TEACHERS' BELIEFS ON THE CHALLENGES TO THE SUCCESSFUL IMPLEMENTATION OF INQUIRY-BASED LEARNING IN PRIMARY SCIENCE CLASSES

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Abstract

Inquiry-based learning reflects students' involvement in acquiring new experience that enables them to change their previous concepts and offer students possibilities to direct classes. It creates the prevailing atmosphere of curiosity and questioning and formats links between cognitive and research processes. Despite the many advantages of inquiry-based learning, recent research has shown that teachers rarely include it in daily teaching practice. Among them, we can point out the inconsistency and generality of defining the concept of inquiry-based learning and the lack of guidelines for its integration into teaching, insufficiently developed competence of teachers to organize such teaching, and the extensive nature of curricula. Moreover, assessment, which is usually content-oriented, puts added pressure on teachers to cover the curriculum; thus, this is a hindering factor in implementing inquiry-based learning. This paper presents the research whose aim was to identify the challenges of implementing inquiry-based teaching in primary grade science. The survey was conducted on a sample of 365 teachers in Croatia. The results show that teachers do not see obstacles to inquiry-based teaching in students` behavior, their working habits, motivation, or discipline but emphasize the material conditions necessary for the design of inquiry-based teaching, the time it takes for its implementation, and insufficient experience in its organization. A negative correlation was found between teachers' beliefs about barriers to implementing inquiry-based learning and the frequency of their inquiry-based learning experience in formal education. Also, a negative correlation was found between teachers' attitudes about barriers to implementing inquiry-based learning and the frequency of its application in primary science classes. Teachers need to overcome the challenges and barriers mentioned above, so that inquiry learning becomes an integral part of their educational practice. It is necessary to create an appropriate receptive atmosphere among teachers, parents, students, and the whole school community towards inquiry-based learning develop a positive attitude and understanding of that approach by recognizing its multiple benefits, and creating quality teachers` professional development for its successful implementation.

Keywords: advantages and disadvantages, challenges, inquiry-based learning, primary grade science, teachers' beliefs.

1 INTRODUCTION

Contemporary teaching should be a process of active, partner acquisition of competencies in the pedagogical co-relationship between students and teachers, teaching materials, tools, and media mediation. It is expected to develop a complete person and individuals who will act effectively in various life situations [1]. Therefore, contemporary educational aspirations are directed towards introducing more flexible and creative teaching organizations, i.e., towards the student's requirement to learn by exploring. Regarding that, it is not surprising that inquiry-based learning occurs as a fundamental educational goal in different countries of the world [2, 3, 4] and that the quality of Science teaching often equates with the application of the inquiry-based approach [5]. The inquiry-based approach introduces students to activities that require them to manage the research process, which, in addition to constructing their understanding of the world, develops students' research skills and competencies of independent learning and communication. The value of such an approach is also evident in the fact that participation in inquiry-based activities stimulates natural curiosity, promotes scientific activity as an intellectual value, and supports the world's perception in a scientific way [6]. It places more responsibility for the task on students, supports individual decision-making processes, and provokes socio-scientific discussion [7].

An inquiry-based approach was developed to increase the efficiency of learning. Its essence is learning by asking questions, emphasizing the logic of scientific research, and productive thinking. After collecting data by highly organized thinking processes, connections and relationships are created between them, and rules, laws, theories, and generalizations are determined by applying mental

operations, describing, evaluating, distinguishing, assuming, analyzing, synthesizing, summarizing, and concretizing. The essence of inquiry-based learning in primary science classes is comprehending the scientific method with teachers' appropriate help [8]. The content elements that students learn are not presented in the finished form, but students should discover them independently and then include them in their cognitive circuits. It has a particularly favorable effect on developing students' competencies for lifelong learning and creativity. An essential feature of inquiry-based learning is its ability to ensure that all students achieve the set objective without a specially organized individualized approach because it includes moving every student in a specific direction. However, it does not determine only one path to the final goal but ensures that the goal is reached differently, thus enabling each individual's creative action [9].

