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Age and gender differences between pupils' preferences in teaching general and compulsory technology education in Croatia

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Abstract
Today's dynamic change of the pupils' technological environment certainly affects their preferences towards technology, which may be important for planning, structuring and organising general technology education. This highlights the problem of general student preferences, which are not the product of current trends but the universal rules for structuring teaching. To contribute toward the solution of this problem, research into pupils' preferences towards the teaching of Technical Culture was carried out with the aim of determining general age and gender differences in pupils' preferences. Accordingly, the study was conducted on a stratified sample, comprising primary school pupils, aged 11 to 15 (N = 699). By applying the customised PATT questionnaire, pupils' interests in technology, their attitudes towards the teaching contents of the Technical Culture, as well as the attitudes to the importance and consequences of technology were examined. The analysis of the obtained data was carried out using a two-factor ANOVA and *t* test, as the basis for determining the differences and characteristics of preference with regard to the age and gender of the pupils. The results of the research show that younger pupils are mostly satisfied with the lessons, while older ones expect more modular teaching. More concretely, boys are more inclined to traditional teaching contents, while girls show much less inclination towards such contents. The presented findings indicate the necessity of a modular approach to the teaching of general technology education, especially between the age of 13 and 15, which should allow equally affirmation of boys and girls in this field of education. The development of such teaching requires a series of additional research to facilitate the development of the future curriculum of general technology education.

Keywords Girls' and boys' technological affirmations · Student preferences · Pupils' attitudes · Technical culture · Technology education

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Introduction

The meaning of preference, in the general sense of this word, refers to the state of an individual in which something or someone is loved more than something or someone else (McIntosh 2013). Thus, pupils' preferences relate to his or her preferences to the teaching subject or the contents of teaching. In essence, students' attitudes and interests towards teaching content or subject matter are seen as motivational variables (Krapp and Prenzel 2011). Individual attitudes and beliefs, such as the attitudes of students towards teaching, are defined as subset of construct groups, by which the structure and the content of mental states that run the actions of a particular person are named, defined and described (Richardson 1996). Thus, attitudes represent his or her personal perceptions, beliefs, values, judgements, opinions, perceptions, prejudices, tendencies, personal theories and similar constructs of a particular reality. As opposed to attitudes, which are considered to be psychological tendencies expressed by the estimation of a given entity with a certain degree of adherence (Eagly and Chaiken 1993), interest can change depending on the individual's interactions with his or her environment and pronounced readiness to acquire new domain-specific knowledge (Krapp and Prenzel 2011). Hidi and Renninger (2006) state that interest may be situational and individual, i.e. conditioned by a particular situation that will stimulate interest based on the individual's personal beliefs. They also state that these two types of interests are interrelated and that the development of interests from situational to individual must involve positive feelings and opportunities for the development of knowledge. In the learning process, individual interests should certainly be the target interest category. Situational interest is what drives interest development, and it is necessary in any process of education. The subsequent maintenance of interest and the development of individual interest are, to a great extent, inter-personal processes in each individual. However, in the process of learning and teaching, maintaining positive emotions, which is possible by guiding students to success, can contribute to the development of individual interest. In technology education, situational interest is achieved mainly by the interaction of the individual with technology artefacts and other students. If students' interaction accompanied by challenges, success, and self-realization, it will arouse positive feelings about the topic and encourage student to engage more deeply in a particular subject. This means that the student is on the right path of developing individual interest.

Nevertheless, this is no guarantee of the development of individual interest. Therefore, even though attitudes related to what a certain person knows about something, it is generally considered that they lack a cognitive dimension (Ardies et al. 2013). By contrast, the interests and tendencies of an individual are more relevant if they come from the knowledge and experience of such a reality. Thus, research shows that a student with a tendency to perform positive action relating to the subject would also show greater interest in the subject (Krathwohl et al. 1964). It is also assumed that a student with a positive attitude toward technology is also more likely to achieve general technological literacy (Bame et al. 1993; Svenningsson et al. 2016). As a result of this, pupils' preferences towards the subject or the content of teaching, as a sum of attitudes and interests, may and should be an important starting point for the development of each type of teaching.

Although, these days, technology education is considered to be an important part of the national curriculum of developed countries (Ardies et al. 2013; Barlex 2015; Benson 2009; de Vries 2009; Green 2011), it has been facing the problems of insufficient interest in technology, as well as the interest in technology-related jobs and studies (Johansson 2009; OECD 2008) for decades. In addition to the problems of lesser interest in technology and

engineering, this teaching area is faced with the problems of massive growth of technological knowledge, the appropriateness of technological training and the problems of individual progress and achievement of excellence in technology and engineering (Purković 2015). These problems point to the necessity of radical changes in education, which would enable the dynamic adaptation of curricula to pupils' interests and preferences, as well as the appropriate development of those students who want and can build their own career in technology and engineering. The dynamic adaptation of the curriculum implies the harmonisation of teaching contents and activities with pupils' interests and preferences, which presupposes the openness of the curriculum framework. For this reason, the results of the study of students' attitudes towards technology and engineering should be an important source of information, both for educational policy and for technology teachers.

Since the mid-1980s, students' attitudes towards technology were conducted using different versions of the PATT (Pupils' Attitudes Towards Technology) questionnaire. Raat and de Vries (1986) carried out the first significant research, with the aim of strengthening the status of the subject and determining its relevance to the students. Different versions of this questionnaire examine the general understanding of technology, the attitudes towards the importance of technology to life, the attitudes to learning technology, gender differences in learning and technology usage, as well as the interests in and the aspiration towards the work in the field of technology and engineering. Previous research has shown that technology, as a subject, is less interesting to girls than boys, and that students who have a positive experience with this field of education will develop a positive attitude towards technology and show a greater interest in career development in this area (Boser et al. 1998). However, research suggests that pupils' attitudes depend on socio-economic background, parents' interest, and other factors (Ardies et al. 2015; Davies and Brember 2001; Lindahl 2003), and that pupils often have a narrow or limited understanding of the nature of technology (Chikasanda et al. 2011). Studies also indicate that the student's conceptualisation of technology and his or her attitudes towards technology are often a reflection of the teacher's knowledge and their approach (concept) to teaching (de Vries 2000; Chikasanda et al. 2011; Rohaan et al. 2010). Although the PATT instrument has, so far, been used in different versions and has been validated several times, some conceptual weaknesses of this instrument have been noted. Weaknesses are evident in the lack of adaptation to the cultural and traditional differences in educational systems (Svenningsson et al. 2016) but also in the conceptual absence of the behavioural component (Ankiewicz 2018). Such findings diminish the importance of gender-related particles and point to the need to explore the intentions of students' activities in the technological environment or in the teaching of the subject.

