazines were influenced by printed magazines, but later, they adapted to the new circumstances enabled by electronics. This was also shown by the new, interactive sections, which were added such as *Agora*, *Book Club*, *New Publications*, etc. So the speed of interactivity, as a feature of the age of globalization, was a significant added value. It was time to ask a raise some questions:

How could the flexibility of these magazines be utilized, at a time when students could not physically use libraries? Could e-Magazines create the necessary space for the literature required by students? Could theoretical or essay materials be added, according to a special system, going to an increasingly optimal progression?

The burden was not so easy, because, as mentioned above, in the case of Albania, most of the theoretical books of contemporary theorists are not translated, but only a limited number of important works. Thus, there were more reasons to think of a quick option for students which was also the same one for all of them. First and foremost, it was necessary to popularize the idea that this problem could be solved with the new opportunities provided by online publishing. Its archive became the first impetus. Thus, it was conceptualized an organization of the main rubrics.

In this reorganization, priority was given to sections that provided access to:

- Literary theory

It was intended that, in addition to its applications in various works of literary criticism and studies, to make available for students original pieces of writings of the most famous and important theorists. Likewise, it was thought to enable publications that discussed the methods of contemporary literary studies, such as “Literature and literary itinerary”, “Literature and vlog” etc.

- Archival documents

It was intended that, in addition to examples of literary theories applications in various articles of literary criticism and studies, to enable for students also original materials which were not in circulation. We mean those materials that were previously kept locked in archives for a long time. Some of them *ineditum*. These materials were of interest for literary criticism and to give a new dimension to the entire literary system in general and even for Albanology in particular.

- Literary history

The aim was that in addition to examples of its implementations in various writings and studies for authors and literary works, to familiarize to students with such concepts such as the literary system, literary evolution, pre-national and national literature, classicism and modernity, which enrich the methods of how literary history functions or how a literary story is written.

Since the very beginning of this reorganization it was ascertained that this online magazine offered some real opportunities for students because:

- Up to that time there was a considerable fund of materials for the areas of interest to the students, the reason why they required a detailed exploration in order to assess how well it suited the needs of the students.
- Students received information from reliable and specialized sources. The translation or presentation of the materials was made by some of the most famous translators or critics in the country.
- It contained and preserved the resource bibliographic data and this helped students to use them according to their personal goals as well.

- At a time when access to online materials was becoming increasingly difficult in financial terms, the eMagazine provided students with the opportunity to obtain materials for free;
- It provided the possibility of maximum use of time by students. Time could be fully managed according to the requirements and needs of the students.
- Some journal issues could be used directly by students as class discussion topics.
- Familiarization of students with the materials of the eMagazine, led increasingly to concrete objectives and goals related to the learning process.

This project reinforced what the researcher Adam Hammond noted: “The field of literary studies itself experienced its greatest expansion in a period of medium transition, developing in response to the emergence of electronic media in the early twentieth century. To the question “Is literature dying in the digital age?” the historical record suggests a clear answer: “no” (Hammond, A. 2016: 22). A conclusion that goes in line with what Borges wrote: “The book is the extension of human memory and imagination” (Borges, J.L. 2000: 9).

3. Key Issues

It was natural that during the process to take note of all the possible flexible means of communications that we could turn in our advantage, having the goal of increasing the competencies of the students, to set long-term objectives. Rapid familiarization with the process of consulting learning materials in electronic formats proved that this tool will be one of the main alternatives offered by the future of teaching and learning.

Students comprehended that this practice:

- Prepared them for further education, both for themselves and for their time as future teachers.
- Encouraged them to commit themselves to search for similar or related projects,
- Strengthened their belief that they could find materials quickly and efficiently, by maximizing their useful time.
- Increased the independence of the search, by finding relevant and proper information.
- Other benefits that students had during this process were especially appreciated:
 - Students could work detached from the school each other;
 - They could work on a group project, regardless of the physical distance between them.