One of the most popular and common forms of presenting inquiry-based learning is the cyclic form. The circular presentation suggests the continuity achieved by such learning and its continuous replication to ask questions. These questions are stimulated by the student's natural curiosity and represent a vital driver of the circular movement of the research process and the final stage of this process, thus creating an impetus for a new sequence of research. The specificity of the circular sequence of inquiry-based learning individual activities is its exit from the circular series of activities, i.e., applying knowledge gained in the research process in everyday life situations. However, it should be emphasized that this exit from the research continuum does not mean the interruption of the research process, but only the practical application of its products while the research process continues, driven by new questions that arise during the research. It emphasizes that inquiry-based learning is not solely a purpose in itself, but its purpose is to apply what was learned in a real-life context. The essence of inquiry-based science education is developing students' initial motivation and interest in natural sciences. The basic premise of such education is that science should be presented to students as a search and discovery process. Such education offers students a conceptual understanding of science adapted to their psychophysical development level and enables the holistic development of their personality, their ability to think critically and argue scientifically. Wenning [10] makes essential arguments in favor of inquiry-based learning concerning students' scientific literacy development. Through inquiry-based learning students: a) learn about science as a process, not just a product, b) learn to construct their knowledge base through dialogue, c) learn about science and the world around them with understanding, d) learn about science as a dynamic, cooperative and accumulative process, e) develop a scientific worldview and skepticism towards ready-made information and learn to understand scientific epistemology.

The advantages of inquiry-based learning are in its holistic focus on developing the students' entire personalities. The core inquiry-based learning includes discovering, defining, and solving questions and problems and encouraging students to be critical of the obtained solutions. The great value of this approach is in stimulating their creative activity. It also allows the students' direct insight into information and personal experiences about the world around them. By actively participating in scientific research, students can receive appropriate feedback directly from their research results. Liebig [11] talks about better knowledge transfer during inquiry-based learning, which will increase the students' intellectual potential. Wang, Haertel, and Walberg [12] show that students' success depends on connecting prior knowledge with new content, a fundamental feature of the inquiry-based approach. Such a connection contributes to the quality of the students' cognitions, which are integrated and intertwined. Thus, they do not form a series of unrelated facts, as usually happens in traditional approaches to learning where greater importance is given to quantity, not the quality of acquired knowledge.

A significant advantage of inquiry-based learning is students' ability to make decisions independently during their research activities. In everyday life, children rarely have the opportunity to make crucial decisions. Inquiry-based learning will provide students with an experience that will enable them to cope with specific life situations when they become active participants in human society. Inquiry-based learning will enable students to set hypotheses about the relationships of different objects interestingly and dynamically, and it will increase their motivation and interest in the subject, develop the ability of abstraction and inductive reasoning, develop students' vision, their independence in experiential learning and enable the horizontal and vertical integration of knowledge.

Despite the many advantages of inquiry-based learning, several fundamental reasons can be found in the literature that hinders its implementation in primary science classes. Among them, we can point out the inconsistency and generality of defining the concept of inquiry-based learning and the lack of guidelines for its integration into teaching [13], insufficiently developed competence of teachers to organize such teaching [14] and the extensive nature of curricula [15]. Haagen-Schützenhöfer and Joham [16] considered that teachers` interpretation of the idea of inquiry-based learning has a strong

influence on how they implement it in the classroom. Also, Walan and Rundgren [17] point out that teachers' self-efficacy is related to inquiry-based science education.

In scientific studies, we can observe various attempts to define inquiry-based learning [18, 19]. Some authors define it as an active learning strategy using practical work [20], while others define it as open research that includes generating student questions, designing a method to answer a question, conducting research, answering questions, and drawing conclusions [21]. In most studies, three stages in the implementation of inquiry-based learning have been highlighted: structured inquiry, guided inquiry, and open inquiry. However, apart from listing the many benefits of exploratory learning, most of its definitions are so general that they do not provide enough information to the teacher to organize inquiry-based learning. The fact is that no educational document offers a clear explanation for the transformation of traditional science teaching into inquiry-based teaching, which is why teachers often give up on applying this teaching strategy. Instead, we come across general frameworks and examples of inquiry-based teaching, so general that each teacher can form their understanding of inquiry, which is not sufficient for its quality application in education. Without appropriate and more specific guidelines, it is impossible to expect teachers to apply inquiry-based teaching only because its application is recommended in educational documents [4, 22].

