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Application of digital technologies in updating the content of the educational branches of primary school

Aplicación de tecnologías digitales en la actualización de contenidos de las ramas educativas de educación primaria

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Abstract

The aim of the work was to study the possibility of updating the content of the educational branches of the primary school by means of digital technologies and to evaluate its impact on students' motivation and performance. The teachers' Computer Self-Efficacy Scale was used in the study. The primary school teachers' Media and Technology Usage and Attitudes Scale was also applied. The Motivated Strategies for Learning Questionnaire (MSLQ) was used. It was established that a third of primary school teachers are not active users of digital technologies. The vast majority of teachers use digital technologies in their everyday life and during their teaching activities. It was proved that digital technologies make it possible to update the content of educational branches of primary education. It was found that the introduction of measures to update the content of education in primary school with the help of digital technologies led to an increase in the students' motivation and performance. It is worth continuing work on identifying effective means of updating the content of educational branches not only in primary school, but also in secondary and higher education. In this process, it is necessary to comply with the content relevance and update it synchronously with the pace of development of the relevant industries.

Key Words: Innovation, knowledge, learning, digital skills, digital literacy, motivation, primary education.

Resumen

El objetivo del trabajo fue estudiar la posibilidad de actualizar los contenidos de las ramas educativas de la

escuela primaria por medio de tecnologías digitales y evaluar su impacto en la motivación y el rendimiento de los estudiantes. En el estudio se utilizó la Escala de Autoeficacia Informática de los docentes. También se aplicó la Escala de Actitudes y Uso de Medios y Tecnología de los maestros de primaria. Se utilizó el Cuestionario de Estrategias Motivadas para el Aprendizaje (MSLQ). Se estableció que un tercio de los docentes de primaria no son usuarios activos de tecnologías digitales. La gran mayoría de los docentes utilizan las tecnologías digitales en su vida cotidiana y durante sus actividades docentes. Se comprobó que las tecnologías digitales permiten actualizar los contenidos de las ramas educativas de la educación primaria. Se encontró que la introducción de medidas para actualizar el contenido de la educación en la escuela primaria con la ayuda de tecnologías digitales condujo a un aumento en la motivación y el rendimiento de los estudiantes. Vale la pena continuar trabajando en la identificación de medios efectivos para actualizar el contenido de las ramas educativas no solo en la escuela primaria, sino también en la educación secundaria y superior. En este proceso, es necesario cumplir con la relevancia del contenido y actualizarlo de forma sincronizada con el ritmo de desarrollo de las industrias relevantes.

Palabras clave: Innovación, conocimiento, aprendizaje, habilidades digitales, alfabetización digital, motivación, educación primaria.

1. Introduction

The school and the teaching staff must respond synchronously to the changes associated with the rapid development of technologies, introduce them into the educational process, and build students' 21st century skills necessary for adult life. This is the key to the social, political and economic development of the country (Yaroshenko et al., 2020). The ability to read and write is no longer enough to be competitive. The era of digitization requires members of society to have other skills, including digital literacy. Therefore, it is necessary to introduce digital technologies into education. Digital technologies are believed to help spread knowledge and are a major driver of educational reforms in many countries (Haleem et al., 2022). They facilitate the learning process, making it more productive (Rachmadtullah et al., 2020) and intensive. Besides, they help in extreme conditions to ensure continuity of learning, for example, during a pandemic (Moorhouse & Wong, 2022). Digital technologies help to provide high quality of education at the initial stage, which is important for the future development of the child (Rahiem, 2021). Besides, the education system requires constant update of the educational content in accordance with the changes associated with the rapid emergence of new information and the loss of its relevance over the next few years. Many works on the use of digital technologies in education were found in the academic literature. However, little attention was paid to the problem of updating the content in primary education, filling it with relevant information, in particular through the use of digital technologies. Therefore, the aim of this work was to study the impact of the use of digital technologies in the educational process on updating the content of educational branches, using the example of primary school, and to find out what effect it will have, for example, on students' motivation and performance.

The aim involved the fulfilment of the following research objectives:

1) Study the frequency and features of the use of digital technologies by primary school teachers;
2) Establish the attitude of primary school teachers towards digital technologies, and to assess their digital self-efficacy perception;
3) Introduce content of educational branches in primary school updated through digital technologies;
4) Identify the impact of the updated content of primary school education on students' motivation;
5) Determine the impact of the updated content of education on the academic performance of primary school students.

2. Literature review

Digital technologies are currently used both in secondary (Jannah et al., 2020) and preschool (Gjelaj et al., 2020) education. They help to support blended learning (Macaruso et al., 2020), uninterrupted mobile learning (Hamid et al., 2019) or distance learning (Azzahra et al., 2022) under various learning conditions (Wahyuningsih & Baidi, 2021). They are used in the teaching of various subjects: fine arts (Kupaysinovna, 2021), foreign language (Bereczki & Kárpáti, 2021), mathematics (Novita & Herman, 2021), musical art (Desyandri et al., 2021), natural science (Bereczki & Kárpáti, 2021), physical education (Mansurovich, 2022), the development of reading and writing skills in younger schoolchildren (Novita & Herman, 2021), as well as creative skills (Bereczki & Kárpáti, 2021), they enrich children's vocabulary (Rahiem, 2021).