In this way, teamwork accelerated knowledge sharing and interaction.

We add that in this process, we also benefited from the idea that, in addition to seeing electronic journals as an alternative sources in the given situation where we were, on the other hand,

students were provided with a method that will be useful in life after school, since technology is increasingly expanding in the field of education. In particular, from the point of view of identifying reliable sources and conducting research it is the proper and most practical tool. In other words, it also prepared students for the near or distant future.

Likewise, to increase interactivity, certain student papers, which were rated as very good ones, and became part of the magazine's rubrics.

4. Surveys and their results

To increase the interactivity and better orient the functioning of the magazine in the interest of the reader's requirements, mini-surveys were conducted with questionnaires. The purpose of conducting the mini-survey was to create a clear picture of whether what the magazine offered met the academic, aesthetic and entertainment interests of the readers (mostly students, but not only) and whether the rubrics and materials offered by the magazine could be expanded in service of even more specified fields of study.

The survey questions focused on the following areas:

- a. Curricula mandatory learning literature to be read by students;
- b. In the suggested curricula literature;
- c. In the literature for personal reading pleasure;
- d. Mandatory learning literature and for personal reading;
- e. Mandatory learning literature and suggested literature.

What did the students want beyond the suggestions of the professors?

In the survey responses we noticed that out of 202 respondents:

- 90 responded that they would like to find the mandatory literature
- 52 responded that they would like to find the suggested literature
- 25 responded that they would like to find literature for reading pleasure
- 22 responded that they would like to find mandatory literature with personal reading
- 13 responded that they would like to find the required literature combined with the suggested literature.

Expressed in percentages:

44.5% requested the mandatory literature

25.7% asked for the suggested literature

12.3% requested literature for personal reading pleasure (a gratia sui)

10.8% combined mandatory reading with reading for personal enjoyment

6.4% combined mandatory literature with suggested literature

A special question in the survey was related to the suggestions, to which the students gave the following answers:

- Add extracts from the works of well-known theorists.
- Systematize continuously the content materials.
- Increase the sources of information.

Some conclusions

Technology as an advantage for student reading is a possible reality, because we witnessed how an electronic magazine became an alternative source for the use of learning materials that are mandatory during the learning process, learning materials that serve to expand the cultural horizon, as well as fulfillment of personal satisfaction.

The use of technology helps to reform the methods of literary study, by considering literature through the advantages that electronics enables, with image, collage and intercommunication. This would be a way to make reading and studying literature more interesting. It helps because the true test of rigor for students is to be able to look at material they've never seen before and know what to do with it, or information, simply as information, is no longer an advantage of higher education nor a privilege of educators alone.

Survey data shows that readers use the electronic magazine mostly for the mandatory literature, which means that they see it as an alternative or complementary to the search for materials. This demonstrates the benefits for the students, as well as the growing belief that digital time suggests many unknown possibilities for encouraging students to read.