Crawford [23] and Garet, Porter, Desimone, Birman, and Yoon [24] point out the critical role of teachers in implementation inquiry-based learning [25, 26, 4]. Many teachers are still not sufficiently trained to implement that kind of learning, indicating the need to design a professional development program for teachers that will enable them to integrate it into science teaching successfully. The last obstacle to the implementation of inquiry-based learning encountered by teachers relates to the extensiveness of the curricula on the one hand and the time complexity of inquiry-based learning on the other, which is why the predicted learning outcomes cannot be thoroughly and deeply achieved through an inquiry-based approach. Moreover, assessment, which is usually content-oriented, puts added pressure on teachers to cover the curriculum. Thus this is a hindering factor for implementing inquiry-based learning [27]. Many students in the classroom are also an obstacle to inquiry-based learning because, in such conditions, the teacher cannot provide individual assistance and assistance to small groups in developing their research skills [18]. Instead, teachers turn to the traditional, frontal teaching and the transfer of ready-made information, which is much more effective and enables the realization of the curriculum content in a given time.

Costenson and Lawson [28] interviewed twelve experienced science teachers and compiled a list of reasons for avoiding inquiry-based learning in science education: a) time and energy - teachers spend too much time preparing material and students spend too much time in independent activities; b) slowness of inquiry-based teaching and the necessity to realize the planned content of the curriculum, c) the study of professional and scientific sources dealing with research is too demanding and too complicated for teachers d) too much risk - teachers think that in this way they risk, or they are not sure whether such a teaching strategy will lead to the desired student's achievement e) student immaturity - teachers think that students spend a lot of time on research and do not learn enough f) teaching habits - teachers who have been teaching science for a long time consider inquiry-based teaching too complicated for their own application d) discomfort - teachers feel uncomfortable while applying inquiry-based teaching because they have less control over the teaching process and students, h) cost - teachers think that the supplies and materials needed for inquiry-based teaching are too expensive. Most of these challenges confirm Kinyota [29] in the context of science teaching in Tanzania. Adiguna and Sutapa [30] identified five challenges faced by the inquiry-based learning method: it requires higher motivation from students, a higher level of accuracy and attention, require knowledge of science content, and the management of complex activities, and must be in accordance with the resources and schedules available.

In Staer, Goodrum, and Hackling's [31] research, the time and material for inquiry-based learning are listed to be the most significant obstacle to its application in educational practice. Similarly, Shao [32] reports that educators reported the lack of financial support and implementation guidance for inquiry-based learning, and therefore most of them continued their traditional teaching method. Trowbridge and Bybee [33], in addition to the obstacles already mentioned, state the lack of experiential participation of teachers in inquiry-based learning during their formal personal education, the rejection of research as the goal of science teaching by most teachers, and the opinion of many teachers that such an approach is appropriate only for gifted students, and particularly unsuitable for students with learning difficulties.

Wenning's research [10] emphasizes the need to create an affirmative atmosphere towards inquiry-based learning among students, parents, and teachers before its introduction in teaching to successfully implement this form of learning in teaching practice. Namely, it turned out that all three groups often