Technology education in Croatia

In the general and compulsory education in Croatia, technology has existed in the curriculum as a compulsory subject for the last 60 years. This subject has changed considerably over time, with regard to the curriculum, contents and performance time. In the beginning, these classes mainly performed as hands-on activities, utilitarian focused on the production of various teaching aids. From the mid-1950s, technological content was introduced into this subject, and textbooks and manuals were printed in the early 1960s. By the end of the 1960s, a system of technical knowledge appropriate to the primary school was being established, which was being developed and supplemented by the end of the 1980s, and its content structure was basically retained to this day. Thus, in the

5th grade, the content is based on the basics of designing and making products of wood, paper, cardboard, fabric and the development of traffic culture. In the 6th grade, the content is related to construction, building design and model making. In the 7th grade, the content focuses on mechanical engineering and the production of metal products, and, in the 8th grade, the field of electrical engineering and automation are processed, as well as the assembly of electric and electronic circuits. By the end of the 1980s, classes taught weekly for two hours: one hour teaching technology with the entire classroom and two hours of hands-on activities with half the classroom. Experts in the field to this day consider such performance optimal (Boranić 1980; Malinar 2008; Purković 2015).

In addition to the compulsory program, by the 1990s, there were elective technology education programs that provided an opportunity for affirmation of technologically gifted pupils, in which teaching largely based on project activities. In the 1980s, educational authorities attempted to introduce general technological education in all secondary schools, but because of the content that followed the then socialist doctrine, this subject did not show results and was soon abandoned. In the early 1990s, under the pressure of transitional change, the entire technology education characterised as a 'relic of the past' and a series of attempts made to abolish it (Purković 2015). Practical activities in grades 7 and 8 first discontinued, and, in 1997, the curriculum was changed and classes were reduced to teaching the history of technology for one hour per week. During that time, workshops and laboratories were decommissioned and many technical tools, supplies and equipment were almost gone. Due to the insights into the meaninglessness of such teaching, and after pressure from educational experts, in 2004, an experimental program was launched. In 2006, the curriculum changed and practical activities resumed in teaching Technical Culture. This curriculum, based on the traditional conceptualization of technology and strictly prescribed cataloguing topics (Purkovic 2018), will continue to be implemented until 2022. In it, technological knowledge is a concept that includes materials, technical information, energy, technical means, rules (norms) of work, occupational safety, basic knowledge of ICT (Information and Communication Technology) and, in principle, socio-economic relations and ecology. Today, compulsory technology education in Croatia is implemented as a teaching subject called Technical Culture, which is taught one hour per week (or two hours every 15 days) and aimed toward pupils aged 11 to 15. During the realisation of the subject, pupils learn about technology (depending on the class) and carry out basic technical activities (e.g. design, production, assembly, testing, etc.). Although the time provided by the curriculum is often insufficient for the realisation of more complex activities, the teachers try to develop the technological literacy and competences of the pupils through various organisational variants and additional engagement. The current curricular reform is also changing the curriculum of the Technical Culture, as a semi-open attempt to structure technological knowledge based on the manifestations of technology (Mitcham 1994), that is, according to the concept of technical knowledge arising from the manifestations of technology (Purković 2018). Thus, the new curriculum is based on clear learning outcomes for each domain of learning and teaching, such as objects (artefacts) of technology, design and documentation (activities) and technique and quality of life (humane aspect). Despite the positive reviews, the restrictive content added in the latest and official version of this curriculum (Ministry of Science and Education 2019) has made it impossible to successfully and safely carry out pupils' technological activities. In addition, turning away from the humanistic paradigmatic starting points of reform, which aims to strictly control the teachers and their teaching process rather than the learning outcomes, the feasibility of such a curriculum becomes very questionable at first.

The latest research into students' attitudes towards this subject were conducted 15 years ago, according to the curriculum in which only the history of technology was taught without any pupils' activity. That research has shown that a significant number of students do not find this teaching subject interesting and important for their own development (Marušić 2006). Additionally, that research provided a certain comparison of student attitudes towards the teaching subject, without considering the issues of a particular subject. In Croatia, the PATT questionnaire version was first applied two year ago (Suman and Purković 2018), as a part of a preliminary study that was conducted according to the mode (forms) of teaching in Technical Culture, and it explored the pupils' interest in the types of content, as well as their attitudes. That research has shown that pupils' interest in teaching content varies considerably during maturation, from product design (technical drawing) in the 5th grade to robotic technology in the 8th grade. More specifically, girls are more inclined to design products, while boys prefer robotics, wood handling and metal processing (Suman and Purković 2018).

Due to the current education reform in Croatia, which foresees the implementation of this subject based on a highly open curriculum, pupils' preferences become an important orientation and guidance for teachers in structuring and planning their own teaching. Therefore, the aim of this research is to find regularity in age and gender differences within the preferences of pupils towards technology (i.e. in relation to Technical Culture). The primary objective of the research is to determine the pupils' preferences in the Technical Culture curriculum and the variation of preferences with respect to the age and gender of the pupils. By extending the knowledge of these differences, the nature of pupils' preferences, as universal rules that could influence the formation of general and compulsory technology education curricula in culturally and traditionally similar countries, would be possible. In this respect, the research starts from the basic assumption (H0) that the pupils' preferences towards the teaching of Technical Culture are not significantly different, with respect to: a) the age of the pupils and b) the gender of the pupils.