The acceptance of digital technologies in the field of education by teachers and lecturers is important for their effective use. Jannah et al. (2020) showed a positive attitude of primary school teachers towards the integration of digital technologies into the educational process. It was found that with the help of digital technologies, students' learning motivation and the level of critical thinking increased, they became more active and took initiative more often. It was also established that the productivity of learning depends on the availability of digital technology infrastructure in the school and the teacher's digital competence. Although some teachers have an erroneous belief that digital technologies perform only an administrative function.

Despite the availability of digital technologies in schools, international studies indicated their low effectiveness for students' academic performance (Spiteri & Chang Rundgren, 2020). The main obstacles that hinder the application of digital technologies in school were identified: insufficient digital literacy, lack of digital skills (Jobirovich, 2021), attitude towards digital technologies as a secondary, not a central tool in the formation of students' literacy (Watt, 2019). Overcoming these obstacles requires, for example, conducting courses and educational seminars on the use of digital technologies and the Internet (Walters et al., 2019), training teachers to create presentations, use animations, videos (Agélii Genlott et al., 2019; Vasylykiv et al., 2022). This is important because the influence of a teachers' digital literacy on their self-efficacy perception was proved, and the latter, in turn, is related to the willingness to teach and successfully fulfil the curriculum (Gudek, 2019).

The positive consequences of using digital technologies in primary school include (Jobirovich, 2021): enthusiasm in learning; keen observation of the lesson; independent study of students in small groups; development of communication skills; enhanced curiosity, activity, motivation, concentration, reading literacy, observation, critical thinking; increasing the speed of response to digital stimuli; development of self-study skills; personalization of training; expansion of educational opportunities through updating the educational content with accessible educational materials, quick obtaining and updating of information. The productivity of teaching and learning increases in this way (Haleem et al., 2022). Besides, digital technologies facilitate the development of online libraries and e-books. They create a space with open educational content for shared use, which significantly saves teachers' time when creating and updating educational material.

Digital technologies contribute to the development of distance education, they make education accessible to everyone, even those with disabilities. They also speed up the assessment of students' knowledge, thereby reducing the teacher's load (Haleem et al., 2022). Although there are also negative consequences: decreasing willingness to read and write, increasing individualization and decreasing socialization of students, a negative effect on students' emotions, hypodynamia, irregular time management, etc. (Jannah et al., 2020).

According to Jobirovich (2021), the main directions of influence of digital technologies should be: development of students' thinking, support of cognitive activity, acquisition of knowledge, development of

abilities and skills, individualization and differentiation of the educational process. Digital technologies as means of learning are divided into: electronic textbooks, virtual meccanos, educational computer games, multimedia, video lessons, individual tests, etc. (Watt, 2019). Multimedia projectors and interactive whiteboards also had a positive effect on student learning. Stringer et al., (2019) developed a number of recommendations for their application at different stages of education.

Digital technologies help to make educational materials bright and colourful, which contributes to their better memorization (Jobirovich, 2021). Gamified educational environments can develop the creative abilities of elementary school students (Bereczki & Kárpáti, 2021). Digital stories develop reading comprehension, explain scientific facts, develop speech, improve communication skills, and contribute to moral and social development (Rahiem, 2021).

It is appropriate to follow a three-frame approach to learning when using digital technologies: students' academic success, school environment and behaviour at school, students' extracurricular life. It is important to introduce students to digital etiquette as early as possible (Walters et al., 2019). It is also necessary to remember that not all content on the Internet is suitable for primary school students (Akhwani, 2019). It is necessary to make students the danger of a digital trail left on the Internet that can lead to cyberbullying or other negative consequences. Introducing digital technologies into the educational process requires the development of students' digital medical literacy. It is important to make them understand the harmful effects of technology on health, and the benefits of a mobile lifestyle as an equivalent of a healthy lifestyle (Hyman et al., 2020).

3. Methods

Research design

The research was conducted in three stages.

The first stage involved sampling, the division of the sample into experimental and control groups using the criteria for selecting research participants.

The second stage provided for the introduction of training according to the updated content of education in the experimental group with the use of digital technologies. Digital technologies were involved in teaching of all subjects in the experimental group. The teachers used multimedia projectors to demonstrate learning material, usually in the form of presentations or videos. The requirement for educational digital content was not to replicate the material of the textbook, but to supplement it with other, new, relevant information. At the same time, teachers also included work with textbooks in the lessons.

When teaching visual arts, students were offered, for example, to create a picture in Paint Graphic Editor, to create heroes of the children's favourite digital game, using the geometric shapes available in the editor. They were also offered to make a collage on a given topic from images available on the Internet, or use mobile applications to colour one of the pictures from a large number of proposed ones. Internet resources were also used to search for information about the history of art, features of various directions and styles, both historical and modern, etc.

