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DIGITAL EDUCATIONAL CONTENT IN THE LEARNING ENVIRONMENT OF EDUCATIONAL INSTITUTIONS IN THE CONTEXT OF DISTANCE AND BLENDED LEARNING IN MATHEMATICS

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Abstract: *This article deals with the use of digital educational content in mathematics teaching. The relevance of its use in distance and blended learning is important in a difficult epidemiological situation and in wartime, not only for the organisation of learning, but also for ensuring the quality of educational services. To this end, a questionnaire was developed and an online survey of 261 teachers from all regions of Ukraine was conducted. As a result of surveying teachers who teach mathematics in primary, basic, profiled schools, vocational and higher education, we found that 99.9% of them have experience in distance or blended learning, with 94.6% using digital educational content. In this regard, the question of which digital resources are the most popular among teachers, as well as at what level they use them – develop their own content or use ready-made content, is relevant. The article also explores teachers purposes for using digital content, their awareness, and their experience with such content. According to the analysis of teachers' responses, only 16.9% constantly create interactive assignments in various online services, and 70.9% do so occasionally.*

The results of the survey identified the most popular software packages for creating educational content; software for preparing presentations; tools for creating graphics and infographics; software for creating and editing videos; specialized mathematical packages and tools for studying mathematics; online services for test writing; services for creating interactive exercises, games, mental maps; online whiteboards; educational platforms. Teachers were also asked to assess their level of

ICT-competence, and 68.2% of teachers in Ukraine considered it sufficient. At the same time, there is a trend towards the development of ICT competences through mastering new services, in particular, software for working with multimedia information, and for this purpose 79.2% of teachers need seminars, webinars and trainings.

Keywords: ICT competences of mathematics teachers, teaching mathematics, digital content in education, distance and blended learning.

INTRODUCTION

Since 2020, humanity has found itself in conditions of periodic quarantines due to the pandemic, which brings the problem of using digital services, platforms for organizing schoolchildren's education in distance and blended learning up to date. In Ukraine, the problem of switching to distance learning has become even more relevant since February 2022 due to the declaration of martial law as a result of the Russian Federation's aggression. It should be noted that by this time teachers in Ukraine have gained some experience in organizing both distance and blended learning. We are therefore interested in the following *questions*: 1) to what extent do school and university teachers use the potential of digital educational resources? 2) has the dynamics of the use of digital educational resources by school and university teachers changed due to the organisation of distance and blended learning in Ukraine during the pandemic? 3) which digital learning tools are most popular in modern schools and universities? 4) how do teachers assess their level of activity in the use of digital learning tools and, specifically, their ICT competence?

1. ANALYSIS OF RESEARCH PUBLICATIONS IN THE FIELD OF DIGITAL EDUCATIONAL CONTENT

In recent years, scholarly attention has focused on the organisation of distance and blended learning in both universities and schools. The contemporary educational environment is considered by researchers to be two-component, i.e. consisting of two interrelated and mutually influencing parts: traditional classroom interaction and a digitally-based environment as an innovative complex of educational activities (Noskova & Pavlova, 2021). The study and development of a digitally based virtual classroom learning environment (VCLE) for undergraduate students in the study of STEM / STEAM disciplines in the context of gamification is the focus of Thai researchers, namely: Wannapiroon and Pimdee (2022). The study of Sun, Ruokamo, Kangas et al., (2022) shows the impact of collaborative digital game on students' behavioural, emotional, and cognitive engagement in mathematics. The experience of using ICT in educational innovation through the creation of digital content for an interactive digital board (IDB) is presented in the article of Castineira-Rodriguez, Perez-Rodriguez, & Lorenzo-Rial (2022). Thus, the creation of a digitally based environment involves the use of digital tools to create educational and gamification content.

Didactic aspects of blended learning in higher education, both traditional composition and e-learning are studied by Balyk, Shmyger, Vasylenko et al., (2021). The effectiveness of blended learning in training Greek teachers for the use of digital technologies in pedagogical work was proven by Zagouras, Egarchou, Skiniotis et al., (2022).

Obviously, the need for distance and blended learning brings the search for digital tools and their set up to date. Modern ICT tools are studied by an international team of researchers – Smyrnova-Trybulska, Sekret, and Morze (2021) – as part of the "Direction to the MOOCs" project. The aim of the project is to develop and implement the course "Contemporary ICT tools and innovative methods of creative education" in the students' training process. Thus, the problem of organising distance and blended learning is solved in two dimensions: 1) the use of digital tools by a teacher; 2) the preparation of students for the use of digital tools.