To achieve the research aim, it was necessary to: (a) examine pupils' preferences, with regard to the particularities of teaching subject; (b) determine the distribution of the results of the observed group; (c) establish the existence of statistical significance of the differences within the group; (d) analyse the existence of statistical significance of differences in relation to age and gender of the pupils; and (e) in the case of differences, determine how preferences differ. In line with the stated goal, the research question that this article seeks to answer may formulate as follows: *How do pupils' preferences towards teaching technology in general and compulsory education in Croatia differ in terms of pupils' developmental age (class) and gender?* Since technology in Croatian general education is mainly taught in the subject of Technical Culture, this research is an attempt to learn more about the differences in pupils' preferences in this subject.

Methods

This research conducted an anonymous survey of pupils' attitudes and interests towards the Technical Culture teaching. Attitudes and interests were examined using a questionnaire, which is a customised version of the PATT test, in the form of a pupil's agreement with the statements on a Likert-type scale. Quantitative analysis methods were used to collect and process the data. A one-way ANOVA was used to determine the statistical significance of differences by age of pupils, while a t test was used to determine gender differences.

Ultimately, the results were qualitatively interpreted, as an attempt to determine the regularities that may influence the further development of the Technical Culture curriculum.

Participants

The study was conducted with a sample (N = 699) of pupils in grades 5 through 8 of primary school in Croatia. Schools and classes were selected according to criteria that include different pupil environments, from rural to large urban areas, and different areas (counties) of Croatia. In doing so, the equal representation of pupils from each grade was considered. This is a stratified sample of respondents. All of the pupils attended the Technical Culture classes as a compulsory subject, which was taught with the whole class for two school hours (i.e. a block of 90 min) every other week. With all of the pupils, the teaching was conducted according to the Technical Culture curriculum of 2006 (MSES 2006). According to this curriculum, the classes were taught through 15 catalogue topics, during which pupils were taught technology (i.e. materials, technical drawing, energy, artefacts of technology, ICT, special topics), after which they carried out practical activities (i.e. design-drawing, assembly, production, testing, etc.), according to pre-prepared materials from the mandatory kit (the so-called box).

Instrument

The instrument used in this research was inspired by the PATT-SQ questionnaire (Ardies et al. 2013), which represents a very narrow version of the PATT-USA test (Bame and Dugger 1989). Despite being inspired by the PATT-SQ test, this instrument has further reduced and adapted to the specificities of the Croatian educational context. The reasons for this approach are different. Namely, if we literally translated the items from the PATT-SQ questionnaire, Croatian pupils would not understand many of them. The second reason directed at attempting to include behavioural elements, which includes a person's predisposition or willingness to act, as well as his or her actions concerning the 'behavioural object' (Ankiewicz 2018). In other words, an attempt was made to introduce items that reflect the indirect feedback of the pupil on his or her actual performance in Technical Culture, which, in most cases, is the pupil's first experience with technology. For this reason, new items were introduced in this instrument, as result of the way of technology learning in the Technical Culture subject, as a part of the knowledge system in the general and compulsory education curriculum in Croatia.

The questionnaire consisted of 21 items, divided into three sections. The first section was made up of the characteristics of the group: the gender of pupil (SPUC) and the class (RAZR). The second part consisted of pupils' attitudes and interests towards Technical Culture, which conceptually focused mainly on the interest, relationship and consequences of the schools' technology. This section contains the categories of items related to technology interests, the consequences of technology and the particle about technology as something difficult, according to the PATT-SQ test (Ardies et al. 2013). There are also particles that reflect pupils' attitudes toward technology in the school curriculum (subject Technical Culture), modelled on the PATT-USA Questionnaire (Bame and Dugger 1989). The questionnaire did not contain items looking into pupils' career aspirations, items about technology for boys and girls nor items about technology as something that was difficult. The gender and career categories were rejected because gender differences were intended to investigated, not to prejudice gender differences. The career category was rejected due to pupils'

lack of knowledge about jobs and career opportunities in technology, as the Technical Culture does not teach them this. Thus, gender and career categories were discarded here for reasons similar to those reported by Svenningsson et al. (2016). Instead, the questionnaire focused on the attitudes and interests that arose from the experiences gained mainly in the context of Technical Culture. In this way, it was necessary to isolate the external factors that influence and to adapt the questionnaire to the specific context of education. Therefore, this part of the questionnaire consisted of 17 items—statements that pupils had to show the level of agreement (Table 1). The level of agreement was expressed using a Likert-type scale: 1 = totally disagree, 2 = mostly disagree, 3 = neither agree nor disagree; 4 = mostly agree; 5 = completely agree.

The PVSV, PVUC, PVPO, and PVNE items in Table 1, relate to feedback from pupils on technology experiences, as a behavioural elements of the research. Specifically, pupils who are successful in technology activities are likely to have a more positive attitude than those who are not. These items can also show how situational interests relate to pupils' individual interests. By comparing the results of these particles with those associated with technology as something difficult (OBPO and TESA) and with particles related to the dynamics of teaching (BSDR and BSDJ), one can also find how situational interests relate to the individual interests of pupils. For example, if students express themselves positively about interactions and negatively about what they learn and when they learn, there is clearly a problem in the development of students' individual interests. This is also important from the standpoint of certain dispositional indicators of those pupils who, in further education, should be allowed to develop in the field of technology, which is not currently the case in the Croatian education system. Such an indicator can be important from the standpoint of the justification of elective programs in the education system and, thus, the importance of technological education as a whole.