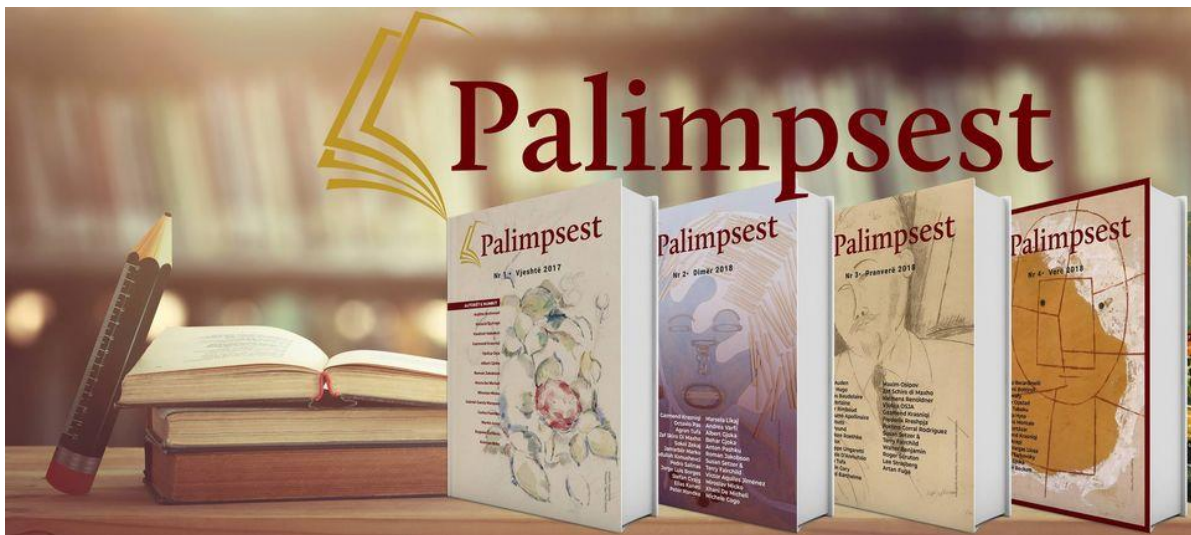
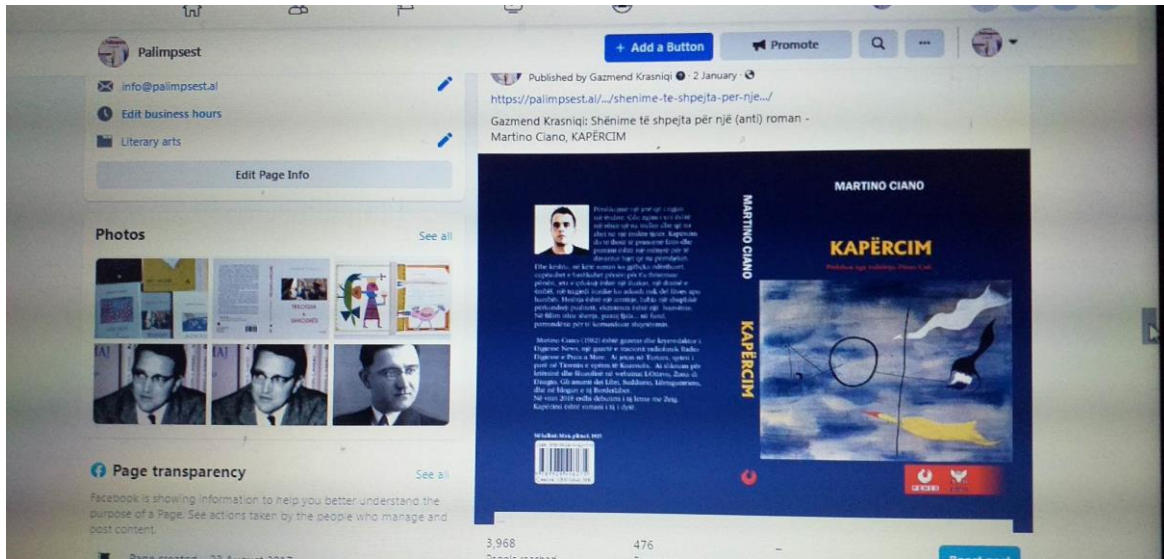
Interactivity enabled by the digital age, strengthens the sense of collectivity and enlivens the energies of students towards the learning process, as well as for new knowledge and information. It was observed likewise that during pandemics, it can be fully utilized to the utmost efficiency in the operation of an e-Magazine.

