A Research on the Application of Modern Information Technologies in Teaching

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Abstract **– This paper examines the use of modern information technologies in Bulgarian pre-school and primary education, focusing on teachers' knowledge and use of technologies and the challenges they face. The study is based on an extensive literature review, which highlights the potential of modern information technologies such as programmable devices, virtual reality (VR) and augmented reality (AR) to improve the quality of education, student engagement and continuous learning. However, the research also identifies persistent barriers to their implementation, including insufficient resources, limited training opportunities and teacher resistance to technological change. The main objective of the study is to assess the level of knowledge and use of technologies among Bulgarian teachers, with a focus on identifying the main barriers to their effective integration into educational practice. The preliminary hypothesis suggests that despite the recognition of the potential benefits of technologies, their use remains limited due to institutional and personal factors. Methodologically, the study used a descriptive survey approach with 205 participants, including pre-school and primary school teachers, principals and education administrators. Data was collected using an online survey platform included in Microsoft Office 365. Key findings show varying levels of knowledge and use of modern technologies among teachers.**

Although a significant proportion of respondents use technology in their teaching, the level of adoption of more advanced technologies such as programmable devices, VR and AR is significantly lower. Teachers expressed a strong desire for additional information and training on modern technologies, highlighting their potential to enrich learning experiences in a variety of subjects. The study has important implications for the Bulgarian education system. It highlights the gap between the recognised potential of technologies and their practical application in the classroom. Addressing the identified barriers through targeted investment in resources, comprehensive professional development programmes and ongoing support for teachers is crucial. By overcoming these barriers, educational institutions can better prepare students for the challenges of the digital age, improve learning outcomes and create a more dynamic and effective educational environment.

Keywords **– Modern technologies, information technologies, educational technologies.**

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1. Introduction

The development of new informational technologies in education, supported by innovative methods and contemporary technological equipment, is the key to high-quality training of future school professionals [1].

It may be considered that innovative technologies in teacher training are aimed at creating purposeful changes, which are aimed at moving educational systems from one state to another [2]. At the same time, the effective use of interactive teaching methods is impossible without the use of appropriate information technologies and software [3].

The system of education, even with the obvious need for greater application of modern learning technologies, acts as a stimulus for the informatisation of society. It serves as an effective tool for developing the informational culture of the people and for training a new generation of professionals [4]. Educational technological progress creates new challenges for education to meet the changing needs of the world of work and to provide access and quality education in a more agile way.

New approaches and technologies exploit distance and blended learning and strengthen the role of open universities in widening access to higher education. E-learning is seen as one of the effective tools to increase the availability and flexibility of continuous professional development and lifelong learning [5].

Education today requires a deep understanding of the digital context. Digital literacy allows educators to improve the quality of teaching and ensure that the learning outcomes stay relevant [6]. The new digital reality is transforming the educational system - the role of teachers and parents in the educational process is changing, there is a need to explore new disciplines, mainly related to IT technologies [7].

In modern society, education, mainly as a result of the introduction of more modern and advanced information and communication technologies in the digital learning environment, is gradually becoming a continuous process that takes place throughout a person's life, providing an opportunity to update and enrich knowledge, skills, and abilities according to personal and social needs [8]. Understanding the basics of information processing using new technologies is considered a fundamental aspect of digital literacy in today's reality [7]. Teachers' lack of understanding of the importance of technology for teaching and learning is one of the secondary barriers to the integration of educational technologies. Therefore, it is crucial that teachers are familiar with modern educational technologies and the benefits of using them in the classroom [9].

The implementation process may be disruptive, annoying, and require a lot of time and effort for some teachers, yet technologies can ultimately 'open doors' to new experiences, discoveries, ways of learning, and collaboration between students and teachers [10]. The findings of the study conducted by Ohei *et al*. [9] show that most South African teachers have a negative attitude towards the use of modern technology in education. In Europe, time devoted towards innovative technologies is expected to increase by 20%, while time allocated to basic technological skills is expected to increase by 65% [11].