Table 1 Items of second section of the questionnaire

Item no.	Item
3.	The subject is interesting (ZANI)
4.	The subject is important and useful for everyday life (KORI)
5.	Theoretical contents are interesting and useful (TEKO)
6.	I understand theoretical contents and I can easily remember them (TEPA)
7.	I need more explanation and repetition in the classroom (OBPO)
8.	I hardly follow the content of the lesson (TESA)
9.	Content is difficult and demanding for learning (SATE)
10.	Content is too diverse and unconnected (RANE)
11.	I often use a tutorial for learning (UCUD)
12.	The textbook is understandable and easy to use (UDLA)
13.	This subject is unnecessary at school (NETK)
14.	I like the practical activities I've been working on (PVSV)
15.	I learned a lot during practical activities (PVUC)
16.	I often need help with practical activities (PVPO)
17.	Practical activities are unnecessary (PVNE)
18.	I like 90-minute lessons every other week (BSDR)
19.	A 90-minute lessons should be every week (BSTJ)

The OBPO and TESA items in Table 1, as part of the technology as something difficult, are basically aimed at exploring pupils' attitudes toward the existing, relatively rigid, teaching style in Technical Culture. Although curriculum reform is ongoing in Croatia, a Technical Culture teaching style will not change by changing curricular documents only. This process can take years, and it is certain that the time available for teaching or the expectations from the pupils will not change significantly. Therefore, these items intend to examine pupils' attitudes toward the dynamics of teaching, that is, whether and to what extent they can successfully keep up with the teaching content. The insights from this section are important for arguing the depth and scope of the teaching content, the appropriateness of the content of the age and gender of the pupils, but also the rhythm and choice of strategies to teach at this level in a very limited time. Given the years of developed technological knowledge that primary school pupils in Croatia should master, there is a long tradition of publishing textbooks that follow the curriculum of the subject. Although previous research has shown that textbooks have the least importance for technology learning (Purković 2016), the UCUD item intends to determine whether pupils use the textbook for learning and how such use varies in regard to age and gender. Actually, it is an item from the category of perceiving technology as something difficult. Items BSDR and BSTJ exclusively relate to pupils' views on the time of teaching Technical Culture in the Croatian education system. The Technical Culture is represented in the curriculum for one hour per week, and according to the recommendations of the Education and Teacher Training Agency, every other week is taught as a 90-min course. Although this allows at least some technological activities to carry out, learning continuity is lost. Therefore, through these items it was indirectly sought to identify which groups of pupils support this kind of performance, which do not want this teaching at all and which want such instruction every week. Thus, although there are direct items in the questionnaire about attitudes towards the subject, these particles indirectly show the pupils' interest in the subject and technological content. These results can be important from the standpoint of arguing the time required for the subject in the general education curriculum but also from the standpoint of justifying the elective and flexible access to general technology education.

The third section focused on pupils' interests in the technological content and their suggestions for the teaching improvement, such as: *in the teaching of the Technical Culture should be more…* (INTU), *if elective courses were to be organised, I would choose…* (IZBU), and *Introduce your thinking or suggestions for changes in the teaching of Technical Culture* (PROM). The INTU, IZBU and PROM items subsequently were excluded from further consideration because it was possible to apply a mostly qualitative methodology for processing. For this reason, further processing of the results for this part of the questionnaire are reserved for future consideration of the pupils' preferences.

The validity and reliability of the questionnaire was established during the pilot study on a sample consisting of 32 pupils. To determine the reliability of the questionnaire, a test–retest method, with a one-month time lag, was used, and reliability was established by a *t*-test, correlation analysis and Cronbach-alpha parameter estimation of internal items consistency. The *t*-test results showed no statistically significant difference between initial and repeated testing ($p=0.258$). Further analysis established a high average correlation between initial and repeated testing ($r=0.79$), at the level of statistical significance $p<0.001$, and high average internal items consistency ($C-\alpha=0.81$).

Data collection and analysis

After obtaining the consent of the parent-guardian, in accordance with the Code of Ethics prescribed by the Council for Children of the Government of the Republic of Croatia, the data was collected through the abovementioned questionnaire. When completing the paper-based questionnaire, pupils were clearly told that the questionnaire was anonymous, that they should read the statements carefully and that they could freely round their agreement or disagreement. The pupils were informed about a scale expressing agreement or disagreement and were told that they could ask the teacher about any ambiguities. A Technical Culture teacher who takes classes with them carried out the direct collection of data with children. Data collection took 25 min, after which the questionnaires were stored in an envelope, closed and forwarded to the researchers for further processing.

After collecting the data of the separated variables, it was then processed by the method of descriptive statistics and calculated by the following parameters: mean (M), standard deviation (SD), coefficient of variation (CV), asymmetry (SKEW) and curvature (KURT). A one-way variance analysis (ANOVA) was used to determine the statistical significance of the differences in estimates between pupils' age (levels of agreement with the statements), with the first type error $\alpha = 0.05$. When comparing class-related results, the Bonferroni's post hoc tests were applied for significant F values, which revealed a statistically significant difference between the pupils' age groups. A *t*-test was used to determine the statistical significance of differences in estimates between the gender, with the first type of error $\alpha = 0.05$. This way, the basic assumption (H0) on the differentiation of pupils' preferences was accepted or rejected with respect to the age and gender characteristics of the group. Finally, all the results were interpreted qualitatively, which gave insight into the general preferences of the pupils towards Technical Culture, as a unique part of technology education in Croatia. This has resulted in general guidelines for aligning Technical Culture curriculum with pupils' preferences. All data were computer-processed using the statistical program, *Statistica 8.0*, at the University of Rijeka.

Results

Out of the 702 pupils involved in the survey, 699 pupils completed the questionnaire. Therefore, only those completed questionnaires were considered for this study. Out of the total number of respondents, 183 (26.18%) were 5th-grade pupils, 176 (25.18%) were 6th-grade pupils, 161 (23.03%) 7th-grade pupils and 179 (25.61%) were 8th-grade pupils. Among them, 333 (47.60%) were boys and 366 (52.40%) were girls. The collected data were first processed using descriptive statistics to determine distribution estimates and establish the application of further statistical procedures. Looking at the descriptive statistical data (Table 2), pupils show the highest level of agreement with the statement about them liking the practical activities performed during the course (M = 4.28), with the lowest coefficient of variation (CV = 26.47%). A high level of agreement was also noted in relation to the statements that they have learned a lot from practical exercises (M = 3.97) and the statement that the subject is important and useful for everyday life (M = 3.87). The lowest agreement with the statement is observed with regard to the statement that practical activities are unnecessary (M = 1.77), where pupils' estimates vary most (CV = 68.34%). A low agreement was also noted when it comes to the statement that Technical Culture is