In view of the validity of organising both distance and blended learning, the issue of developing digital competences among university teachers arises. Researchers Sandi-Delgado, Sanz and Lovos (2022) address this problem through the use of serious games called AstroCodigo. The results obtained by the authors can be used to organise academic strategies for teaching digital skills in universities. It should be noted that the right set of skills is the foundation of teachers' digital well-being, as confirmed by an online survey of 336 teachers in Pakistan conducted by Yu, Mirza, Chaudhry et al. (2022).

The creation of a digitally based environment in teaching mathematics consists not only of the use of widely used digital tools, but also of specific mathematical software. The impact of implementing Inquiry-Based Learning (IBL) in mathematics teaching on the use of innovative pedagogical methods is explored by Morze, Boiko, and Smyrnova-Trybulska (2021). The authors consider theoretical and practical aspects of the development of academic teaching community for the introduction of innovative pedagogical technologies using IBL at educational institutions where staff work, carry out research and work together to improve teaching and research. Morze, Boiko and Smyrnova-Trybulska (2021) proved that community participation influences the use of innovative pedagogical methods in mathematics teaching. Ishchenko (2019) investigated the implementation of STEM education in Ukrainian schools, the selection of appropriate tools of modern pedagogical and information technologies for the organisation of STEM education in mathematics lessons, the methodological preparation of mathematics teachers for this activity, the development of innovations, the willingness to use IT technologies in the implementation of interdisciplinary links.

The issue of using various online services in teaching mathematics to primary school pupils was studied in the works of Skvortsova and Britskan (2021); Skvortsova, Britskan, and Haievets (2020); Skvortsova, Onopriienko, and Britskan (2019); Skvortsova and Britskan (2018). The authors conducted a comparative analysis of such online services as LearningApps, Google Classroom, Classtime, Classdojo; Renderforest, MS PowerPoint; Renderforest, H5P, Learnis; Padlet, Lino.it, Liveworksheets, Wizer.me. They have developed the algorithms for working in each of the templates of these services. However, in most cases, the researchers choose one or two services

for a particular idea. Thus, Khamcharoen, Kantathanawat, and Sukkamart (2022), researchers in Bangkok, used the online service Padlet to develop creative problem solving skills (CPSS) in 30 students in the Computer Education Programme, at Dhonburi Rajabhat University's Faculty of Education in Thailand.

In addition to widely used online services, specific digital tools are used in mathematics teaching. For example, in 2018 the Basic Digital Education (BDE) system was implemented in Austrian lower secondary schools (10–14 years old) to develop students' Computational Thinking (CT) as well as problem-solving skills. The system involves combining an Open Educational Resource (OER) textbook and Physical Computing with the micro:bit device. This system is planned to be introduced for pupils in grades 3 and 4 (8–10 years old) (Kastner-Hauler, Tengler, Sabitzer, & Lavicza, 2022).

The problem of formation the computational skills of primary school pupils was studied by Skvortsova, and Romanyshyn, (2020). The authors proved the effectiveness of using interactive mental arithmetic tasks created in the online services LearningApps, Liveworksheets, Wizer.me and the online platform OnlineMSchool, Pranglimine.

In order to shape the spatial abilities of preschoolers, such scientists as Lahav and Wolfson (2022) use the Osmo tactile user interface, which combines digital and physical objects, in particular the Osmo Tangram. Many mathematics teachers use spatial visualisation in their work using the GeoGebra service. It should also be noted that there are other online services for learning mathematics.

Obviously, teachers with professional experience, finding themselves in a distance or blended learning setting, are forced to master digital skills on their own through self-education or advanced training courses. Thus, researchers from the University of Los Llanos in Colombia, following a survey of teachers, came to the conclusion that teachers have a desire to develop digital skills through their professional practice, and thus acquire skills with a digital approach, understanding them as an opportunity for professional development (Torres-Florez & Diaz-Betancour, 2021).

The aim of the article is to interpret the results of an analysis of pedagogical work in Ukraine in the context of teachers' use of digital tools while organising the process of teaching mathematics in primary, middle (basic) and profiled schools; reflecting on the experience of using a digital learning environment in a distance learning setting. Achieving the aim of the study involves solving the following tasks:

1. to analyse scientific, methodological and regulatory sources in order to identify the specific characteristics of the process of creating a digital learning environment;
2. to determine the types of digital tools for creating educational content for schoolchildren in the systems of distance and blended learning in Ukraine;
3. to develop the content of a questionnaire, the answers to which will determine the experience of organizing mathematical distance and blended learning using digital tools, including specialised software packages. To organize and conduct a survey of teachers and lecturers through the social networks Facebook and Viber;

4. to identify popular application packages for creating educational content using comprehensive monitoring of teachers' use of various ICT technologies;
5. to interpret the results of monitoring the state of pedagogical practice in Ukraine on the use of digital resources in mathematics teaching in distance and blended learning settings.