Summarising all the above, it is important to note that the development of informatisation, under the strong influence of various information and communication technologies, has served as the basis for a new wave of industrial revolution around the world, called 'digitalisation', which has been given a new impetus by the introduction of various types of digital resources and technologies in the modern educational environment [8].

However, modern information and communication technologies have made it possible to not only connect teachers and students in the educational process in an online format, but also to enhance this communication process by offering educators various opportunities for technological improvement of specific training courses, as well as expanding the technical possibilities of educational platforms [5].

Technology-enhanced learning enables the integration of the curriculum with students' cultural experiences and needs, and contributes significantly to the development of independent lifelong learners equipped with the knowledge and abilities required to thrive in today's fast-evolving world [12].

Other benefits of innovative technologies include: enabling students to acquire solid and comprehensible knowledge, developing independence in learning activities, increasing the time available for the delivery of learning material in the classroom, creating a positive emotional climate, no fear of wrong answers, a sense of confidence, increasing the culture of communication, increasing motivation to continue learning, increasing students' self-esteem, eliminating psychological stress, reducing tension among students, and enabling learners to achieve at a higher level [10].

By reaching the student's heart and mind with modern technology, learning becomes more successful. This can be achieved through the use of advanced technologies that are eye-catching, user-friendly, and flexible. Their integration leads to better comprehension and teamwork, as well as getting students interested in learning and keeping their attention [13].

Technology ensures high standard training and increases the competitiveness of professionals, improves the process of continuing education and makes learning more affordable and efficient. They also play a vital role in preparing the younger generation for life in the information age society. Technology provides numerous tools and methods that can enhance the standard of learning practices [1].

Teachers can be more flexible if they can work with modern technologies. This can increase student interest. Providing challenging learning experiences keeps students interested [13].

In addition, the use of modern technology in the classroom helps prepare students for challenging scenarios they may face in the future. It also improves communication between students, teachers, and other adults [9]. It allows students to become more active participants in the educational process and teachers to develop new approaches, methods, and models of teaching and education [10].

The widespread adoption of technologies has facilitated the optimization of many educational aspects, but their further development is a major obstacle [2].

2. Implementation of the Study

205 teachers and principals took part in the survey that is the subject of this paper. It was conducted online using the forms that are part of the Microsoft Office 365 package.

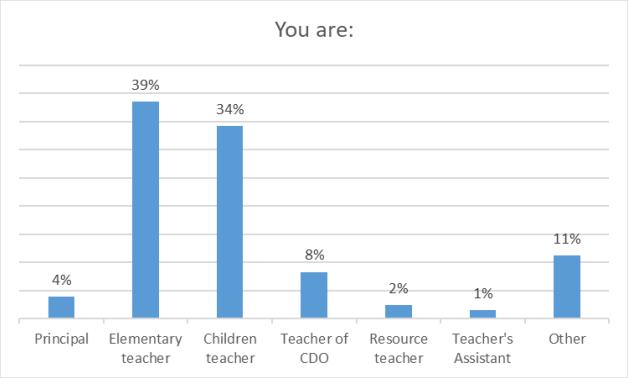

Figure 1. Position of respondents

Figure 1 shows the distribution of respondents regarding the position they hold. Of interest for the study are mainly children and primary school teachers, and due to this fact their participation is the most represented (39% and 34% respectively). In addition, there are also respondents from principals, tutors, resource teachers, and subject teachers.