Table 2 Descriptive statistics parameters: mean (M), standard deviation (SD), coefficient of variation (CV), asymmetry (SKEW), curvature (KURT)

Monitored variables	M	SD	CV	SKEW	KURT
The subject is interesting (ZANI)	3.58	1.231	34.38	− .593	− .524
The subject is important and useful for everyday life (KORI)	3.87	1.057	27.32	− .794	.065
Theoretical contents are interesting and useful (TEKO)	3.49	1.257	36.04	− .440	− .786
I understand theoretical contents and I can easily remember them (TEPA)	3.37	1.156	34.31	− .390	− .602
I need more explanation and repetition in the classroom (OBPO)	3.07	1.386	45.13	− .062	− 1.218
I hardly follow the content of the lesson (TESA)	3.10	2.160	50.55	− .079	− 1.458
Content is difficult and demanding for learning (SATE)	2.51	1.339	53.40	.407	− .967
Content is too diverse and unconnected (RANE)	2.74	1.294	47.22	.249	− .941
I often use a tutorial for learning (UCUD)	3.49	1.433	41.06	− .488	− 1.098
The textbook is understandable and easy to use (UDLA)	3.51	1.327	37.79	− .492	− .869
This subject is unnecessary at school (NETK)	2.45	1.554	63.48	.552	− 1.227
I like the practical activities I've been working on (PVSV)	4.28	1.133	26.47	− 1.571	1.537
I learned a lot during practical activities (PVUC)	3.97	1.198	30.21	− .980	.025
I often need help with practical activities (PVPO)	2.49	1.305	52.38	.419	− .941
Practical activities are unnecessary (PVNE)	1.77	1.209	68.34	1.459	.983
I like 90-min lessons every other week (BSDR)	3.85	1.440	37.38	− .961	− .477
A 90-min lessons should be every week (BSTJ)	2.80	1.547	55.22	.190	− 1.410

unnecessary in school (M = 2.45), with a high variation of the estimates (CV = 63.48%). The data show a very asymmetric distribution of estimates with regard to the statements that pupils like practical activities (SKEW = − 1.571) and that practical activities are unnecessary (SKEW = 1.459). Based on the results, it is apparent that estimates for the item (PVSV) are grouped on the side of total agreement with the statement, while for the item (PVNE) are grouped on the side of complete disagreement. The distribution curvature results indicate that most variables have negative curvature, and estimates are largely distributed around the mean. The results obtained by the Kolmogorov–Smirnov test reveal the deviation of several variables from normal distribution, which may be due to sensitivity to relatively large samples. Although the data derived from descriptive statistics show some preferences of the pupils, as a whole group, it is not possible to discern differences with respect to gender and age.

According to the results of the one-way ANOVA (Table 3), there is a statistically significant difference in the pupils' preferences between classes. The results show that there are differences in the following items:

- pupils' interest in the subject (ZANI);
- subject importance and its benefits for everyday life (KORI);
- how interesting and useful the teaching contents are (TEKO);
- the understanding of the theoretical contents (TEPA);
- contents weight and complexity for learning (SATE);
- the frequency of using textbooks (UCUD);
- understanding and dealing with textbooks (UDLA);
- views about the need for this school subject (NETK);
- knowledge acquisition during practical activities (PVUC); and

Table 3 Results of the ANOVA test – Pupils' preferences with regard to the classes: sum of squares (**SS**), degrees of freedom (**df**), mean of the squares (**MS**), F-value (**F**), statistical significance (**p**)

Monitored variables	SS	df	MS	F	p
The subject is interesting (ZANI)	45.417	3	15.139	10.389	.000
The subject is important and useful for everyday life (KORI)	14.164	3	4.721	4.285	.005
Theoretical contents are interesting and useful (TEKO)	67.241	3	22.414	15.038	.000
I understand theoretical contents and I can easily remember them (TEPA)	46.542	3	15.514	12.162	.000
I need more explanation and repetition in the classroom (OBPO)	8.575	3	2.858	1.491	.216
I hardly follow the content of the lesson (TESA)	4.041	3	1.347	.288	.834
Content is difficult and demanding for learning (SATE)	24.526	3	8.175	4.630	.003
Content is too diverse and unconnected (RANE)	12.582	3	4.194	2.523	.057
I often use a textbook for learning (UCUD)	68.660	3	22.887	11.654	.000
The textbook is understandable and easy to use (UDLA)	57.316	3	19.105	11.344	.000
This subject is unnecessary at school (NETK)	22.755	3	7.585	3.171	.024
I like the practical activities I've been working on (PVSV)	5.641	3	1.880	1.469	.222
I learned a lot during practical activities (PVUC)	15.961	3	5.320	3.751	.011
I often need help with practical activities (PVPO)	22.222	3	7.407	4.416	.004
Practical activities are unnecessary (PVNE)	10.970	3	3.657	2.520	.057
I like 90-min lessons every other week (BSDR)	13.145	3	4.382	2.123	.096
A 90-min lesson should be every week (BSTJ)	16.770	3	5.590	2.349	.071

- the need for help during practical activities (PVPO).

After further processing Bonferroni's post hoc tests, we found statistically significant differences between classes for some variables (Table 4). After the post hoc tests, no statistically significant differences were observed for the following variables: OBPO (*I need more explanation and repetition in the classroom)*, TESA (*I hardly follow the content of the lesson*), RANE (*Content is too diverse and unconnected*), PVSV (*I like the practical activities I've been working on*), PVNE (*Practical activities are unnecessary*), BSDR (*I like 90-minute lessons every other week), and* BSTJ (*A 90-minute lesson should be every week*). For the variable, *The subject is interesting* (ZANI), there was a difference between the preference of 5th-grade and 8th-grade pupils, at a statistical significance level of $p = 0.000$; between the 6th-grade and 8th-grade pupils, at a statistical significance level of $p = 0.014$; and between the 5th-grade and 7th-grade pupils, at a statistical significance level of $p = 0.021$. When it comes to the variable, *The subject was important and useful for everyday life* (KORI), the difference between the 5th-grade and 8th-grade pupils was statistically significant at $p = 0.004$, while the differences among other classes were not statistically considerable. Regarding the variable, *Theoretical contents are interesting and useful* (TEKO), statistically significant differences were found between the 5th-grade and 8th-grade pupils, at a statistical significance level of $p = 0.000$; between the 5th-grade and 7th-grade pupils, at a statistical significance level of $p = 0.026$; between the 6th-grade and 8th-grade pupils, at a statistical significance level of $p = 0.000$; and between the 7th-grade and 8th-grade pupils, at a statistical significance level of $p = 0.009$.