Bibliography

- Barron, B. (2006). *Interest and Self-Sustained Learning as Catalysts of Development: A Learning Ecology Perspective: Human Development*
- Borges. L. J. (2000). *Pavdekësia dhe ligjërata të tjera*. Tirana: Afërdita
- Clayton M. Christensen & Henry J. Eyring (2011). *Innovative University: Changing the DNA of Higher Education from the inside out*: John Wiley & Sons

- Darling-Hammond, Linda (2010). New Policies for 21st Century Demands, in 21st Century skills: Rethinking how students learn, ed. by Bellanca & Brandt: Solution Tree Press
- Hammond, A. (2016). Literature in the digital age: an Introduction. USA: Cambridge University Press
- Pipa, A. (1944). Shpirti kritik. Revista "Kritika", nr. 1, v. I , Shkodër.

Appendix



NJOFTIME

Agorë

Albanologji

Artefakt

Bisedë

Botime

Dramë

Esse

Histori letrare

Klubi i Librit

Konkurs

Kritikë

Kultesë

Njoftime

Parafjala

Pershëpje

Prezantim

Prozë

Recenzë

Adopting the use of assistive technology in a child with multiple disabilities

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Abstract

Assistive technology represents various forms of equipment, programs or products used to increase, maintain or improve the functional abilities of people with disabilities. For children with multiple disabilities, the use of assistive technology is an opportunity to engage in various activities and consequently improve the quality of life.

The aim of this paper is to present an example of adopting the use of assistive technology in a child with multiple disabilities and factors that contribute to this process from the perspective of an educational rehabilitator during the rehabilitation treatment period.

After studying theoretical assumptions of the use of eye gaze technology and the challenges that arise in practice, problem areas were identified. The data was collected by a questionnaire during a semi-structured interview and then processed with thematic analysis of the content. The results point to progress of a child in communication contributed to adopting the use of assistive technology. Furthermore, the results point to the contribution of educational rehabilitation assessment and selection of assistive technology, application of pre-training and training, customization process and providing education and support to the parents of a child with multiple disabilities. The findings indicate an important role of educational rehabilitation work in the adoption of the use of assistive technology in a child with multiple disabilities.

Keywords: assistive technology, eye gaze technology, multiple disabilities

Introduction

The use of assistive technology (AT) enables daily functioning and involvement in activities and significantly contributes to the quality of the lives of children with disabilities and disabled people in general (Lancioni et al., 2013). Eye gaze systems are defined as hightech gaze based assistive technology and usually consist of an eye tracker device that is attached to

a tablet or a computer monitor with built-in specialised software (Batistić Pešić 2012.; Karlsson et al., 2017). Eye gaze assistive technology has the potential to enhance performance within several domains related to activities and participation in the daily lives of children with multiple disabilities. Usage of eye gaze can contribute to the progress in the efficient use of computers, increase learning opportunities, development of independence and social interaction (Perfect et al., 2020). As key factors in adopting usage of eye gaze technology authors implicate assessment of visual skills, positioning and posture, cognitive status, purpose of usage, motivation for usage, constant professional support as well as family support (Stokes & Roden, 2017).

Methods

The aim of this paper is to present an example of adopting the use of assistive technology in a child with multiple disabilities and factors that contribute to this process from the perspective of an educational rehabilitator during the rehabilitation treatment period. This study was conducted using semi-structured interview. Given the theoretical assumptions of the use of assistive technology and the challenges that arise in practice, a list of topics was created to guide the interview. The interview was 70 minutes long, audio recorded and transcribed verbatim.

The research participant is an educational rehabilitator with specialised knowledge of assistive technology, including assessment, rehabilitation treatment, providing support and counselling to the family. The object of interest in this study was defined as educational rehabilitation treatment for a school-aged child who does not use functional speech, generate writing, or use any other typical forms of language. This includes communication through facial expressions or eye gaze. School-aged was defined as ages 7-21 years because children and youth with disabilities in Croatia can access primary and secondary education until age of 21. The educational rehabilitation treatment consisted of three parts: assessment and selection of AT solution, pretraining and training activities for adopting the use of AT and providing support to the child's family.