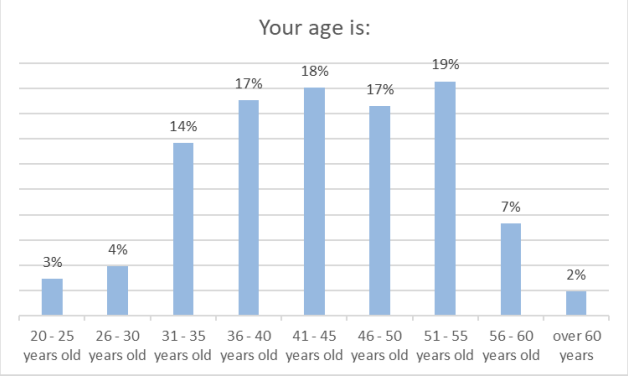

Figure 2. Respondents' age

Figure 2 visualizes the age distribution of participants. Deliberately, to provide a better overview, the age ranges are relatively small. In general, respondents between 31 and 55 years of age are predominant. There are also representatives of recent graduates as well as of colleges in pre-retirement age.

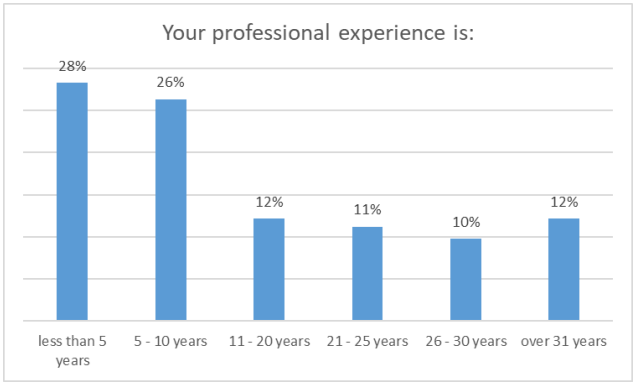

Figure 3. Professional experience of respondents

Half of the participants have less than 10 years of professional experience, which suggests that there should be a large number of people who know and apply modern information educational technologies. Respondents with experience between 11-20, 21-25, 26-30, and over 31 years had almost equal shares, between 10 and 12 percent.

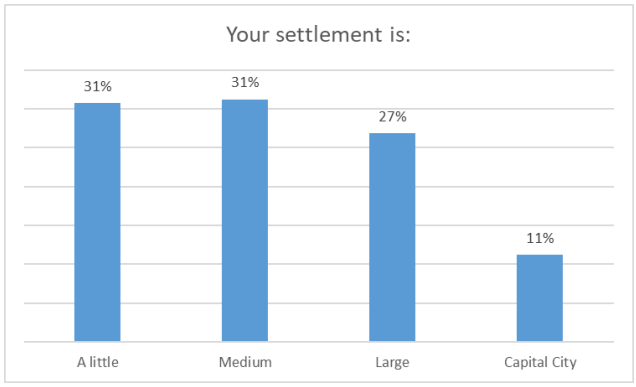

Figure 4. Type of settlement of respondents

The next important characteristic of the participants was the place where they teach. It can be seen that if the large locations and the national capital added-up, an almost equal distribution between small and medium-sized locations are obtained. This speaks well for the credibility of the survey carried out.

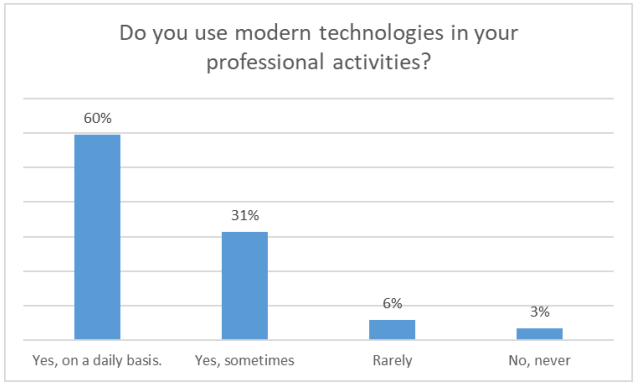

Figure 5. Answers of the question "Do you use modern technologies in your professional activities?"