As for the variable, *I understand theoretical contents and I can easily remember them* (TEPA), there was a statistically significant difference between the 5th-grade and 8th-grade pupils, as well as between the 6th-grade and 8th-grade pupils, at a statistical

Table 4 Significant main differences of the multiple comparisons between classes by Bonferroni's post hoc test

Variables with statistically significant differences	Class	6	7	8
The subject is interesting (ZANI)	5	.29	.46*	.72*
	6		.17	.43*
	7			.26
The subject is important and useful for everyday life (KORI)	5	.08	.10	.42*
	6		.02	.34*
	7			.32
Theoretical contents are interesting and useful (TEKO)	5	.12	.40*	.83*
	6		.28	.71*
	7			.43*
I understand theoretical contents and I can easily remember them (TEPA)	5	.19	.36*	.74*
	6		.17	.55*
	7			.38*
Content is difficult and demanding for learning (SATE)	5	.37	.29	.54*
	6		.08	.17
	7			.26
I often use a tutorial for learning (UCUD)	5	.02	.43	.74*
	6		.41	.72*
	7			.31
The textbook is understandable and easy to use (UDLA)	5	.25	.38	.77*
	6		.13	.52*
	7			.39
This subject is unnecessary at school (NETK)	5	.10	.39	.49*
	6		.29	.39
	7			.10
I learned a lot during practical activities (PVUC)	5	.03	.32	.33
	6		.35	.36*
	7			.01
I often need help with practical activities (PVPO)	5	.04	.38	.43*
	6		.42*	.48*
	7			.05

*Shows the main difference is significant at the 0.05 level

significance level of $p = 0.000$. Moreover, a statistically significant difference was noticed between the 5th-grade and 7th-grade pupils, at a statistical significance level of $p = 0.041$, as well as between the 7th-grade and 8th-grade pupils, at a statistical significance level of $p = 0.016$. In relation to the variable, *Content is difficult and demanding for learning* (SATE), a statistically significant difference was found between the 5th-grade and 8th-grade pupils, at a statistical significance level of $p = 0.002$. With regard to the variable, *I often use a textbook for learning* (UCUD), there was a statistically significant difference between the 5th-grade and 8th-grade pupils, at a statistical significance level of $p = 0.000$; between the 5th-grade and 7th-grade pupils, at a statistical significance level of $p = 0.021$; and between the pupils of the 6th and 8th grades,

at a statistical significance level of $p = 0.000$. Concerning the variable, *The textbook is understandable and easy to use* (UDLA), the statistically significant difference was determined between the 5th-grade and 8th-grade pupils, at a statistical significance level of $p = 0.000$; between the 5th-grade and 7th-grade pupils, at a statistical significance level of $p = 0.015$; and between the pupils of the 6th and 8th grade, at a statistical significance level of $p = 0.002$. When it comes to variable, *This subject is unnecessary at school* (NETK), pupils' preferences are statistically significant only between 5th-grade and 8th-grade pupils, at a statistical significance level of $p = 0.027$. Although there was a difference ($p = 0.011$), with respect to *I learned a lot during practical activities* (PVUC), post hoc tests did not show statistically significant differences in the preferences between the classes. As for the variable, *I often need help during practical activities* (PVPO), the statistical significance of the difference between the 5th-grade and 8th-grade pupils was at a statistical significance level of $p = 0.020$, and the one between the 6th-grade and 8th-grade pupils was at a statistical significance level of $p = 0.013$ were established.

With respect to gender differences in pupils' preferences (Table 5), a *t*-test revealed the existence of statistically significant differences regarding the majority of the observed variables. The exceptions are the variables (OBPO), (TESA), (RANE), (UCUD) and (BSDR), in relation to which no statistically significant differences in attitudes towards the pupils' gender are established. When it comes to the majority of the other variables, there is a difference in the pupils' preferences, with regard to gender, at the level of statistical significance $p = 0.000$. The exceptions are the variables (SATE) and (PVNE), in relation to which the statistical significance of the differences $p = 0.002$ and $p = 0.001$ are established.

Given the differences in pupils' preferences, with respect to the characteristic groups, further analysis of the research results is necessary, mainly because of the specificity of

Table 5 Results of *t*-test of the gender differences of pupils' preferences: mean of scores of female pupils ($\mathbf{M_0}$), mean of scores of male pupils ($\mathbf{M_1}$), *t*-values (**t**), statistical significance (**p**)

Monitored variables	M_0	M_1	t	*p*
The subject is interesting (ZANI)	3.118	4.087	−11.2969	.000
The subject is important and useful for everyday life (KORI)	3.655	4.102	−5.7097	.000
Theoretical contents are interesting and useful (TEKO)	3.203	3.801	−6.4574	.000
I understand theoretical contents and I can easily remember them (TEPA)	3.192	3.567	−4.3220	.000
I need more explanation and repetition in the classroom (OBPO)	3.114	3.024	0.8474	.397
I hardly follow the content of the lesson (TESA)	3.085	3.006	0.6744	.500
Content is difficult and demanding for learning (SATE)	2.661	2.342	3.1506	.002
Content is too diverse and unconnected (RANE)	2.863	2.603	2.6127	.009
I often use a tutorial for learning (UCUD)	3.477	3.506	−0.2694	.787
The textbook is understandable and easy to use (UDLA)	3.308	3.733	−4.2737	.000
This subject is unnecessary at school (NETK)	2.907	1.946	8.5667	.000
I like the practical activities I've been working on (PVSV)	4.068	4.508	−5.2101	.000
I learned a lot during practical activities (PVUC)	3.715	4.239	−5.8803	.000
I often need help with practical activities (PVPO)	2.736	2.220	5.2920	.000
Practical activities are unnecessary (PVNE)	1.915	1.607	3.3759	.001
I like 90-min lessons every other week (BSDR)	3.796	3.915	−1.0879	.277
A 90-min lessons should be every week (BSTJ)	2.580	3.045	−4.0038	.000