When learning a foreign language, students expanded their vocabulary with the help of mobile applications, while improving their listening, reading, speaking and writing skills. The content was updated with interesting short videos containing dialogues of the main characters of modern children's films. Digital foreign language games and quizzes were also used. Students were offered to study digital images and illustrations of foreign literary texts, not only those contained in textbooks, but also new ones found on the Internet. Students were also asked to create illustrations for the text they heard or create a video interview

in which to express the feelings that arose when reading or listening to the text. Besides, students worked on digital posters. So, digital technologies were used to update the content of education along with the updating of teaching methods.

When studying mathematics, different applications were used in order to study mathematical concepts and rules. Training exercises were also conducted, with a gradual increase in the complexity level and the transition to a higher level, provided that the previous level was correctly completed. At the same time, the content of the exercises was relevant and close to the students' interests, and did not replicate the content of the textbooks, but supplemented it. Similarly, the content of education in Musical Art, Technologies, Ukrainian Language and I Explore the World was updated.

The third stage involved studying the impact of the introduction of the content of the educational branches of primary education updated through the use of digital technologies on students' motivation and their academic performance.

The pedagogical experiment lasted for two academic years from September 2020 to May 2022.

Tools

The Computer Self-Efficacy Scale (CSE) (Murphy et al., 1989) and the Media and Technology Usage and Attitudes Scale (Rosen et al., 2013) were used in order to determine the attitude of primary school teachers to technology and their sense of their self-efficacy of using digital technologies in the educational process. Besides, the effect of the updated content on the cognitive motivation of elementary school students according to the Motivated Strategies for Learning Questionnaire (MSLQ) was measured (Pintrich & DeGroot, 1990), and students' academic performance was determined based on the results of the final control.

The representativeness of the Computer Self-Efficacy Scale (Murphy et al., 1989) was tested using Kaiser criterion. Cronbach's alpha ranged from 0.77 to 0.96. For the Media and Technology Usage and Attitudes Scale (Rosen et al., 2013), Cronbach's alpha was 0.61 - 0.97. The reliability coefficient of the Motivated Strategies for Learning Questionnaire (Pintrich & DeGroot, 1990) was 0.74-0.89. At the same time, the correlation coefficient was 0.33-0.73, the significance level was 0.05.

Sample

The study involved 36 primary school teachers. The age of the teachers ranged from 27 to 60 years old. Their teaching experience ranged from 5 to 35 years. Evaluating the attitude of primary school teachers to digital technologies made it possible to divide the participants of the experiment into control and experimental groups. The control group included 12 teachers who, on average, scored less than half of the maximum score on the subscale (less than 15 points) on the "Positive Attitude" subscale. The experimental group included 24 teachers who scored above 15 on this subscale.

The sample also included 793 students of grades 1-2 who were students of the teachers included in the sample: 264 were included in the control group, and 529 — in the experimental group.

Data collection

At the first stage of the study, the teachers of the sample were asked to evaluate their attitude to digital technologies by rating the first 40 items of the scale on a 10-point frequency scale. 1 point corresponded to the answer "Never", 2 – "Once a month", 3 – "Several times a month", 4 – "Once a week", 5 – "Several times a week", 6 – "Once a day", 7 – "Several times a day", 8 – "Once an hour", 9 – "Several times an

hour", 10 – "All the time". The last 4 items were evaluated on a 9-point quantitative scale, where 1 point meant 0 people, 2 - from 1 to 50 people, 3 - from 51 to 100, 4 - from 101 to 175, 5 - from 176 to 250, 6 - from 251 to 375, 7 - from 376 to 500, 8 - from 501 to 750, 9 - more than 750.

The teachers' digital self-efficacy perception was also studied according to 12 factors, which teachers evaluated on a 5-point Likert scale, where 1 – "Totally disagree", 2 – "Totally agree".

At the last stage of the study, the Motivated Strategies for Learning Questionnaire (MSLQ) was used, and students were asked to answer 44 questions on a 7-point Likert scale, where 1 is "Not correct at all", 7 is "Completely correct".

The final control of students' educational performance was carried out on a 12-point scale, where 1-3 points are the elementary level, 4-6 — the medium level, 7-9 — the sufficient level, 10-12 — the high level.

Data analysis

The Statistica application software was used in the study for the purposes of statistical analysis. Analysis of variance, the Pearson correlation coefficient and Cohen's kappa coefficient were also used.
Participation in the study was voluntary, free of charge, and anonymous. All teachers and parents of students gave their written consent to participate in the study.

4. Results

At the initial stage of the study, the use of digital technologies and teachers' attitudes towards them were assessed using a scale (Rosen et al., 2013). The obtained results are presented in Tables 1 and 2.