Having established the demographic characteristics of the participants, the focus turns to questions directly related to the research problem. The first question in this category was dedicated to the use of modern technologies in teachers' professional activities. Here, the majority of respondents indicated that they use technology in their teaching - 60% daily, 31% only sometimes. Only 3% of teachers never use technology. Although this percentage is small, it is surprising because after the pandemic, it is expected that there will no longer be teachers who do not use any technology in their teaching.

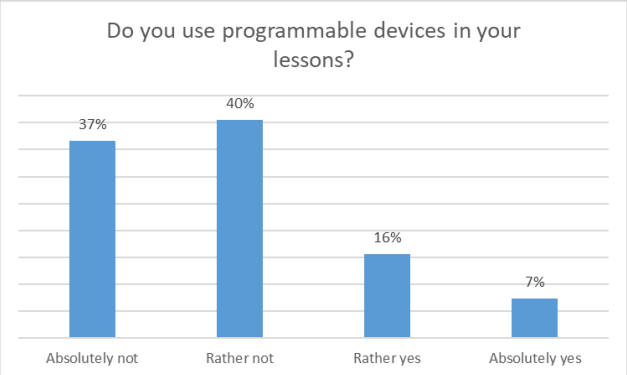

Figure 6. Answers of the question "Do you use programmable devices in your lessons?"

When asked if they use programmable devices in their classes, the results are quite different. Here, only 7% of teachers say they definitely use them, followed by 16% who say they probably use them. This result is extremely worrying, given the range of opportunities this application offers for the much-needed development of students' thinking skills.

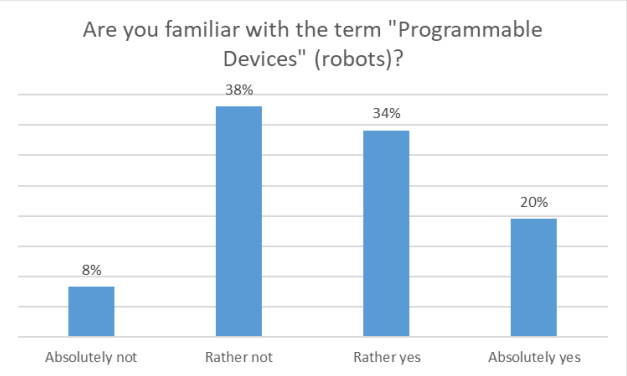

Figure 7. Answers of the question "Are you familiar with the term "Programmable devices?"

When it comes to familiarity with programmable devices, respondents are almost evenly divided. Half of them (54%) said they were very familiar (20%) and somewhat familiar (34%). This gives us at least some hope for the possible future use of this type of technology by teachers.

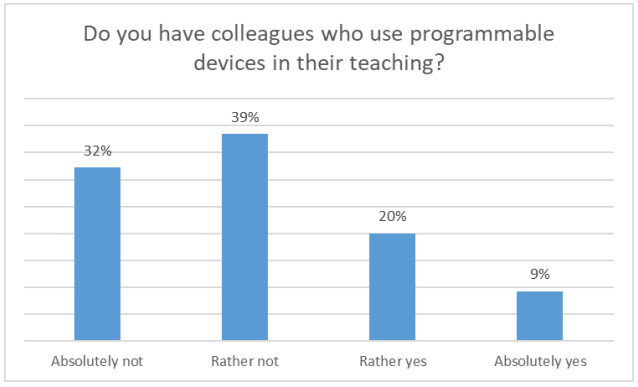

Figure 8. Answers of the question "Do you have colleagues who use programmable devices in their teaching?"

Figure 8 shows the percentage distribution of participants who are aware of teachers/colleagues who use some type of programmable device in their teaching. Only 9% responded with a strong yes, followed by 20% with a more likely yes. The significant percentage of teachers answering in the negative confirms the results already obtained in the previous question, indicating the low number of teachers using this type of modern technological solutions.