2. RESEARCH METHODS

We conducted an online survey of teachers from all regions of Ukraine during the academic years 2021-2022. The aim of the survey was to investigate the issue of teachers' use of digital tools in the process of teaching mathematics, both in distance and blended format, to find out teachers' goals of using digital content, their awareness and experience of using such content, and to identify the digital resources that are most popular among teachers, and the level, on which they use them – develop their own content or use ready-made content.

The purpose of the study is to prove the hypothesis, which is as follows: 1) due to the organisation of distance and blended learning under pandemic conditions, school and university teachers have gained significant experience in the use of digital resources (digital didactic tools, virtualisation, digitalisation and gamification of the educational environment); 2) services for creating presentations for mathematics lessons, graphic editors, services for creating interactive exercises, test tasks, special software packages for teaching mathematics are widely used for the effective organisation of distance and blended learning; 3) the sustained positive dynamics of teachers' readiness for the full use of virtualisation, digitalisation and gamification of the digital educational environment is linked to the consideration of trends in contemporary educational practice and the development of further steps to improve the ICT competence of school and university teachers.

Our study used diagnostic methods of the basic level of teachers' awareness of the didactic potential of digital educational tools. For this purpose, a series of monitoring procedures was carried out using special questionnaires. This format of diagnostics made it possible to reveal the general level of teachers' awareness of special application packages and programs that provide virtualisation, digitalisation and gamification of the modern educational environment of Ukrainian educational institutions in distance and blended learning settings.

The diagnostics was carried out by processing the questionnaire material, based on the principle of teachers' "open" statements regarding the advantages and disadvantages of using digital tools in the classroom. The "open" format of the questionnaire did not provide for the development of a special scale for measuring teachers' ICT competence. In addition, during the experiment, respondents were deliberately not divided into control and experimental groups, since the use of distance learning in Ukraine has been carried out systematically for only two years and the verified data on the effectiveness of the use of digital didactic tools are absent. That is why the result of this stage of the study provides for the identification of only a generalised and average level of teachers' awareness of the advantages and disadvantages of digital educational content in the ratio.

The questionnaire was created using Google Forms and distributed through social networks such as Facebook and Viber. The survey was anonymous, the teachers were asked to answer 22 questions (21 closed type questions with a choice of answers, but at the same time each question allowed them to indicate their own answer), some of which were of a general nature: position in the education system, professional experience, experience in organizing distance and blended learning, using digital educational content, and experience in using digital technologies (https://docs.google.com/forms/d/e/1FAIpQLScKVShmqSYzwOStCIl5HiHwRzgTqZ4KYsVUzPq0aYt056pDCw/viewform).

The second set of questions provided information on the most commonly used digital educational content, the purpose of using electronic materials, the level of digital content use, the frequency of using educational content, the types of universal application packages, programs for creating presentations, graphics and infographics, video editing, types of specialized packages for mathematics teaching, services for compiling tests, interactive exercises, games, quizzes, mind maps, online boards, educational platforms. The third set of questions involved self-assessment of their own level of ICT competence, the need to master digital tools and the methods of obtaining knowledge.

Answering the questions, teachers were able to choose one or several suitable answers from the proposed ones, as well as write their own version. A total of 261 Ukrainian teachers took part in the survey: primary school teachers (41.4%; n = 108), mathematics teachers of middle school (40.2%, n = 105) and mathematics teachers of profiled schools (5.0%, n = 13), vocational school teachers (1.9%, n = 5), university teachers (7.3%, n = 19) (shown in Figure 1).

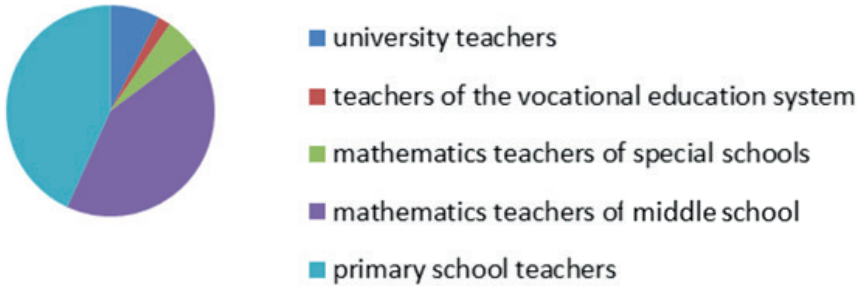


Figure 1. Distribution of teachers' answers by specialties

Source: Own work.

The others are teachers of both basic and profiled schools at the same time, students of pedagogical universities, teachers of the extended day-care groups, tutors. Depending on their professional experience, the respondents: 57.1% – have more than 20 years of teaching experience, 20.7% – 11–20 years, 11.9% of the respondents have 6–10 years professional experience and 7.3% – up to 5 years, while 1.9% claim the experience of 30–40 years and 1.1% – more than 40 (shown in Figure 2).