show resistance to the application of inquiry-based learning, which arises from their habit of traditional teaching. Student resistance occurs, especially if they perceive the inquiry-based approach to endanger their previous grade in a particular subject. Namely, inquiry-based learning requires the active mental participation of students. It is more demanding in terms of their engagement in acquiring new knowledge than traditional teaching, which students may experience as an additional burden if they are accustomed to teachers who provide them with ready-made facts and evidence. Since they are always expected to reproduce exactly what the teacher has said in traditional teaching, many feel afraid to express their assumptions and observations or participate in a heuristic conversation, thinking they will say something wrong. Parental resistance to this teaching method occurs most often after students complain about a new approach to teaching. Based on this, parents begin to worry about whether such an approach will have a negative impact on children's knowledge, success on external evaluation tests, and schooling at higher levels. They also express concern that the textbook is used less or not, relying primarily on experiences from their schooling, which were most often marked by the traditional teaching approach and the textbook as the only source of new knowledge. However, once parents are aware of this approach's benefits, resistance and concern on their part soon diminishes and eventually disappears. Resistance to this approach often occurs among teachers, supporters of traditional teaching, who are usually insufficiently and inadequately trained to organize inquiry-based teaching, which makes them uncomfortable in its application. Based on this data, Wenning [10] concludes that it is first necessary to develop a positive attitude and understand an approach recognizing its multiple benefits. Teachers should not introduce this approach suddenly and react after resisting and creating unwanted prejudices against it. The same author suggests that teachers first need to introduce the differences between traditional and inquiry-based approaches in teaching, the changed teachers' and students' roles in it, and the students' responsibility and activity in solving problems or the value that comes from acquiring knowledge based on personal experience. In this way, an appropriate classroom atmosphere will be created for the joyful acceptance of this way of learning.

In this paper, the mentioned findings on barriers and challenges of inquiry-based teaching, considered by teachers to be interfering factors in its implementation in primary science, are expanded, and a study was conducted to determine the correlation of their beliefs on challenges for inquiry-based learning and their experiences of inquiry-based learning in formal education. The correlation analysis also sought to determine whether teachers who consider barriers to its implementation permanently present are less likely to use such teaching forms.

2 METHODOLOGY

This research aimed to determine teachers' beliefs on the challenges to implementing inquiry-based learning in primary science classes. Based on the defined objective, the following research problems have been set:

1 What beliefs do teachers have about challenges to conducting inquiry-based learning in primary science classes?

2 Is there a correlation between teachers' beliefs on the challenges to implementing inquiry-based learning and the frequency of their inquiry-based learning experience in their formal education?

3 Is there a correlation between teachers' beliefs on the challenges to implementing inquiry-based learning and the frequency of its application in their teaching practice?

The sample of this research consists of 365 primary school teachers from Croatia. Most respondents have a bachelor's degree (53%), while others have a university degree (47%). Concerning work experience, the sample includes the least number of teachers with work experience from 11 to 15 years (10%) and those with work experience from 6 to 10 years (11%), followed by 11 to 15 years (10%) and from 16 to 20 years (23%), while the most represented are teachers with over 20 years of service (43%). Teachers teaching the first (24%), second (26%), third (24%), and fourth grade (26%) are equally represented in the sample. All teachers voluntarily agreed to participate in this research, approved by the school's ethics committee. The survey was anonymous, while participants could withdraw from responding to the questionnaire at any time and opt out of the survey.

A specially designed questionnaire was used to determine the teachers` beliefs about challenges to implementing inquiry-based learning. It was made on Ibrahim's instrument to measure teachers' beliefs and experiences on inquiry-based learning [34]. It encompasses various aspects of inquiry-based learning and is based on previous research [28, 35, 36, 26]. For this research, the questionnaire items were adapted to the specific characteristics of the school subject Science and Social studies in Croatia

in the first educational cycle. It consisted of three subscales that determined teachers` experiences of inquiry-based learning in their formal personal education (30 items), frequency of using inquiry-based teaching in primary science classes (30 items), and their beliefs about challenges to its implementation in teaching practice (27 items). The frequency of teachers` experience of inquiry-based learning during their formal education and its use in the current teaching practice was assessed on a Likert-type scale from 1 (never) to 5 (always), while teachers` beliefs were assessed on the same scale from 1 (totally disagree) to 5 (totally agree).

To analyze and apply the results obtained by this research, they were processed qualitatively and quantitatively. In the statistical analysis of the data, we used the statistical software package SPSS (Statistical Package for Social Sciences). Descriptive parameters, such as arithmetic mean, standard deviation, minimum and maximum values, and distribution of results expressed in frequencies, were used to determine individual particles and scales' descriptive indicators. The reliability of the instrument was checked by calculating the Cronbach α coefficient, and it was determined that the reliability of used scales of internal consistency type is satisfactory or high for all used scales (from 0.87 - 0.93), which suggests that all particles in the subscales correspond highly to measure the examined concepts. It can be used in further analyses and research as reliable measures of the examined concepts.