Data analysis for this study occurred in two phases. In the first phase, authors read the transcribed interview. In this phase data was assigned with preliminary codes in order to describe the content. Furthermore, authors reviewed codes along with defining and naming macro-thematic topics in the second phase.

Results

Based on the thematic analysis, the following issues have been identified: (i) assistive technology assessment, (ii) educational rehabilitation treatment, (iii) barriers and challenges in adopting the use of assistive technology, (iv) efficiency of using assistive technology.

Assistive technology assessment

The assistive technology assessment is a complex process preceded by studying a child's needs and abilities based on documentation provided by a neuropsychiatrist, physiatrist, psychologist, speech and language pathologist and functional vision assessment specialist. For a child with multiple disabilities AT assessment includes assessment of the following developmental areas: motor development including posture and positioning, vision and visual functions, communication skills. Several assessment tools were used to determine possible assistive technology solutions that address the child's needs and abilities. According to the research data following assessment tools were used in the intervention: the Communication Matrix, the Pragmatic Profile of Everyday Communication Skills in Children and WATI Assistive Technology Assessment. Considering child's specific use of eye pointing and eye gaze skills to communicate, following visual skills were assessed using the software Look to learn on an eye gaze device: looking at images, visual attention, tracking, recognition, inspecting and searching. Based on the results of assessment of the child's skills and need for the use of AT, eye gaze intervention was recommended. Within intervention Tobii Dynavox

Eye Gaze Device and communication software Grid 3 were recommended.

Educational rehabilitation treatment

Main goal of educational rehabilitation treatment was adopting the use of eye gaze technology and consequently the improvement of a child's communication skills. Within the main goal the following three sub-goals have been identified: the child will be able to express confirmation and rejection using AT, the child will adopt at least three different categories of word using AT and finally, the child will use AT in at least two everyday situations. The treatment was planned to last for 6 months. Due to epidemiological situation the first three months were conducted in a direct, in-person treatment and the next three months through teletherapy and providing counselling and support to the family. Educational rehabilitation treatment was held once a week lasting from 45 to 60 minutes and included following activities: positioning and calibration for the use of eye gaze device, activities of improving vision skills and training the usage of eye gaze device, providing advice and support to the child's family. In consultation with a

physiotherapist, the child was positioned in an existing wheelchair to achieve the best head position to execute eye gaze device calibration. In addition to the head position and body posture, a significant role in effective calibration had the use of mounting stand and effects of different environmental factors, such as lightning and interfering sounds. Pre-training activities included the use of low-tech solutions such as a mechanical frame and concrete symbols for oculomotor exercises, as well as the continued use of communication board to adopt vocabulary. To provide positive reinforcement in the

use of eye gaze device for communication purposes, priority in the pre-training activities was to identify the child's motivation. This was done using different video materials and interactive activities through the software Look to learn. In addition, software Look to learn was used in training activities to practice and improve visual skills and achieve following skills important in adopting the use of eye gaze technology: acquisition of navigation skills, following directions and determining the time sequence of symbol activation. When these skills are acquired the application of software Grid 3 has begun. The priority in educational rehabilitation treatment was to adopt core vocabulary and determine fringe vocabulary. However, for the effective adoption of using the AT solution it was important to use eye gaze technology in various daily activities such as feeding, maintaining hygiene, leisure activities and especially in activities of expressing the needs, feelings and opinions. To achieve these skills, it is important to involve family members or caregivers in the use of eye gaze technology. Each educational rehabilitation treatment should include providing education and counselling to the family as well as providing support. Such support included changing attitudes towards using AT in everyday life, understanding the important role of modelling and using positive reinforcement in everyday communication.