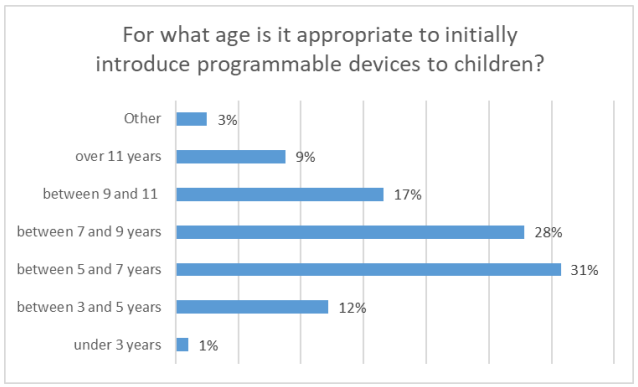

Figure 9. Answers of the question "For what age is it appropriate to initially introduce programmable devices to children?"

The interest of the authors is on respondents' views on the age at which it is appropriate for children to start using programmable devices. The highest percentage was between 5 and 7 years (31%), followed by between 7 and 9 years (28%). Only 9% of respondents said that the appropriate age for introducing such technologies was over 11 years.

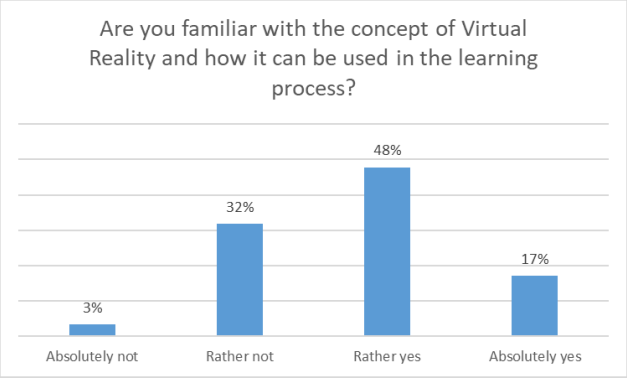

Figure 10. Answers of the question "Are you familiar with the concept of Virtual reality and how it can be used in the learning process?"

Surprisingly, a higher percentage of teachers are familiar with the use of virtual reality in education - a total of 65% responded positively. Only 3 per cent of respondents were definitely unaware of the possibilities of using this type of technology in the educational process.

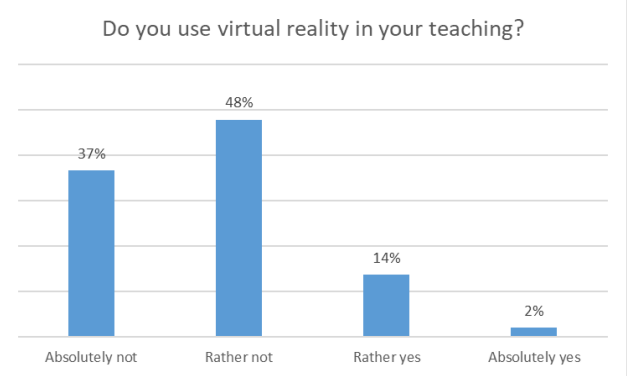

Figure 11. Answers of the question "Do you use virtual reality in your teaching?"

Despite the high percentage of respondents who were aware of the potential for using virtual reality in education, only 2 per cent of respondents said they would definitely use this type of technology, followed by 14 per cent who were less confident and said they would probably use it. The high number of teachers not using this technology can be attributed to three main reasons: the still high cost of purchasing virtual reality glasses, the lack of developed ideas for integrating these technologies into the curriculum and, the still growing digital competence of teachers.

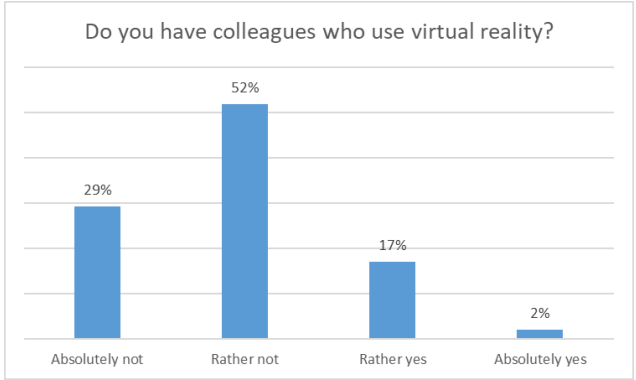

Figure 12. Answers of the question "Do you have colleagues who use virtual reality?"