3 RESULTS

Descriptive parameters of teachers` beliefs about challenges to the implementation of inquiry-based learning are shown in Table 1.

Table1. Descriptive parameters of particles used to measure teachers' beliefs about challenges to conducting inquiry-based learning in primary science classes.

Items	*M*	*SD*
Time challenges		
Lack of time in the school class.	3.90	0.93
Lack of time in the school day.	3.56	1.05
Insufficient time for adequate preparation of inquiry-based teaching.	3.47	1.05
Difficulties in covering the curriculum in the available time (excessiveness of the primary science curriculum).	3.58	1.07
Total	**3.63**	**1.03**
Organizational barriers		
The complexity of the inquiry-based teaching organization.	3.79	0.90
Class - subject system that dominates in our schools.	3.82	0.83
Lack of textbook materials.	3.43	1.01
Costs for the material needed to perform experiments.	4.30	0.81
Lack of appropriate equipment needed to perform experiments in classrooms.	4.46	0.78
Lack of topics suitable for inquiry-based learning in the primary Science curriculum.	2.97	1.08
Total	**3.80**	**0.90**
Student characteristics and competencies		
Student (i)maturity.	2.71	0.99
Poor students' working attitudes to conducting research.	2.48	0.99
Difficulties in motivating students to conduct research.	2.29	0.96
Difficulties in establishing appropriate student discipline.	2.41	1.05
Inadequacy of inquiry-based teaching for students with learning difficulties.	2.89	1.04
Inadequacy of the inquiry-based approach in teaching for all students (all ages of students and all education levels).	2.91	0.95
Difficulties that arise from the assessment of student's achievement in inquiry-based learning.	3.20	0.98
Total	**2.70**	**0.99**

Teacher competencies		
Inadequate training of teachers for the application of inquiry-based primary Science teaching during formal teacher education.	3.56	1.01
Lack of clear guidelines for teachers to conduct inquiry-based primary Science classes.	3.58	0.95
The simplicity of application of lecture-based teaching in relation to inquiry-based teaching.	3.50	0.92
Insufficient teachers` self-confidence for the implementation of inquiry-based teaching.	3.01	1.03
Teachers' skills to conduct inquiry-based primary Science classes.	2.89	0.94
Total	**3.24**	**0.97**
Lack of support for the implementation of IBL		
Lack of support for the professional development of teachers on the topic of inquiry-based primary Science teaching.	3.66	0.97
Lack of parental support.	3.21	1.00
Lack of support from the headmaster.	2.74	0.96
Lack of educational policy support in the implementation of inquiry-based teaching.	3.40	0.97
Lack of literature on inquiry-based teaching, which can help teachers in their self-education for this teaching strategy.	3.53	0.97
Total	**2.67**	**0.97**

Table 1 shows that the highest arithmetic mean value is presented in the organizational (M = 3.80) assessment and the time challenges to implementing inquiry-based learning (M = 3.63). The lowest value is observed in the assessment of support for implementing inquiry-based learning (M = 2.67) and students` competencies as a barrier to its application in everyday teaching practice (M = 2.70). The presentation of descriptive parameters of individual particles used to assess challenges to conducting inquiry-based learning shows that teachers generally agree or do not have an expressed opinion (neither agree nor disagree) on challenges to conducting inquiry-based learning (M = 2.29 - 4.46). Items which have the largest arithmetic mean are lack of appropriate equipment needed to perform experiments (M = 4.46; SD = 0.78), cost of material needed to perform experiments (M = 4.30; SD = 0.81) and lack of time per school hour (M = 3.90; SD = 0.93). These items emphasize the material conditions necessary for the organization of inquiry-based learning in primary science classes and the time required for its implementation in teaching practice. Since teachers assessed the material conditions for conducting experiments as the biggest challenge to conducting inquiry-based learning, we could conclude that teachers are not instructed about the possibility of conducting experiments with minimal material costs or using common subjects from our everyday environment without special material investments. In primary science, many experiments are feasible without "professional" chemical equipment and supplies. This fact should also be accounted for among teachers.