Barriers and challenges in adopting the use of assistive technology

Adopting the use of AT can be a time consuming and challenging process for a child with multiple disabilities as well as its family. While most eye gaze technology procurement costs are not covered by the Croatian Health Institute Fund, the family has a key role in financing the purchase of the needed device. After overcoming the challenge of procurement, the family needs to actively participate in using eye gaze technology in everyday communication. This can be a great challenge, so it is important to involve family members in using the AT and raise awareness of their role. Although an educational rehabilitator provides counselling, education and support in the use of eye gaze technology, family also requires psychological support. Furthermore, the occurrence of technical failures in the use of eye gaze devices is not

uncommon. These requirements cannot be met by an educational rehabilitator on its own, therefore a need for a multidisciplinary team emerges. Such team should include an educational rehabilitator, physiotherapist, speech and language therapist, psychologist and technical support specialist. As well this team could provide not just rehabilitation, but technical and psychological support to parents and educational experts in the school the child attends.

Efficiency of using assistive technology

After six months of educational rehabilitation treatment, an assessment of adopting the use of AT was conducted through direct observation of a child using the AT. Based on the assessment of the adoption of sub-goals, it was determined that the child effectively adopted the use of AT. Using the AT child can express confirmation and rejection, for example a child can express simple affirmative or negative answers when it is offered an activity. Further, the child has adopted the following three categories of word using AT: food, drink and leisure activities. Finally, the child uses AT in everyday situations such as feeding and leisure activities.

However, the following shortcomings in the adopting of the use of AT were noted. The child is not completely independent in the use of AT because it requires support in turning on and off the eye gaze device. Also, some mistakes in the use can occur due to the child's involuntary movements. Despite these lacks, it has been found that using an AT child is no longer a passive observer but an active participant in interacting with the environment. A further recommendation for educational rehabilitation treatment is to encourage the use of AT in daily activities, with special emphasis on counselling the parents.

Discussion

Once the data of this study was analysed it was compared to relevant studies. The results of this study indicate that the first step in adopting the use of AT is to provide a comprehensive AT assessment. Sam (2020) states that AT assessment should include observing a child's medical documentation, consulting with different professionals and individual approach to assessing child's needs and abilities. These data are consistent with study findings. Furthermore, authors state the following criteria as prerequisite for quality rehabilitation services in the field of AT: procedures to determine the best combinations of devices, conducting holistic assessment of a person's needs considering the need for AT, providing treatment and adaptation of environmental conditions (de Jonge et al., 2015). The results of this study also reveal that education rehabilitation treatment consists of several procedures such as adaptation process, training for the use of AT and providing support to the child's family.

Adaptation process for the use of AT includes positioning of a child, device adjustments through calibration procedures and adjusting the time sequence of symbol activation. Such individual adjustment has contributed to adoption of the use of eye gaze technology, which is consistent with previous research (Griffiths, 2020).

Also, study results show the importance of establishing positive reinforcement to motivate a child to use AT but also provide support and counselling to the family. The need for collaboration between an educational rehabilitator and parents has been highlighted, which found that absence of counselling and motivating a child's family can be a barrier in adopting the use of AT (Borgestig et al., 2021).

Furthermore, authors describe the need for a multidisciplinary team to enable a comprehensive approach in the use of AT (Borgestig et al., 2021). Comparing these data to study findings, a difference in educational rehabilitation treatment can be noticed. Even though educational rehabilitators include medical documentation and counselling with different professionals in discussing AT assessment and positioning of a child, a multidisciplinary work in conducting treatment has not yet been established. This can also present an obstacle in effective adoption of the use of AT (Borgestig et al., 2021). Other researchers state the need for identifying successful outcomes from the user's perspective (Desmond et al., 2018). Due to the child's multiple disabilities and limited vocabulary at the given moment, this was not achieved. Efficiency of adopting the use of AT solution was estimated based on achieving three sub-goals. In further studies the child's perspective should be inspected using this AT solution.