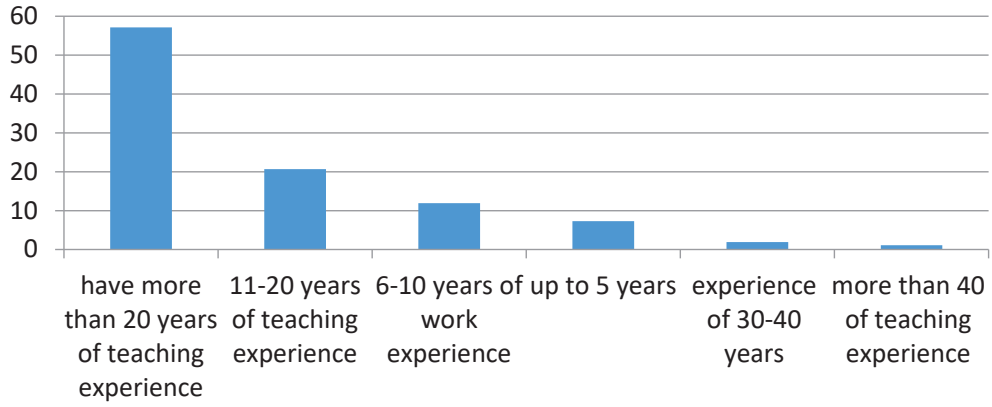


Figure 2. Distribution of teachers according to professional experience

Source: Own work.

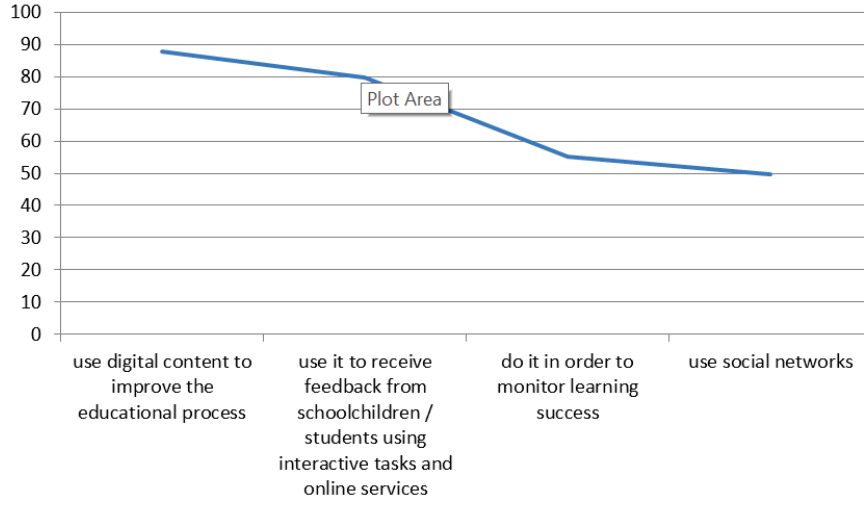
3. RESULTS AND DISCUSSION

As a result of a survey of the teachers who teach mathematics in primary, middle (basic), profiled schools, in the vocational education system and in the institutions of higher education, we have found out that 99.9% of them have experience in distance or blended learning, with 94.6% using digital educational content. Such a high percentage of teachers with distance learning experience is beyond doubt, because since March 2020, schools in Ukraine have periodically switched to distance learning. But some questions arise to 4.6% of teachers who provide distance learning but do not use digital educational content. Perhaps these teachers used only such social services as Viber, Skype, Zoom, Teams, Google Meet for online lessons, and organized videoconferences for mathematics lessons. At the same time, such a low percentage of teachers who do not use digital educational content is encouraging, taking into account the fact that 57.1% of respondents have more than 20 years of experience. This means that teachers with a long teaching experience have mastered digital skills to some extent. The data on the time spent using digital educational content is also encouraging: 25.3% use digital content in their work for more than 10 years, 31.0% – from 6 to 10 years, there are 20.3% of respondents with 3–5 years of such experience and 22.6% – up to 3 years. These data indicate the popularity of such resources in the pedagogical community. Thus, we can state that Ukrainian teachers widely use digital tools while organising mathematics education.

This raises the question of what digital resources are most popular among teachers, as well as at what level they use them – develop their own materials or use ready-made content. The majority of respondents (80.1%) use educational content posted on the Internet. Among the respondents there are those who develop and modify the necessary educational materials on their own (60.2%), and 41.4% of the respondents use ready-made educational content and their own materials. But there are those who do not use digital content in their work, but this percentage is quite low – 1.1%. It is important to note some disparity in similar data. Thus, when answering the question

about the experience of using digital educational content in distance and blended learning, 4.6% of respondents indicated its absence, and only 1.1% answered a direct question about the use of digital educational content. It can be seen that 4.6% have no experience of using it, and only 1.1% do not use digital content. Based on this data, we conclude that 3.5% use digital content, but they consider the experience of using it insufficient.