When asked about the use of virtual reality by colleagues, 2 per cent of respondents again answered "strongly yes", followed by 17 per cent who chose the "more likely yes" option. These results confirm the previous conclusion about the low level of use of virtual reality in the Bulgarian education system.

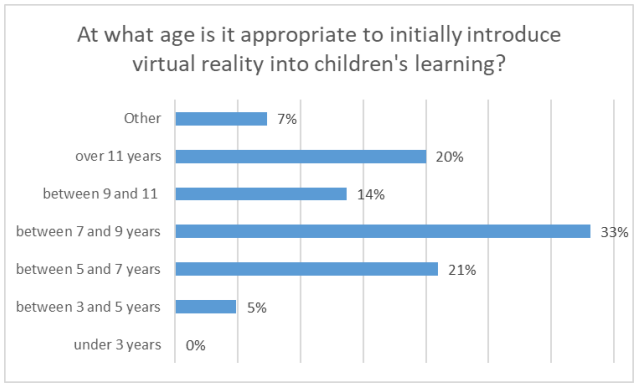

Figure 13. Answers of the question "At what age is it appropriate to initially introduce virtual reality into children's learning?"

A third of respondents indicated that the most appropriate age for the introduction of virtual reality would be between 7 and 9 years. It is quite logical to indicate a limit slightly higher than that indicated for the introduction of programmable devices, given the specificities of the technology of virtual reality applications.

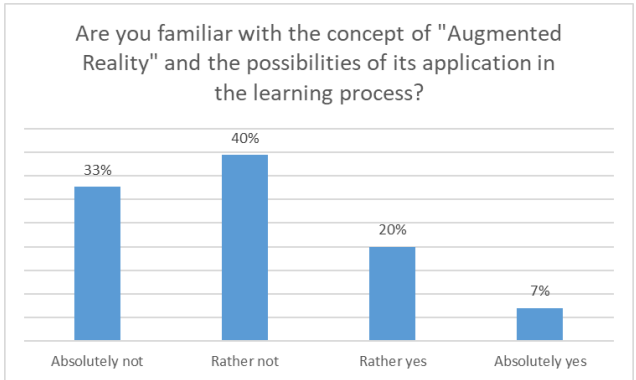

Figure 14. Answers of the question "Are you familiar with the concept of Augmented reality and the possibilities of its application in the learning process?"

Following virtual reality, the next question is about respondents' familiarity with augmented reality and its applicability in the learning process. Here a total of 27% of teachers are familiar with it and answer affirmative. This significant difference between familiarity with virtual reality and augmented reality is interesting. A possible reason for this could be the low number of software products using augmented reality on the Bulgarian market.

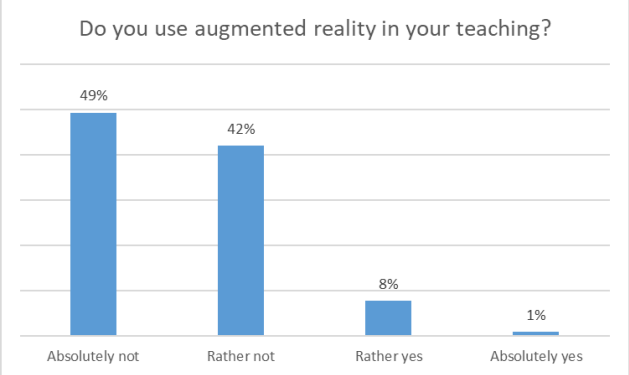

Figure 15. Answers of the question "Do you use augmented reality in your teaching?"