Conclusion

This study aimed to present an example of adopting the use of AT in a child with multiple disabilities, as well as to identify the factors that contribute to this process from the perspective of an educational rehabilitator during the rehabilitation treatment period. This study shows that AT assessment and educational rehabilitation treatment have an impact in the process of adopting the use of AT solution. Furthermore, providing educational and technical support and psychological counselling to the child's family are also necessary. For these reasons, the need for a multidisciplinary AT team was expressed.

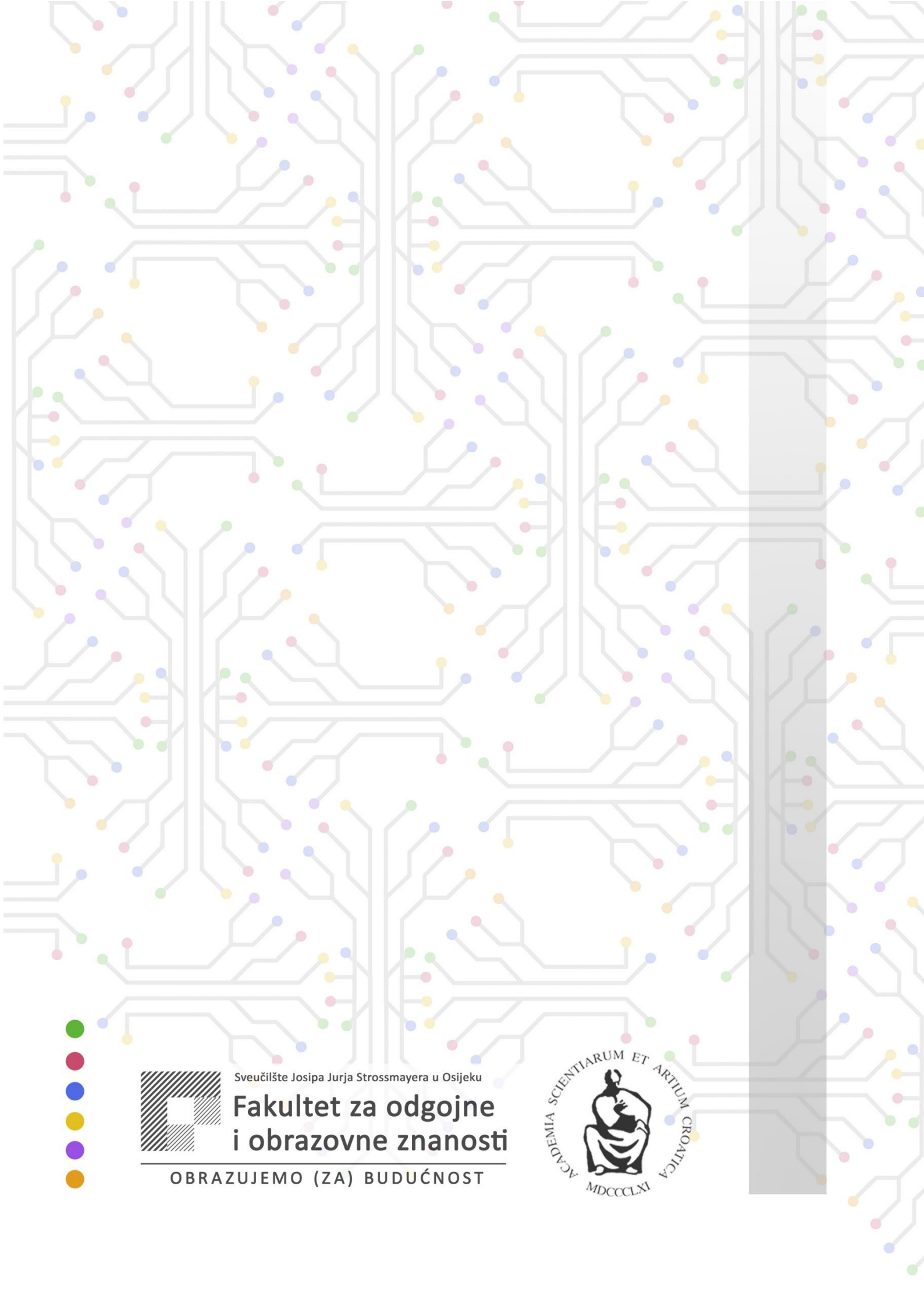
The findings of this study indicate a value of educational rehabilitation treatment in the field of AT. This value is reflected in the following results: progress in child's communication skills and the child's developed ability to express independent choice and voluntarily participate in