Through the survey, we investigated teachers' goals of using digital content in the organisation of mathematics teaching. The most common use of digital content by 87.7% of teachers is to improve the educational process, 79.7% use it to receive feedback from pupils / students using interactive tasks and online services, 55.2% of teachers do it to monitor learning success, for pedagogical collaboration with colleagues, 49.8% of respondents use social networks. It should be noted that a quarter of teachers use electronic learning materials, realising a whole range of goals – to monitor the learning success of pupils/students through the use of electronic journals; to receive feedback from pupils/students through interactive exercises using online services; to cooperate with colleagues using social networks. And only 17.2% of teachers chose one of the proposed goals.



F i g u r e 3. Distribution of teachers according to the purpose of using electronic educational materials

S o u r c e: Own work.

Thus, educational services help to achieve a whole range of goals, which means that the question of what digital resources teachers use is no less important. The results of the analysis of the answers to this question show that 26.4% of respondents use a whole range of tools: universal software tools, digital tools and web services, as well as the content of educational channels, platforms, portals, websites, etc. 17.2% use a narrower set: digital tools and web services, as well as content presented on educational channels, platforms, portals, websites. 24% of teachers in Ukraine use only content posted on educational channels, platforms, portals, and websites.

The next question of the questionnaire gave an opportunity to find out the level of the use of digital resources by teachers. As the analysis of teachers answers show, only 16.9% constantly create interactive tasks in various online services, and 70.9% – from time to time. 11.9% do not perform independent learning content using software. It is most likely these teachers are not digitally literate. A small percentage, only 8.0% of the respondents, have the necessary programming skills and create their own digital learning content. Almost all teachers – 82.4% use the content of educational channels, websites, etc., 60.2% – digital tools and web services, 49.8% of respondents use universal software. Presentation programs (MS PowerPoint, Prezi, SlideRocet, VoiceThread, PowerPoint, etc.) are the most popular among 92.3% of respondents; word processors (Microsoft Word, Word Perfect, ChiWriter, MultiEdit, Open Office, etc.) – among 88.5% of teachers. However, database management systems (Microsoft Access, Microsoft FoxPro, Paradox, Oracle, Informix, Sybase) are used by only 4.2% of teachers.

Teachers make sufficient use of: spreadsheet programs (Microsoft Excel, Lotus, Quattro Pro, etc.) – 48.7%; graphic editors (Paint Windows, CorelDRAW packages, Adobe PhotoShop and Adobe Illustrator, etc.) – 47.5%. Less popular among teachers in Ukraine, are: systems for automating calculations (Mathematica, Maple, MatLab, MathCad, etc.) – 21.5%; virtual sound and music programs – 24.1%; software tools for working with multimedia information (Movavi Screen Capture, Camtasia Studio, etc.) – 25.7% (shown in Figure 4).

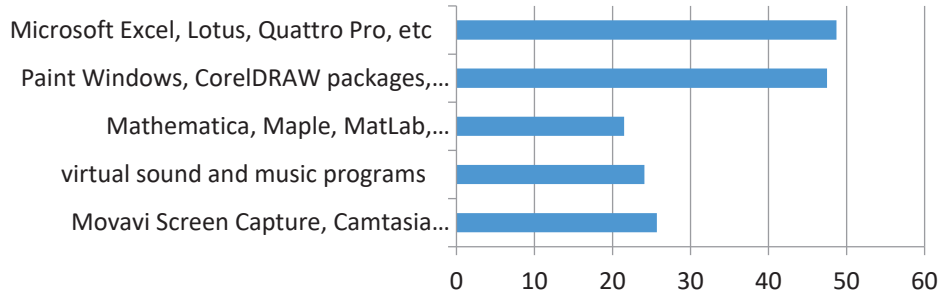


Figure 4. Types of digital resources used by teachers in their professional activities

Source: Own work.

It is important to note that only 0.7% of teachers use all the packages of educational content listed in the questionnaire (word processors, presentation programs, spreadsheet programs, graphic editors, database management systems, systems for automating calculations, virtual sound and music programs and software tools for working with multimedia information). Among them: a quarter are primary school teachers and one sixth are middle school teachers with more than 20 years of experience, 11.0% are primary school teachers with 6–10 years of experience and 11.0% of middle school teachers (6–10 years and 11–20 years of professional experience) and only 5.5% are university teachers. The majority (14.0%) only work with word processors and presentation programs.