the identified differences. Determining the peculiarity of the differences is necessary to provide guidelines for matching the curriculum of Technical Culture to the pupils' preferences. A more detailed analysis of the differences between pupils' preferences, in cases where they are established, shows that 69.9% of the 5th-grade pupils, compared to 34.2% of the 8th-grade pupils, consider this teaching subject to be interesting. With regard to the importance and usefulness of the subject for everyday life, 8.2% of the 5th-grade pupils disagree with this, as opposed to 16.2% of the 8th-grade pupils. Theoretical contents found the subject interesting and useful for as much as 65.9% of the 5th-grade pupils, whereas only 32.4% of the 8th-grade pupils held this belief. Theoretical contents are understandable and easy to learn for 61.8% of the 5th-grade pupils, in comparison with 37.2% of the 8th-grade pupils. When it comes to the statement that the content of Technical Culture is difficult and demanding for learning, 41.5% of the 5th-grade pupils totally disagree with it, while 21.1% of the 8th-grade pupils do not. Although the textbook is understandable and easy to use for 43.4% of 5th-grade pupils, only 16.3% of the 8th-grade pupils agree with that statement. Furthermore, 64.2% of the 5th-grade pupils do not agree with the statement that Technical Culture is unnecessary at school, as opposed to 46.6% of the 8th-grade pupils. While 17.2% of pupils of the 5th grade often require help during practical activities, 33.5% of the 8th-grade pupils need such assistance.

Differences in preferences between girls and boys, established for particular variables, show that 43.4% of boys, compared to 14% of girls, totally agree with the statement that Technical Culture is an interesting teaching subject. Furthermore, 77.8% of boys and 56.8% of girls agree with the statement that the subject is important and useful for everyday life. Theoretical contents are interesting and useful for 64.4% of boys and 41.7% of girls, while 15.2% of boys and 28.2% of girls do not agree with the statement that the content is understandable and easy to learn. Moreover, 7.2% of boys and 14.4% of girls believe that the content is difficult and demanding for learning. Furthermore, 7.6% of boys totally disagree with the statement that the textbook is understandable and easy to use, as well as 14.6% of the girls who do not agree with the statement in question. Technical Culture, as a teaching subject, is considered unnecessary by 10.5% of boys and 25.8% of girls. When it comes to the practical component of the subject, 3.6% of boys and 6.3% of girls totally disagree with the statement that they like their practical activities. However, 77.9% of boys and 59.9% of girls totally agree with the statement that they have learned a lot during practical activities, while 40.5% of boys and 22% of girls totally disagree with the statement that they need help during practical activities. Moreover, 7.8% of boys and 13.7% of girls consider practical activities unnecessary. Finally, 42.1% of boys and only 23.9% of girls want 90-minute teaching every week.

The results of the research show that pupils' preferences are a complex set of indicators, but it is necessary to separate those that are common to all pupils from those that are precisely characteristic of a particular age and gender of the pupils.

Discussion

When it comes to the age of the pupils, as a characteristic of the sample, the results of the research clearly indicate the existence of statistically significant differences in the particular preferences of the pupils. Therefore, as far as some preferences are concerned, it is necessary to reject a part of the null hypothesis, assuming that preferences do not differ with respect to the age of the pupils. However, what can be clearly established are the age

differences in pupils' preferences when it comes to the following: pupils' needs for explanation and repetition of the content (OPPO), difficulties in tracking the teaching content (TESA), attitudes towards the diversity and the mismatches of contents (RANE), pupils' attitudes towards the practical activities they have performed (PVSV), attitudes towards the need for practical activities (PVNE), and the attitudes towards 90-minute teaching every 15 days (BSDR) or every week (BSTJ). Concerning these findings, it is worth pointing out that explaining and repeating the content is equally necessary for all pupils, regardless of their age.

At the same time, it should be emphasised that the difficulties in monitoring the teaching content of Technical Culture are not related to the age of the pupils but are obviously connected to other pupils' characteristics. The variety and connectivity of the teaching content is also equally acceptable or unacceptable in each class. The equal degree of agreement with the statement that pupils like practical activities, regardless of the class in which they are, suggests that such activities are essential in technology education. This was also confirmed by a high level of agreement with the statement that practical activities are needed in this subject, regardless of the age of the pupils. When it comes to the continuity of teaching (i.e. lectures every 15 days or every week), there is no significant difference in the attitudes of pupils, with respect to their age. Despite the previous findings, the results of most variables cannot confirm the assumption that pupils' preferences do not differ, with respect to their age. Very positive feedback on practical activities, reflecting students' situational interest, however, is not fully in line with individual interests, which has been indirectly examined by attitudes about difficulty monitoring and adopting content and aspirations for more frequent teaching. The reasons for this may be different, from inappropriate, maladaptive or under-challenging content, to factors that affect their beliefs outside of school.

Given the shortcomings of this curriculum, as presented in the introduction, the inability of individualised access and self-realisation of pupils will certainly not favour the development of individual interests, regardless of their positive attitude towards interactions. This is also proof of the shortcomings of the Technical Culture. The results of the research clearly indicate that the pupils' interest in the subject, the attitudes towards significance and usefulness, the attitudes towards theoretical contents, the attitudes towards requirement for learning content, the use and appropriateness of the textbooks and the need for help while conducting practical activities differ significantly, with respect to the age of the pupils. This difference is particularly noticeable when the attitudes of the pupils enrolled in the 5th, 6th, 7th and 8th grades are compared. The significantly higher proportion of the 5th-grade pupils, compared to 8th-grade pupils, thinks that Technical Culture is interesting, useful and important to their life; that theoretical contents are important, useful and undemanding; and that the textbook is appropriate and easy to use. Based on such findings, one can conclude that Technical Culture is interesting and challenging for pupils at the beginning of learning, while mature pupils gradually change this perception. All of such points to the necessity of harmonising the content and approaches to learning and teaching with the age of pupils. Likewise, pupils' preferences can substantially change with their maturation, which one should consider when developing and implementing the curriculum.