Considering the results obtained so far, the following distribution of teachers using augmented reality (only 9%) seems quite logical. This result indicates the need for serious development of ideas for the application of augmented reality in Bulgarian education, given the positive aspects of this technology and its possibilities for illustrating the learning process and motivating children to participate in it.

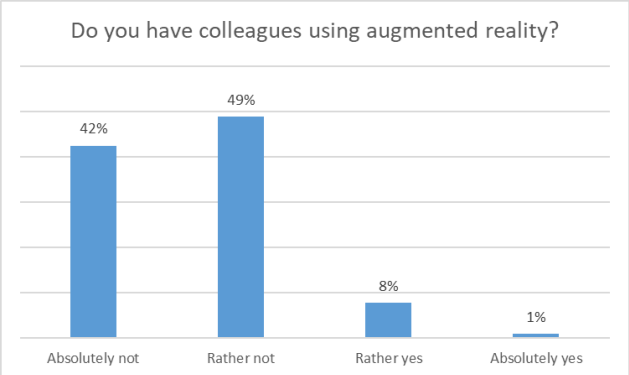

Figure 16. Answers of the question "Do you have colleagues using augmented reality?"

Figure 16 shows the results obtained for the question dedicated to the awareness of colleagues using augmented reality. Here the distribution is almost identical, with a slight exchange in the answers strongly no and rather no. It confirms the conclusions already drawn about the need to promote this type of technology among Bulgarian teachers.

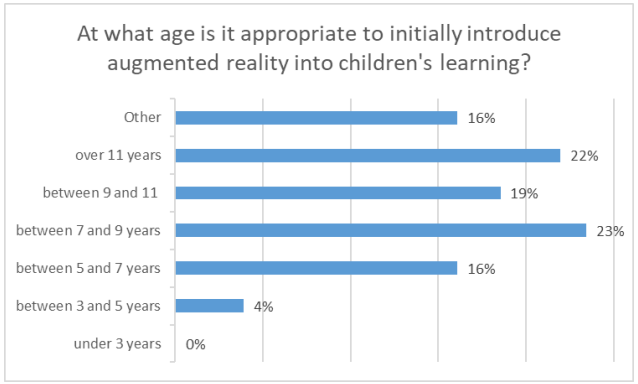

Figure 17. Answers of the question "At what age is it appropriate to initially introduce augmented reality into children's learning?"

The diversity of responses to the next question on the introduction of augmented reality in children's learning is understandable. Here, 23% of respondents chose 7-9 years as the most appropriate age, followed by 22% of teachers who chose 11+ years.

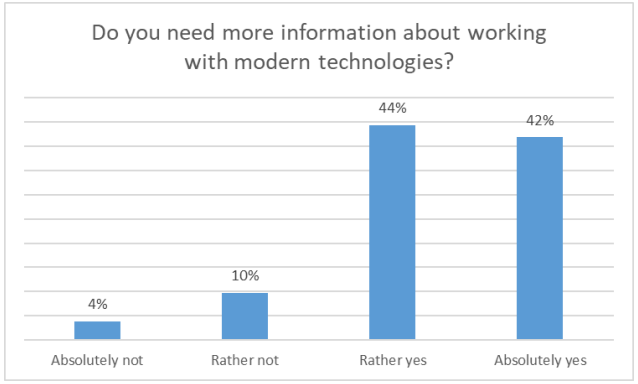

Figure 18. Answers of the question "Do you need more information about working with modern technologies?"

Figure 18 shows the results of this question. Here, the majority of respondents (86%) responded positively that they needed more information about the use of modern information technologies in education. It is also interesting to note the 4% of teachers who expressed a strong reluctance to learn about these technologies. This result can be attributed to the lack of enthusiasm of some teachers to update the teaching process and change the status quo.