PowerPoint turned out to be the most popular program for preparing presentations among teachers – 98.5%, they use Prezi (18.4%), ClearSlide (2.7%), Canva (1.5%) less often. As noted above, teachers had the opportunity to complete their own version; such responses included liveworksheet, Emazi, SlideShare, Google Slides, Genial.ly (shown in Figure 5).

And for creating graphics, infographics, Canva is the most popular tool, 54.0% of respondents work with it, 14.9% and 8.4%, respectively, are familiar with such programs as Piktochart and PosterMyWal. Crello is used by 0.4%, and 3.4% of teachers do not use such services (shown in Figure 6).

The results of the survey show that the majority of teachers work with programs for preparing and editing video tasks: Movavi – 46.7%, iMovie – 21.8%, Learnis – 16.9%, Camtasia – 9.6%, and 18.4% are not familiar with the above software list (shown in Figure 7).

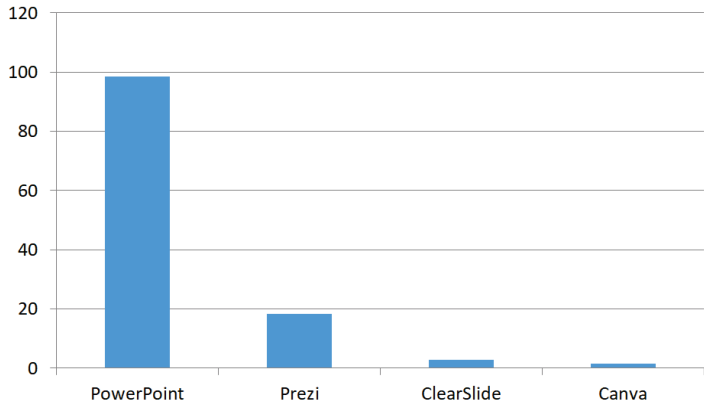


Figure 5. Types of services for creating presentations used by teachers in their professional activities

Source: Own work.

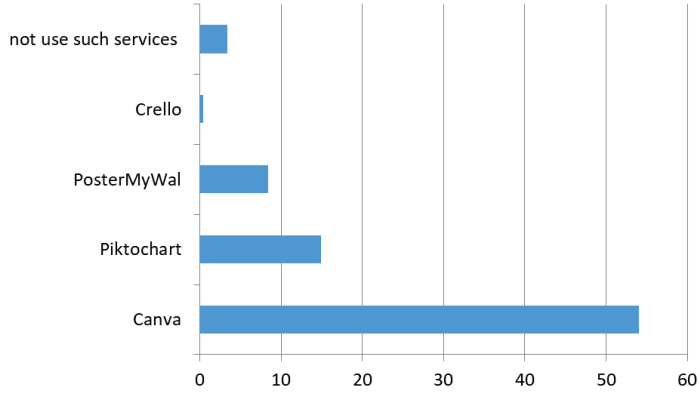
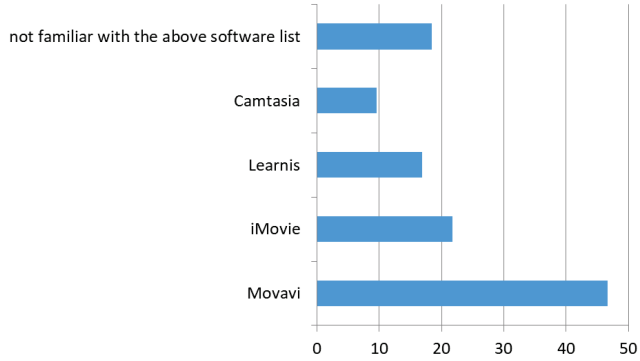


Figure 6. Types of services for creating graphics and infographics used by teachers in their professional activities

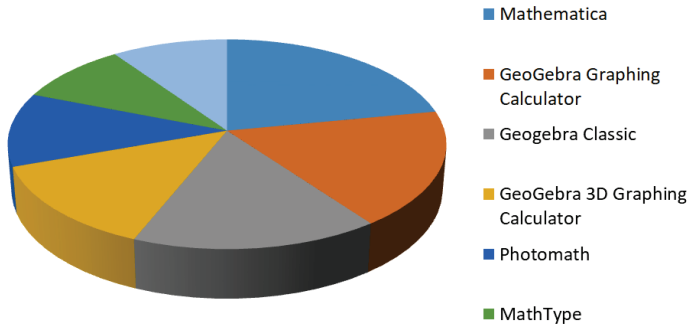
Source: Own work.



F i g u r e 7. Types of programs for preparing and editing videos used by teachers in their professional activities

S o u r c e: Own work.

Special digital tools play an important role in mathematics teaching. In this regard, we were interested in the experience of using mathematical packages, digital tools used by mathematics teachers. The most commonly used applications are Mathematica (29.5%), GeoGebra Graphing Calculator (24.1%), Geogebra Classic (21.8%), GeoGebra 3D Graphing Calculator (18.0%), Photomath (15.3%), MathType (12.6%), MathCAD (13%) (shown in Figure 8).