Furthermore, teachers cite lack of time in the classroom as a significant challenge to conducting inquiry-based learning. It shows that teachers know that it takes slightly more time to conduct quality inquiry-based learning than a traditional 45-minute lesson. However, from the above data, we could also conclude that teachers are still burdened with the duration of the lesson in 45 minutes and do not use the possibilities of flexible organization of teaching (which classroom teaching in the first educational cycle allows).

The lowest arithmetic mean occurs on items students' poor working attitudes to conducting research (M = 2.48; SD = 0.99), difficulties in motivating students to perform research (M = 2.29; SD = 0.96) and difficulties in establishing appropriate students` discipline (M = 2.41; with greater dispersion of SD responses = 1.05). Based on these items' value of arithmetic means, it can be concluded that teachers do not see barriers in conducting inquiry-based learning in students' work habits, motivation, or discipline. Such an assessment is in some way expected because scientific studies have shown that children show great interest in inquiry-based learning, happily accept it, and actively participate in it. Most of the remaining items in this part of the questionnaire were assessed "neutrally" (neither agree nor disagree), from which we can conclude that most teachers do not have a positive or negative attitude about these challenges. The reasons for their "indeterminacy" could be interpreted in several ways. First, teachers do not conduct inquiry-based learning, and therefore cannot effectively assess possible challenges to conducting it. Secondly, teachers are not sufficiently informed about inquiry-based learning, and therefore cannot assess challenges for its realization and thirdly, teachers do not have an attitude on inquiry-based learning because they are not interested in such a form of teaching.

In general, if data indicating negative teachers` beliefs about barriers to the organization of inquiry-based teaching were obtained, it could be assumed that there are no barriers and that in such a case, the organization of this form of teaching will be more frequent. On the other hand, positive beliefs about barriers could lead us to conclude that teachers are more oriented towards traditional teaching due to the numerous barriers they see. However, given the obtained results, the respondents' orientation towards inquiry-based, i.e., traditional learning, cannot be determined because their views on challenges are largely undetermined. The results of this study are confirmed by the previous theoretical considerations of some challenges of inquiry-based learning. Among all the challenges, the time aspect of inquiry-based learning is most often mentioned. The implementation of inquiry-based learning requires more time and teachers` extensive preparation. Excessive time spent to reveal what has already been discovered is also criticized by Liebig [11]. Due to the lack of time for conducting inquiry-based learning and the fear of not achieving educational achievements, many teachers resort to frontal teaching, traditionally the fastest way to convey information to all students. However, such information transfer does not guarantee a successful learning process. There is also the problem of a large number of students in the classroom, which is an aggravating circumstance for implementing inquiry-based learning. Poor material conditions and insufficient classroom equipment for students` research work are barriers to its implementation. As schools usually do not have sufficient material support for inquiry-based teaching, teachers express this as the main reason for giving up its implementation very often, as is confirmed by this study.

The complex process of planning inquiry-based learning requires appropriate teachers' professional competencies [37]. Only a teacher who has the appropriate theoretical knowledge about the specific features of inquiry-based learning and developed pedagogical-didactic-methodical competencies for its implementation in the teaching practice will realize it in a quality way and thus achieve all the benefits of such learning. Teachers have adequate knowledge about inquiry-based learning, but despite this, there is a worrying discrepancy between theoretical knowledge and teachers` willingness to apply it in practice. It would be worthwhile to investigate the reason for such a situation in more detail. Although teachers recognize the benefits and quality of inquiry-based learning, it is rarely or occasionally applied. Therefore, they often resort to traditional forms of teaching in which they participated during their formal education because they feel competent for it [38, 12]. In this research, teachers were indecisive in determining teacher competencies as a challenge to implementing inquiry-based learning, and neither agreed nor disagreed that this was a significant factor affecting its implementation. It could also be argued here that in this part of the questionnaire, teachers gave neutral answers to avoid determining teacher competencies as the main barrier to the application of inquiry-based learning. In this study, teachers also assessed challenges such as student competencies and support for implementing inquiry-based learning neutrally, although, in previous research, there has been much talk about such challenges. For example, Millar [39] cites three fundamental shortcomings of the inquiry-based approach in teaching related to students' ability to do research: 1) students sometimes, due to their inexperience, the quality of the equipment they use when experimenting, or the limited time available to them, have insufficiently accurate observations and measurements which result in data that are inconsistent with the conclusions which the students needed to understand; 2) it may happen that despite the quality data collected during the research, students cannot draw appropriate conclusions from them because ideas and explanations do not simply come from the data but imagination and creativity are needed to form conclusions, and 3) students know that teachers know the solution of the posed problem and therefore often ask teachers to confirm their assumptions and the accuracy of the data obtained by the research ahead of time.