everyday activities. Further studies should investigate child's perspective of use of the AT, observation of use of the AT in everyday activities and observation of AT outcomes.

References

- Batistić Pešić, L. (2012). Potpomognuta komunikacija kod djece s razvojnim odstupanjima.
- Borgestig, M., Al Khatib, I., Masayko, S., Hemmingsson, H. (2021). The Impact of Eye-gaze Controlled Computer on Communication and Functional Independence in Children and Young People with Complex Needs – A Multicenter Intervention Study. *Developmental Neurorehabilitation*. Retrieved from <https://doi.org/10.1080/17518423.2021.1903603>
- de Jonge, D., Layton, N., Vicary, F., Steel, E. J. (2015) Motivations and incentives: exploring assistive technology service delivery from the perspectives of multiple stakeholders. *New Frontiers in Assistive Technology: RESNA Annual Conference*
- Desmond, D., Layton, N., Bentley, J., Boot, F. H., Borg, J., Dhungana, B. M., Gallagher, P., Gitlow, L., Gowran, R. J., Groce, N., Mavrou, K., Mackeogh, T., McDonald, R., Pettersson, C., Scherer, M. J., (2018) Assistive technology and people: a position paper from the first global research, innovation and education on assistive technology (GREAT) summit. *Disability and Rehabilitation: Assistive Technology*. 13(5), 437-444. Retrieved from <https://doi.org/10.1080/17483107.2018.1471169>
- Griffiths, T. (2020). Access to Eye-Gaze Control Technology for Children with Cerebral Palsy. Doctoral thesis (Ph.D). London: University College London (UCL). Retrieved from <https://discovery.ucl.ac.uk/id/eprint/10103754>
- Karlsson, P., Griffiths, T., Clarke, M.T., Monbaliu, E., Himmelmann, K., Bekteshi, S., Allsop, A., Pereksles, R., Galea, C., Wallen, M. (2021). Stakeholder consensus for decision making in eye-gaze control technology for children, adolescents and adults with cerebral palsy service provision: findings from a Delphi study. *BMC Neurology* 21. Retrieved from <https://doi.org/10.1186/s12883-021-02077-z>
- Lancioni, G. E., Sigafos, J., O'Reilly, M. F., Singh, N., N. (2013) *Assistive Technology: Interventions for Individuals with Severe/Profound and Multiple Disabilities*. New York: Springer Science
- Perfect, E., Hoskin, E., Noyek, S., Davies, T.C. (2020) A systematic review investigating outcome measures and uptake barriers when children and youth with complex disabilities use eye gaze assistive technology. *Developmental Neurorehabilitation* 23(3) 145–159. Retrieved from <https://doi.org/10.1080/17518423.2019.1600066>
- Sam, A. (2020). *Disabling access: barriers to eye gaze technology for students with disabilities*. Master of Arts (Graduate Program in Critical Disability Studies). Toronto, Ontario: York University.

- Stokes, T.S., Roden, P. (2017). Establishing the key components of an eye gaze assessment for a child with a severe neurodisability using nominal group technique. *Edorium Journal Disability Rehabilitation* 3:62–68.
- Vinceković, I. (2021). Usvajanje korištenja asistivne tehnologije kod djeteta s višestrukim teškoćama. *Diplomski rad*. Zagreb: Edukacijsko-rehabilitacijski fakultet.



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