F i g u r e 8. Types of digital specialized mathematical tools used by teachers in their professional activities

S o u r c e: Own work.

The next rating group: Advanced Grapher, Pythagoria, LiveMath, Geometryx, Derive with a rating of 8.0%, 5.4%, 4.6%, 4.2%, 3.8%, respectively. Almost never used is Euclidea (0.4% of respondents). Unfortunately, 22.2% of teachers do not use such content in their practice.

For compiling tests teachers mainly use: Google Forms (93.1%), Classtime (28.0%), and Online Test Pad (19.2%). And only 6.9%, 1.9%, 0.4%, respectively, are familiar with Mentimeter.com, Webanketa, Simpol services. Applications Microsoft Forms, Kahoot!, tests of Ukrainian websites “Vseosvita” and “Na urok” are used by 0.4% of respondents who indicated them as “Own answer”.

93.1% of respondents try to diversify classes with the help of quizzes, games, exercises created using digital content, 74.7% of which use Learningapps for this, 33.0% – Quizizz, 25.3% – "Crossword Factory". Ukrainian teachers are less familiar with the services Learnis (14.9%), Liveworksheets (13.4%), Crosswordus (11.1%). The least used ones are Wizer me – 8.0%, CROSS – 6.1%, Flippity – 3.1%. It should be noted that 6.9% of teachers do not use this type of activity in their work.

Based on the characteristics of the cognitive processes of pupils, who are representatives of the digital generation, it is no less important to structure the educational material in teaching mathematics, the results of which can be presented in the form of a mind map. It is obvious that using services for creating mind maps is expedient. Respondents' answers to the question about the types of mind maps which they have used are shown in Figure 9.

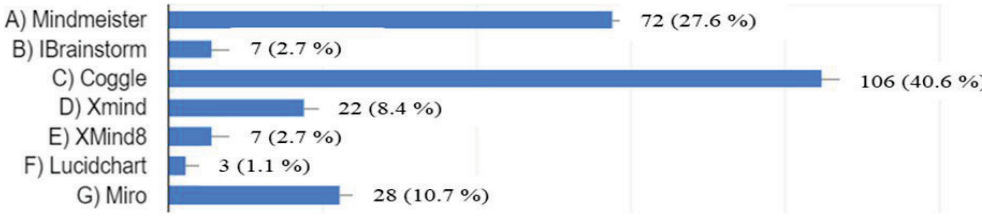


Figure 9. Mind maps in teachers' work

Source: Own work.

The percentage of those who do not use such services, unfortunately, turned out to be high – 21.5%, which is a cause for concern, as the presentation of educational material in a structured form affects the effectiveness of teaching mathematics.

To implement distance learning, 75.1% of respondents use Zoom, while 55.2% also use Padlet. Services such as Rizzoma and Scrumlr turned out to be unfamiliar to the respondents. 0.4% of teachers tried to use Google Meet, Whiteboard, Droo, Jamboard in their work.

Answers to the question "Which educational platforms did you accede?" presented in Figure 10.

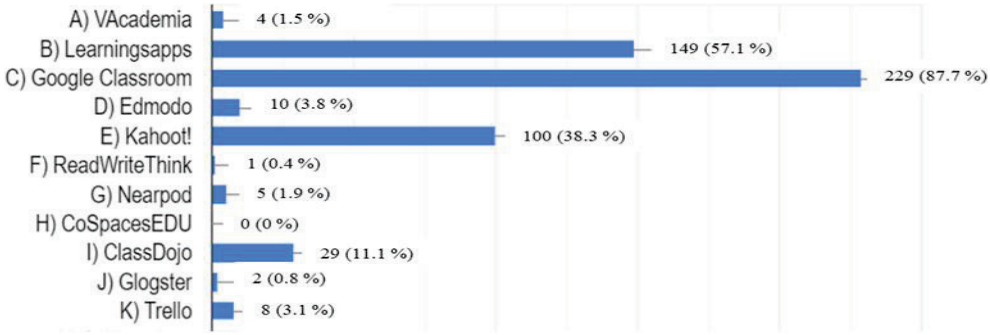


Figure 10. Use of educational platforms

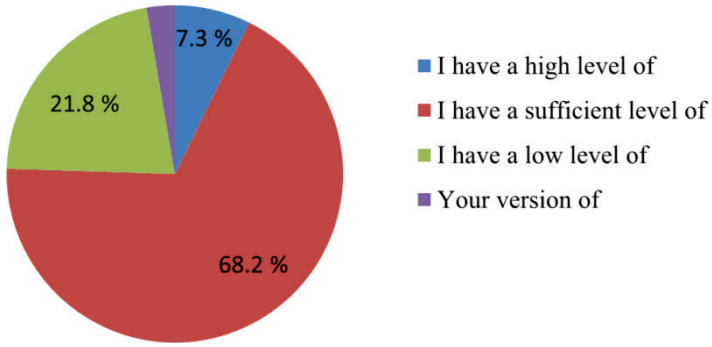
Source: Own work.