Table 1.
Results of assessment of the use of digital technologies

Subscale	Control group		Experimental group		Maximum score for the subscale
	M	SD	M	SD	
Use of a smartphone	36.1	4.7	74.5	5.2	90
Use of social networks	42.7	4.5	63.8	4.3	90
Internet search	18.5	5.2	34.2	5.6	40
Use of e-mail	11.4	3.8	27.3	4.1	40
Sharing media files	12.6	4.3	29.4	4.9	40
Exchange of text messages	17.2	4.6	33.9	5.7	40
Video games	8.1	2.9	21.7	3.6	30
Online friendship	6.5	2.3	14.6	2.5	18
Friendship in social networks	6.2	1.9	13.8	2.4	18
Phone calls	15.6	3.4	14.3	3.1	20
Watching TV shows	12.3	3.9	9.1	3.2	20
Total score	191.2		269.6		446

The assessment of the use of digital technologies revealed that the teachers of the experimental group used smartphones on average once an hour in their life (Table 1), for example, to check e-mail, use GPS navigation, browse web pages, listen to music, take photos, record videos, view news, use programmes and mobile applications, and search for the necessary information. The teachers of the control group did this on average once a week. The frequency of checking one's own social network page, including through

the use of a smartphone, updating one's status, posting photos, viewing profiles and photos, reading and commenting on publications by participants in the experimental group was several times a day, while in the control group — once or several times a week. The teachers of the experimental group used any digital devices to search the Internet for news, information, videos, images, and photos on average once or several times an hour, while the teachers of the control group used them several times a week. Assessment of digital technology use showed that teachers in the experimental group usually checked personal or work e-mail several times a day, as well as sent, received and read e-mails and files. At the same time, the teachers of the control group did that several times a month. The teachers of the experimental group downloaded media files, watched TV shows, movies, video clips, etc. on the computer, shared media files with other users several times a day on average, while the teachers of the control group did that several times a month.

The teachers of the experimental group checked text messages on the phone, sent and received them, used their mobile phone during classes at work once an hour on average, while the teachers of the control group did so once a week. The primary school teachers of the experimental group played digital games several times a day on average, while the teachers of the control group — several times a month. The teachers of the experimental group had an average of more than 500 friends in social networks at the time of the study, while the teachers of the control group had less than 100 friends. The development of digital technologies has changed the format of communication. Active smartphone users used phone calls less (several times a day), and less active users of digital technologies made a phone call once an hour on average. The availability of digital technologies and their wide functionality made active users watch TV programmes on a smartphone or computer, while watching them on TV once a week on average. On the contrary, less active users of digital technologies watched TV shows on TV once a day on average.

Table 2.
Results of assessment of attitudes towards digital technologies

Subscale	Control group		Experimental group		Maximum score for the subscale
	M	SD	M	SD	
Positive attitude	12.1	4.7	25.3	4.1	30
Anxiety/ dependence	8.9	3.6	10.7	2.9	15
Negative attitude	13.4	2.8	4.1	1.6	15
I prefer to focus on another assignment	9.2	3.5	14.6	2.7	20

As Table 2 shows, the teachers of the experimental group mostly agreed with the importance of Internet access at any time and closely followed the development of digital technologies. The vast majority of teachers included in the control group did not consider it important to be able to get information from the Internet at any time when such a need or desire arose. They also disagreed with the importance of following the latest trends in the development of digital technologies. Among the teachers of the experimental group, greater anxiety and dependence on digital technologies was found than in the control group (the average score for the three items of the "Anxiety/dependence" subscale was 10.7 and 8.9, respectively). It was found that the participants of the control group believed that technology takes a lot of time, complicates the lives of users and isolates people from society (average score of 13.4). The teachers of the experimental group held the opposite opinion (average score of 4.1). The last subscale of Table 2 showed how teachers work on performing several tasks. In the experimental group, teachers preferred to perform tasks in parts, while switching attention from one task to another from time to time (14.6 points, compared to 9.2 in the control group).

Figure 1 presents the results of assessing digital self-efficacy perception by primary school teachers according to the scale (Howard, 2014).