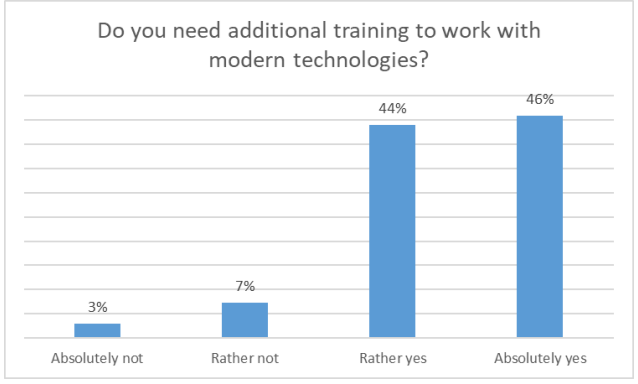

Figure 19. Answers of the question "Do you need additional training to work with modern technologies?"

With 90% of the participants expressing their willingness and need for additional training in modern technologies (Figure 19), the hope is that the Bulgarian education system will receive the necessary modernisation to meet the needs of today's children.

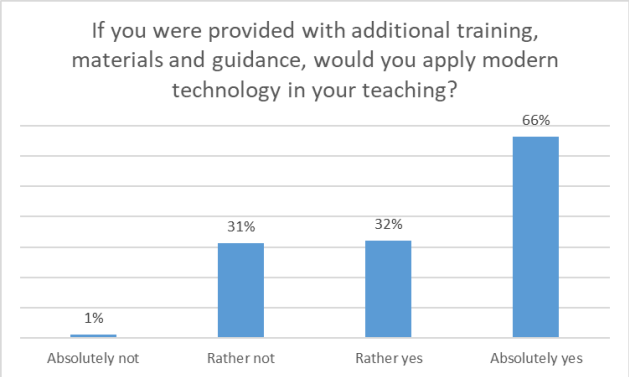

Figure 20. Answers of the question "If you were provided with additional training, materials and guidance, would you apply modern technology in your teaching?"

Teachers' willingness to use new technologies in the learning process is confirmed by the results visualised in Figure 20. In this case, 66% of the respondents expressed a strong willingness to use modern information and educational technologies if they were provided with the necessary materials and training, followed by 32% of the respondents who also tended to answer in the affirmative.

The following questions were open-ended and aimed at exploring respondents' views on the applicability of different technological solutions.

The first aimed to check "For which subjects do you recommend the use of programmable devices? Why?" The majority of teachers said that they believe that programmable devices can be used not only in specialised subjects such as computer modelling, but also in all other subjects, as long as the teacher is willing and creative. The main reasons for their use are the opportunities for enriching the learning process, making cross-curricular links and motivating students to participate actively.

Among the difficulties teachers face in using programmable devices, respondents prioritised the lack of information and practical experience, thematic training, and equipment.

As far as the applicability of virtual reality in specific subjects is concerned, the teachers give priority to the narrative subjects of the primary level: environmental world, man and nature, man and society, and their follow-up subjects in the upper grades. The main difficulties identified by teachers in using virtual reality in the learning process are the lack of experience, information, and resources compatible with specific curricula.

The situation is similar for the use of augmented reality - teachers' main concerns here are narrative, which can be attributed to the possibilities it offers for illustrating and enriching textual information. The main difficulties here are the lack of good equipment and ready-to-use resources.

3. Conclusion

In conclusion, it should be noted that the researched modern information technologies are mostly unfamiliar and distant for Bulgarian teachers. The majority of the respondents do not know them and do not use them in their teaching. However, this kind of technologies is defined by the participants as applicable to early childhood education and has great possibilities for illustrating and enriching the learning process in all school subjects. The results show that the common problems that prevent teachers from using such technologies are related to the available equipment, which is outdated, as well as to the level of their own preparation for working with technology.

Therefore, with the ongoing equipment of all Bulgarian state educational institutions with STEM centers and the planned training of teachers, the Bulgarian education system will be able to meet the needs of today's children and their requirements for living in the 21st century.

Acknowledgment

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