In addition to the platforms mentioned above, Microsoft Teams and "Na Urok" are used (0.4% of respondents each). We would like to note that there were no negative answers to this question.

The survey also included the teachers' self-assessment of ICT competence level (Figure 11). It is encouraging that the majority of teachers rated their level as sufficient, and 21.8% as high.

At the same time, 0.4% of teachers assessed their level as zero. And 42.2% of those who assess their ability to use digital tools at a low level want to improve it.

67.0% of teachers are ready to continue mastering software tools for working with multimedia information, 41.0% are ready to master virtual programs for working with sound and music files, 31.0% want to master new programs for preparing presentations, 39.8% – to improve their skills in using graphic editors, 22.6 and 26.1%, respectively, want to improve the skills in computing automation systems and control systems databases, 16.9% and 10.3% want to master the skills of working with spreadsheets and word processors.



F i g u r e 11. ICT competence of the respondents

S o u r c e: Own work.

At the same time, there is a noticeable trend towards the development of ICT competence through the development of new services, in particular, software tools for working with multimedia information, and for this, 79.2% of teachers need seminars, webinars and training.

Measuring respondents' awareness of the content and organisational parameters of the introduction of digital teaching tools at this stage of the study did not provide for identifying the criteria for the effectiveness of their use by teachers. The study was aimed only at identifying the general level of activity in the use of digital educational content by teachers. The experimental data obtained by means of a generalized percentage illustrate the general dynamics in the use of various application packages. This allows us to determine the prospects for further scientific research in this direction, which envisages the development of a clear criteria base and a set of features that can be used to diagnose the levels of ICT competence of contemporary Ukrainian teachers with their subsequent verification by means of mathematical statistics.

CONCLUSION

1. Based on the results of the analysis of scientific sources and methodological, statistical, informational and instructional literature, it has been established that the development of mathematical education worldwide is moving towards the creation of a digitally based learning environment. Many researchers have devoted their research to the study and development of digital tools that help students understand and assimilate educational material, provide its visualisation, create opportunities for research activities, and provide immediate feedback.
2. Among the digital tools which can be used for teaching mathematics, there are universal programs (creating presentations, educational videos, tables, tests, etc.) and specialised software packages for teaching mathematics (Geogebra, Mathematica, MathCAD, etc.).
3. Various combinations of both universal and specialised software tools can be used to organise a digital learning environment. To determine the most popular digital services among primary school teachers, mathematics teachers, vocational school teachers and university teachers in Ukraine, we included the majority of well-known digital tools in the content of the questionnaire and invited teachers to answer the questions of the anonymous online questionnaire posted on social networks. The activity of teachers should be noted – we received 261 responses.
4. Among the universal software packages, the most popular ones among Ukrainian teachers are programs for creating presentations for lessons (MS PowerPoint, Prezi, SlideRocet, VoiceThread, etc.) and text editors (Microsoft Word, Word Perfect, ChiWriter, Multi-Edit, Open Office, etc.). In particular, the most popular program for creating presentations is PowerPoint, and for creating infographics – Canva, video – Movavi. Among the specialised programs for teaching mathematics to pupils, Ukrainian teachers use Mathematica and Geogebra services the most.
5. Primary school teachers (41.2%) and mathematics teachers (41.4%) took part in the survey, and more than half of the respondents have extensive teaching experience – more than 20 years. 99.6% of respondents have the experience in distance and blended learning, while 94.6% have used digital services. It should be noted that Ukrainian teachers have a long experience of using ICT, in particular, 25.3% have been using digital technologies for more than 10 years, and 31.0% – from 5 to 10 years. However, most of them use digital content from educational channels (82.4%), and only 60.2% use digital tools and web services to create educational digital content. In fact, the use of digital resources by teachers is mostly carried out from time to time (70.9%), and only 16.9% – use digital support in lessons constantly.

Interpretation of the results of monitoring the dynamics of teachers' activity of using various ICT technologies allowed us to notice a trend towards the development of ICT competence through the development of new services, in particular, software tools for working with multimedia information, and to this end, 79.2% of teachers need seminars, webinars and training. The survey implied self-assessment of the level of

ICT competence of practising teachers. 68.2% of teachers considered the level to be «sufficient». This is the basis for the conclusion that subsequent work on increasing the level of ICT competence of teachers and lecturers can be carried out based on the existing set of skills and abilities in the use of digital educational content.

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