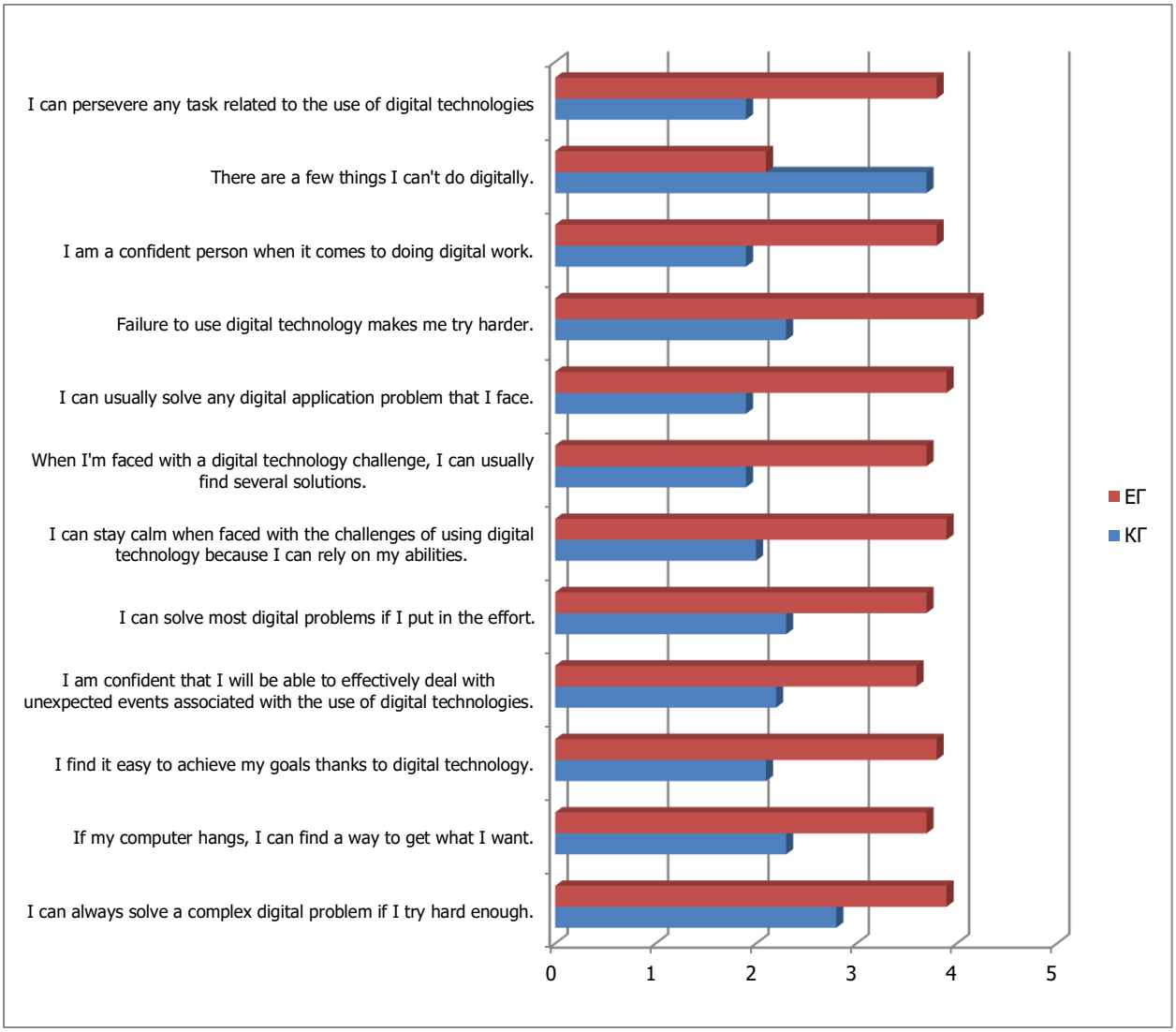

Figure 1. Perception of computer self-efficacy by primary school teachers

As Figure 1 shows, the frequent use of digital technologies by teachers in everyday life and in the educational process contributed to their confidence in their own abilities to perform various operations and tasks on a computer, laptop, tablet, smartphone, etc. Primary school teachers included in the experimental group showed almost twice as much confidence in their own abilities when using digital technologies. They more persistently performed tasks of varying complexity using digital technologies. The experience of unsuccessful use of digital technologies did not stop the teachers of the experimental group, but forced them to work even harder on solving them.

Table 3.
Results of assessment of motivation according to MSLQ

Question no.	Control group		Experimental group	
	M	SD	M	SD
1.	3.8	1.1	4.9	0.9
2.	4.5	1.6	4.7	1.3
3.	3.4	0.8	2.8	0.7
4.	2.7	0.9	4.1	0.8
5.	3.9	0.7	5.2	0.8
6.	3.1	0.8	4.9	0.9
7.	3.4	0.8	5.0	0.8
8.	3.7	1.2	4.9	1.1
9.	3.6	0.7	4.3	1.2
10.	2.7	0.8	3.5	0.9
11	2.9	0.7	4.4	0.7
12.	3.2	0.9	2.5	0.9
13.	2.8	1.0	3.7	0.8
14.	3.3	0.7	4.1	0.8
15.	3. 8	0.9	4.6	0.9
16.	3.1	0.8	3.8	0.7
17.	3.6	1.1	5.4	1.3
18.	3.9	1.1	4.8	1.0
19.	3. 2	1.0	4.5	1.1
20.	3.1	0.9	2.1	0.8
21.	2.9	0.9	4.0	0.9
22.	4.6	0.7	2.3	0.8
23.	3.3	0.8	5.8	0.8
24.	2.9	1.1	4.6	1.1
25.	3.5	0.9	4.7	0.7
26.	5.4	0.9	3.4	0.9
27.	4.7	0.7	2.9	0.8
28.	3.8	0.8	5.1	0.8
29.	3.2	0.9	4.3	0.9
30.	3.7	1.1	4. 8	1.0
31.	2.4	1.0	3.5	0.9
32.	2.1	0.8	3.3	0.8
33.	3.4	0.9	4.1	0.8
34.	3.6	0.8	4.7	0.9
35.	2.9	0.9	4.2	1.1
36.	3.3	0.9	4.8	0.8
37.	4.8	0.8	2.5	0.9
38.	4.9	0.8	2.8	0.8
39.	2.3	1.0	4.9	1.2
40.	2.8	1.1	4.7	1.0
41.	3.1	1.2	4.5	0.9
42.	2.9	0.8	3.2	0.8
43.	3.6	0.8	4.8	0.7
44.	2.7	0.9	4.6	1.1

As Table 3 shows, updating the educational content in primary school with the help of digital technologies, which was introduced during the experiment, had an impact on students' motivation. They were more eager to learn new material thanks to the interesting and relevant content. They passed the test with more confidence, were less nervous about the results they might get. They were interested in the learning process. Students understood the connection between already familiar information and new information. They were able to identify the main idea from what they read or heard. They did not leave the material unlearned, even if it seemed difficult to them at first glance, they tried to learn it until they fully understood the topic. When studying new material, students were less distracted by something secondary, usually listened carefully and tried to understand everything they heard. They read carefully, if they had a question — they reread it again, leaving no questions without answers. The calculation of the Cohen's ratio, which was more than 1.0, showed that there was a high effect of updating the content of educational branches of primary school on enhancing students' motivation. The Pearson correlation coefficient ranged from 59 to 160.