Table 2. Descriptive parameters of subscales for estimating the frequency of participation in inquiry-based learning during their formal education and the frequency of application of inquiry-based learning.

Subscales	***M***	***SD***
Frequency of participation in inquiry-based learning during formal education	2.96	0.94
Frequency of application of inquiry-based learning in primary science classes	3.46	0.83
Beliefs about challenges to the implementation of inquiry-based learning	3.21	0.81

As shown in Table 2, teachers assessed the frequency of applying inquiry-based learning with the highest value of the arithmetic mean (they apply it sometimes (1-2 times a month). The frequency of participation in inquiry-based learning during their formal education was assessed as occasional, while they have a vague (neither positive nor negative) opinion on the challenges to conducting inquiry-based

learning. A correlation between the mentioned variables was examined by calculating the Pearsons` correlation coefficient between the mentioned subscales. A negative correlation was found between teachers' beliefs about challenges to implementing inquiry-based learning and the frequency of their inquiry-based learning experience in formal education ($r = - 0.57$, $p < 0.01$). That means that teachers who positively assess the existence of barriers to inquiry-based learning (and are thus presumably more inclined to traditional teaching) had rare inquiry-based learning experiences during their formal education.

On the other hand, a negative correlation was found between teachers' attitudes about challenges to implementing inquiry-based learning and the frequency of its application in primary science classes ($r = -0.39$; $p < 0.01$). Teachers who have more negative beliefs towards the existence of barriers to conducting inquiry-based learning (i.e., consider that these barriers are not relevant for its implementation) apply such teaching strategy in their practice more often. These results indicate the importance of teachers' experience in the field of inquiry-based learning and lead to the conclusion that there is a need to organize such forms of professional development which will enable teachers to participate in research activities, not just forms of training aimed at developing their theoretical knowledge about inquiry-based learning. The assumption was also confirmed that teachers who have negative beliefs about the existence of challenges, i.e., who do not see them as a potential hindrance to inquiry-based learning, are more prone to inquiry-based learning and implement it more often in their teaching practice.

4 CONCLUSIONS

Teachers do not see barriers to inquiry-based learning in students' work habits, motivation, or discipline. They emphasize the material conditions necessary for designing inquiry-based learning, the time required for its implementation and insufficient experience in its organization as challenges for its implementation. Teachers' beliefs towards challenges to implementing inquiry-based learning are negatively correlated with its application frequency and their experience of inquiry-based learning acquired during formal education. It leads to the conclusion that there is a need for more comprehensive support to teachers, which will include more specific guidelines, examples, and models on how they can apply the inquiry-based approach in teaching primary science in which they will try and experience inquiry-based learning themselves, before trying to implement it in their teaching practice [18]. Given the circumstances, current teacher professional development models need to be re-examined in light of the factors mentioned above. However, professional development does not exist in a vacuum. As Johnson [40] found, even when a high-quality professional learning experience is provided, there are still many technical, political, and cultural barriers to implementation. These barriers include large class sizes, limited resources, space, and administrative burdens within the school context. These are not uncommon barriers identified in such studies [41]. The current educational environment in which there is not enough time or resources to implement the inquiry-based approach is not suitable for conducting sophisticated research with all its specifics and laws. However, despite the identified challenges and the complexity of inquiry-based learning, its advantages and benefits are numerous and can overcome the mentioned disadvantages.

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