As for the gender of pupils, statistically significant differences in pupils' preferences were found in relation to the majority of observed variables. For this reason, it is also necessary to reject a part of the null hypothesis that relates to differences in preferences, with regard to the gender of the pupils. Differences were not statistically significant for the following four variables: the attitudes towards the need for explanation and repetition of contents (OBPO), attitudes towards the difficulties with the teaching contents (TESA), attitudes toward the frequency of textbook use (UCUD) and the attitudes towards 90-minute

lectures every 15 days (BSDR). Attitudes to these preferences are obviously not related to gender, but they are related to the general tendencies and actual needs of pupils. Unlike these variables, all others show significant differences between girls and boys. Thus, boys consider this teaching subject more interesting and more useful than girls, though a small proportion of pupils consider the subject to be unnecessary. Theoretical content, as well as the textbook and its use, are considered to be easy to learn and interesting by more boys than girls.

Likewise, a number of boys who believe that that they have learned a lot about practical activities and that they do not need frequent help while doing these activities is much higher than the number of girls who share the same belief. In addition, there are considerably more boys than girls who want 90-minute teaching of Technical Culture every week. From the findings presented here, it is evident that girls are striving for a different approach to the realisation of the Technical Culture teaching. Based on the structure of the girls' answers or attitudes, one should not conclude that they do not want this subject or consider this teaching unimportant. It is more likely that the existing activities and content of the Technical Culture teaching are more appropriate to boys than girls. In other words, existing content and activities included in the teaching of Technical Culture are more meaningful and significant to boys than girls. The teaching approaches that would enable pupils to exert a greater influence on the choice of activities and, thus, have more responsibility for the results and achievement of the learning outcomes will probably change girls' attitudes towards the teaching of Technical Culture.

Although the results of the research indicate that the null hypothesis should almost completely be rejected, one should consider the findings with a dose of scepticism. Namely, the research was conducted on a limited sample of pupils from select parts of Croatia. It is, therefore, necessary to carry out further research that would include a larger sample of pupils (i.e. the population of pupils from the entire territory of the Republic of Croatia), as well as other Central European countries to which Croatia culturally belongs. In addition, future research should consider other characteristics of a group, such as the urban environment in which pupils live but also particular social categories, culturally diverse groups, etc. Only by conducting such a comprehensive research will it be possible to consider the preferences of pupils towards the Technical Culture and technology education as a whole.

Conclusion

The research findings presented in this paper clearly point to the existence of statistically significant differences between pupils' preferences, with respect to both age and gender of the pupils. The study shows that classroom content and activities are important and challenging for the 5th-grade pupils, but their importance and significance decreases with maturity. It is evident that the pupils' interests in the subject, the significance and usefulness of the subject, the theoretical content, the requirement for learning, the appropriateness of the textbooks and the actual practical activities do not meet the expectations of the primary school pupils who enrolled in the higher grades. Examining pupils' preferences, with respect to gender, it is obvious that the attitudes of girls towards Technical Culture are significantly different from those of boys when it comes to the majority of the examined preferences. The girls find this subject to be less interesting and useful. According to them, the content and practical activities are more

difficult, and the textbook is inappropriate, indicating that the activities and content of Technical Culture are less significant and important to girls.

However, the findings suggest that only a negligible proportion of pupils consider Technical Culture to be an undesirable or unnecessary subject in primary school, casting a different light on the differences in preferences. As far as age differences are concerned, it is clear that the content and activities of Technical Culture should be challenging and meaningful for pupils during their development and maturation. With regard to gender differences in preferences, it was noticed that current content and activities are insufficiently tailored to girls. Therefore, pupils' preferences need to be perceived as a complex segment of Technical Culture during the structuring and planning of its teaching. In this regard, it is important to adopt a general approach to the preferences of pupils, with regard to age and gender, which suggests that pupils should be more intensively involved in the process of selecting and structuring content and activities included in the technology education, as they grow older and mature. In other words, the pupils' development and maturation should also be accompanied by the appropriate intensity of his or her co-responsibility for the process and the results of teaching.

From the point of view of operationalisation of the curriculum, this presupposes full appreciation of the human (volition) aspect of the technology (Mitcham 1994; Purković 2018), and the intensification of the contextual approaches to the technology education (Purković and Bezjak 2015). This implies the dominance of meaningful approaches to teaching, such as project-based and problem-based activities, during which pupils will practically realise their own ideas and give 'different brains' the opportunity to self-realisation. In particular, to improve the Technical Culture, these results mean that radical changes are needed, in terms of how teaching is delivered and how the role of the teacher in this process is strengthened. The implementation modalities that the education authorities should support relate to real support for the implementation of modern learning strategies, such as project activities, problem solving and pupils' exploring activities, which will allow the affirmation of different groups of pupils and encourage their shared responsibility for learning outcomes. Real support also means sufficient resources (i.e. time and material) for this subject. On the other hand, the teacher should take greater responsibility for the choice of content and activities related to the context of the pupil's life, which means that the curriculum of the Technical Culture should be more open, and that the traditionalist approach to teaching should finally abandoned. At the same time it is evident from the pupils' attitudes that Technical Culture should be more represented in the curriculum of general and compulsory education, and that those pupils who wish to further develop in technology should be offered elective programs in this field, which is currently not the case in Croatian education as a whole.

Despite such findings, it is necessary to emphasise that, given the limited sample and the separated variables, it is necessary to widen the inquiry of pupils' preferences to gain a more complete insight into the preferences for the particularities of general and compulsory technology education. Therefore, although the presented findings provide enough elements for generalisations in relation to the age and gender of the pupils, they do not provide a clear picture of the structure of the pupils' preferences in the Technical Culture. For this reason, future research of the pupils' preferences towards technology should extend to the particularities of this teaching and the expectations of students but should also consider the cultural and urban characteristics of the group and their environment.

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