The influence of the updated content of the educational branches of primary school on students' learning outcomes was also studied. Table 4 presents the results of the final control of students' academic performance conducted after the end of the pedagogical experiment.

Table 4.
Results of final control of students' academic performance

Control group		**Experimental group**	
M	SD	M	SD
6.9	2.4	7.8	2.2
Max = 12		Max = 12	
Medium level		Sufficient level	

Updating the content of the educational branches of primary school also had an impact on student learning outcomes. In particular, the final assessment of students' academic performance after two years of conducting a pedagogical experiment related to the introduction of updated content of the educational branches of primary school found that the average value of the level of knowledge, skills and abilities achieved by students in the experimental group increased significantly compared to the control group. The average score according to the results of the final control on the 12-point evaluation system in the experimental group was 7.8 points (sufficient level), in the control group – 6.9 (medium level). The calculation of Cohen's coefficient indicated a high effect of updating the content of the educational branches of primary school on the results of students' academic performance. It was 1.1 for the experimental group, and within 0.6 for the control group, which indicates a medium effect; $\chi 2=118$.

During the research, the weighted sum of the squared deviations of the group averages from the overall average — the intergroup variance d — was obtained using mathematical methods. It was determined by the heterogeneity of the sample because of conducting of a pedagogical experiment in different groups, which included students from different general secondary educational institutions. The root-mean-square deviations from the mean for the same studied parameter in different primary educational institutions included in the sample were different. The intergroup variance, which describes the fluctuations of these groups, and the intragroup variance, which describes the fluctuations caused by random factors not taken into account, were not equal, which is evidence of the invalidity of the null hypothesis

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5. Discussion

This study showed that about 60% of primary school teachers were active users of digital technologies. They used their smartphones at least once an hour for various purposes: checking messages, e-mail, social networks, sharing files, photos, media, etc. Research conducted, for example, in Africa found that 80% of teachers know about digital technologies, computer equipment, mobile phones, electronic devices, the Internet, and social media. All 100% of the interviewed teachers indicated that in the schools where they work, the technical equipment: computers, laptops, multimedia projectors and an Internet network are available for teachers, not students (Jannah et al., 2020). The vast majority of teachers plan the educational process, prepare educational materials, conduct evaluations and solve administrative issues with the help of digital technologies. A survey of Swedish teachers showed that less than a third of them believe in the positive impact of digital technologies on the effectiveness of the educational process (Agélii Genlott et al., 2019). A total of 20% of respondents consider them harmful in pedagogical practice.

The pedagogical experiment carried out in this work, which involved 36 teachers and 793 students, revealed that the educational content of the elementary school updated through the use of digital technologies had a high effect on students' motivation and academic performance. Research conducted among 3,721 schoolchildren found that standard methods were less effective in teaching students to read compared to blended method that included the use of digital technologies (Macaruso et al., 2020). Although some contradictions were found in the teachers' attitude towards traditional teaching and involving digital technologies. Some teachers believe that traditional teaching will be more effective until teachers have sufficient digital literacy.

The study of the impact of computer games on the learning motivation of primary school students, their success and attitude to learning and school was carried out on the example of 90 students of public primary educational institutions. A change in the learning motivation caused by the use of computer games was found, but no changes in the attitude towards the lessons were observed (Sabirli & Çoklar, 2020). It was also established that the thinking of children who play computer games is significantly different from the thinking of those who do not. Besides, a connection was established between technology and creativity, as well as cooperation in education (Aguilar & Pifarre Turmo, 2019).

Thanks to an 8-week experiment conducted among 135 students of the third grade of an elementary school, it was established that digital technologies contributed to the development of knowledge in mathematics and increased accuracy of arithmetic calculations (Christopoulos et al., 2020). The educational environment, which needed changes at the beginning of the experiment, was important.

A survey of 336 elementary school students in Korea showed that more than 95% of them had experience interacting with virtual and augmented reality (Suh & Ahn, 2022). The positive impact of the latter on the success of students was found. Socio-emotional and motivational functioning is associated with the socio-digital participation of schoolchildren (Hietajärvi et al., 2019).

Limitations

This study had a sample limitation (students of grades 1-2). At the same time, it was not taken into account whether students attended preschools. Moreover, the results of the study had a certain sensitivity to the time of the pedagogical experiment and the situation surrounding education in Ukraine (pandemic and war) in the studied period of time.

6. Conclusions

The rapid spread of information promoted by the rapid development of digital technologies makes it obsolete in just a few years. Therefore, the issue of synchronous updating of the content of educational materials in educational institutions in order to support students' interest in learning is urgent. The research conducted in this work showed that more than half of the teachers were active users of digital technologies. They often exchanged files, used social networks, and searched for the necessary information. The teachers emphasized the importance of access to the Internet anytime, anywhere as they used digital technologies to streamline the learning process. The conducted pedagogical experiment on updating the content of the educational branches of primary school carried out through the use of digital technologies revealed an increase in students' interest in learning and their enhanced motivation. It also had a positive effect on reducing their anxiety before tests and persistence on the way to understanding new educational material. The updated content of the educational branches also enabled to increase the performance of elementary school students. The results of this research can have theoretical and practical significance, as they complement the existing knowledge of primary school pedagogy and can be used to improve the effectiveness of the educational process of primary school with the involvement of digital technologies to update the content of the educational branches.

7. Bibliographic references

Agélii Genlott, A., Grönlund, Å., & Viberg, O. (2019). Disseminating digital innovation in school–leading second-order educational change. Education and Information Technologies, 24, 3021-3039. https://doi.org/10.1007/s10639-019-09908-0

Aguilar, D., & Pifarre Turmo, M. (2019). Promoting social creativity in science education with digital technology to overcome inequalities: A scoping review. Frontiers in Psychology, 10, 1474. https://doi.org/10.3389/fpsyg.2019.01474

Akhwani, A. (2019). Strategy of digital etiquette education of elementary school students. PrimaryEdu: Journal of Primary Education, 3(2), 43-54. https://doi.org/10.22460/pej.v3i2.1378

Azzahra, S., Maryanti, R., & Wulandary, V. (2022). Problems faced by elementary school students in the online learning process during the Covid-19 pandemic. Indonesian Journal of Multidiciplinary Research, 2(2), 245-256. https://acortar.link/KfNlnK

Bereczki, E. O., & Kárpáti, A. (2021). Technology-enhanced creativity: A multiple case study of digital technology-integration expert teachers' beliefs and practices. Thinking Skills and Creativity, 39, 100791. https://doi.org/10.1016/j.tsc.2021.100791

Christopoulos, A., Kajasilta, H., Salakoski, T., & Laakso, M. J. (2020). Limits and virtues of educational technology in elementary school mathematics. Journal of Educational Technology Systems, 49(1), 59-81. https://doi.org/10.1177/0047239520908838

Desyandri, D., Yeni, I., Mansurdin, M., & Dilfa, A. H. (2021). Digital student songbook as supporting thematic teaching material in elementary school. Jurnal Ilmiah Sekolah Dasar, 5(2), 342-350. https://doi.org/10.23887/jisd.v5i2.36952

Gjelaj, M., Buza, K., Shatri, K., & Zabeli, N. (2020). Digital technologies in early childhood: Attitudes and practices of parents and teachers in Kosovo. International Journal of Instruction, 13(1), 165-184. https://doi.org/10.29333/iji.2020.13111a

Gudek, B. (2019). Computer self-efficacy perceptions of music teacher candidates and their attitudes towards digital technology. European Journal of Educational Research, 8(3), 683-696. https://doi.org/10.12973/eu-jer.8.3.683

Haleem, A., Javaid, M., Qadri, M. A., & Suman, R. (2022). Understanding the role of digital technologies in education: A review. Sustainable Operations and Computers, 3, 275-285. https://doi.org/10.1016/j.susoc.2022.05.004

Hamid, A., Setyosari, P., Saida, U. L. F. A., & Kuswandi, D. (2019). The implementation of mobile seamless learning strategy in mastering students' concepts for elementary school. Journal for the Education of Gifted Young Scientists, 7(4), 967-982. https://doi.org/10.17478/jegys.622416

Hietajärvi, L., Salmela-Aro, K., Tuominen, H., Hakkarainen, K., & Lonka, K. (2019). Beyond screen time: Multidimensionality of socio-digital participation and relations to academic well-being in three educational phases. Computers in Human Behavior, 93, 13-24. https://doi.org/10.1016/j.chb.2018.11.049

Howard, M. C. (2014). Creation of a computer self-efficacy measure: analysis of internal consistency, psychometric properties, and validity. Cyberpsychology, Behavior, and Social Networking, 17(10), 677-681. http://dx.doi.org/10.1089/cyber.2014.0255

Hyman, A., Stewart, K., Jamin, A. M., Lauscher, H. N., Stacy, E., Kasten, G., & Ho, K. (2020). Testing a school-based program to promote digital health literacy and healthy lifestyle behaviours in intermediate elementary students: The Learning for Life program. Preventive Medicine Reports, 19, 101149. https://doi.org/10.1016/j.pmedr.2020.101149

Jannah, M., Prasojo, L. D., & Jerusalem, M. A. (2020). Elementary school teachers' perceptions of digital technology based learning in the 21st century: promoting digital technology as the proponent learning tools. Al Ibtida: Jurnal Pendidikan Guru MI, 7(1), 1-18. http://dx.doi.org/10.24235/al.ibtida.snj.v7i1.6088

Jobirovich, Y. M. (2021). The role of digital technologies in reform of the education system. The American Journal of Social Science and Education Innovations, 3(4), 461-465. https://doi.org/10.37547/tajssei/Volume03Issue04-73

Kupaysinovna, K. S. (2021). Advanced experiences in the use of digital technologies in teaching fine arts (on the example of Finland and South Korea). Turkish Journal of Computer and Mathematics Education (TURCOMAT), 12(7), 939-946. https://doi.org/10.17762/turcomat.v12i7.2699

Macaruso, P., Wilkes, S., & Prescott, J. E. (2020). An investigation of blended learning to support reading instruction in elementary schools. Educational Technology Research and Development, 68, 2839-2852. https://doi.org/10.1007/s11423-020-09785-2

Mansurovich, S. S. (2022). Methodology of organizing physical education lessons through digital technologies. European Journal of Modern Medicine and Practice, 2(4), 107-111. Retrieved from http://www.inovatus.es/index.php/ejmmp/article/view/761

Moorhouse, B. L., & Wong, K. M. (2022). Blending asynchronous and synchronous digital technologies and instructional approaches to facilitate remote learning. Journal of Computers in Education, 9(1), 51-70. https://doi.org/10.1007/s40692-021-00195-8

Murphy, C. A., Coover, D., & Owen, S. V. (1989). Development and validation of the computer self-efficacy scale. Educational and Psychological Measurement, 49(4), 893-899. https://doi.org/10.1177/001316448904900412

Novita, R., & Herman, T. (2021). Digital technology in learning mathematical literacy, can it helpful? Journal of Physics: Conference Series, 1776(1), 012027. https://doi.org/10.1088/1742-6596/1776/1/012027

Pintrich, R. R., & DeGroot, E. V. (1990). Motivational and self-regulated learning components of classroom academic performance. Journal of Educational Psychology, 82, 33-40. https://doi/10.1037/0022-0663.82.1.33

Rachmadtullah, R., Yustitia, V., Setiawan, B., Fanny, A. M., Pramulia, P., Susiloningsih, W., ... & Ardhian, T. (2020). The challenge of elementary school teachers to encounter superior generation in the 4.0 industrial revolution: Study literature. International Journal of Scientific & Technology Research, 9(4), 1879-1882.

Rahiem, M. D. (2021). Storytelling in early childhood education: Time to go digital. International Journal of Child Care and Education Policy, 15(1), 1-20. https://doi.org/10.1186/s40723-021-00081-x

Rosen, L. D., Whaling, K., Carrier, L. M., Cheever, N. A., & Rokkum, J. (2013). The media and technology usage and attitudes scale: An empirical investigation. Computers in human behavior, 29(6), 2501-2511. https://doi.org/10.1016/j.chb.2013.06.006

Sabirli, Z. E., & Çoklar, A. N. (2020). The effect of educational digital games on education, motivation and attitudes of elementary school students against course access. World Journal on Educational Technology: Current Issues, 12(4), 325-338. https://eric.ed.gov/?id=EJ1272794

Spiteri, M., & Chang Rundgren, S. N. (2020). Literature review on the factors affecting primary teachers' use of digital technology. Technology, Knowledge and Learning, 25, 115-128. https://doi.org/10.1007/s10758-018-9376-x

Stringer, E., Lewin, C., & Coleman, R. (2019). Using digital technology to improve learning: Guidance report. R Education Endowment Foundation. Retrieved from https://educationendowmentfoundation.org.uk/public/files/Publications/digitalTech/EEF_Digital_Technology_Guidance_Report.pdf

Suh, W., & Ahn, S. (2022). Utilizing the metaverse for learner-centered constructivist education in the post-pandemic era: an analysis of elementary school students. Journal of Intelligence, 10(1), 17. https://doi.org/10.3390/jintelligence10010017

Vasylykiv, I., Poplavska, T., Vdovenko, V., Haidamaka, O., Bader, S., & Streletska, N. (2022). The essence of the professional training of elementary school teachers in the context of society informatisation. Revista Romaneasca Pentru Educatie Multidimensionala, 14(2), 348-362. https://doi.org/10.18662/rrem/14.2/585

Wahyuningsih, E., & Baidi, B. (2021). Scrutinizing the potential use of Discord application as a digital platform amidst emergency remote learning. Journal of Educational Management and Instruction (JEMIN), 1(1), 9-18. https://doi.org/10.22515/jemin.v1i1.3448

Walters, M. G., Gee, D., & Mohammed, S. (2019). A literature review: Digital citizenship and the elementary educator. International Journal of Technology in Education, 2(1), 1-21. Retrieved from https://eric.ed.gov/?id=EJ1264251

Watt, D. (2019). Video production in elementary teacher education as a critical digital literacy practice. Media and Communication, 7(2), 82-99. https://doi.org/10.17645/mac.v7i2.1967

Yaroshenko, O. G., Samborska, O. D., & Kiv, A. E. (2020, March). An integrated approach to digital training of prospective primary school teachers. CTE Workshop Proceedings, 7, 94-105. https://doi.org/10.55056/cte.314