



METHODOLOGY FOR THE USE OF DIGITAL SERVICES IN THE ORGANISATION OF ONLINE AND OFFLINE EDUCATION OF PRIMARY SCHOOL CHILDREN

Svitlana Skvortsova¹, Tetiana Symonenko², & Tetiana Britskan³

¹ South Ukrainian National Pedagogical University named after K. Ushynsky,
Staroportofrankivs'ka 26, Odesa, 65020, Ukraine

² Bohdan Khmelnytsky National University at Cherkasy,
Shevchenko Boulevard 81, Cherkasy, 18000, Ukraine

³ Izmail State University of Humanities, Riepina12, Izmail, 68600, Ukraine

¹ skvo08@i.ua, ORCID 0000-0003-4047-1301

² simonenkotetana9@gmail.com, ORCID 0000-0001-5963-0451

³ britskan1994@gmail.com, ORCID 0000-0001-7277-4169

Abstract: *The article presents the results of a study on the problem of training future teachers in the use of a selection of online services in mathematics lessons during online and offline learning. The research was conducted in two stages: theoretical and experimental. At the theoretical stage, as a result of a comparative analysis of the possibilities of online services for organising the education of primary school children and based on the features of the structure of the combined lesson and types of educational activities, we developed a selection of online services and created appropriate recommendations for the use of individual templates in each of them for particular types of tasks. The study of the possibilities of online services for the organisation of online and offline training took place according to the developed plan. As a result of the conducted research, in accordance with the structure of the combined lesson, combinations of online services were selected, with the help of which you can implement all stages of the lesson and make certain types of mathematical tasks interactive.*

At the experimental stage, the developed selection was introduced into the methodological training of students of the Ushynsky University and Izmail University. As a result of mastering the selected set, students demonstrated creative tasks for organising a combined primary school mathematics lesson with the possible use of online services.

Keywords: ICT, online services, teaching mathematics, combined lesson, primary school children.

INTRODUCTION

In recent years, the problem of organising learning with the use of ICT, caused by the COVID-19 pandemic, has become topical. In Ukraine, as of 24 February 2022, this problem has become even more acute as schools have switched to distance learning under martial law. And therefore, based on today's challenges, it has become impossible to train students without the use of digital tools. Therefore, future teacher training should also be aimed at forming students' ICT competences.

1. ORGANISATION OF PRIMARY SCHOOL MATHEMATICS TEACHING WITH THE HELP OF ICT

The problem of using ICT in teaching primary school pupils is quite relevant in the research space (Tuparova, Kaseva, 2016; Borysenko, Bykonja, Rembach, Shumna, Oliinyk, Anishchenko, 2020; Dukic, Petrinsak, Pinjusic, 2020). In teaching mathematics, teachers use a variety of ICT tools – web services that can be used to create their own interactive/non-interactive learning content.

The results of the study of the most popular online services that can be used in teaching primary school children online are reflected in the work of researchers such as (Aleksieva, 2021; Urrutia, 2021; Dziabenko & Budnyk, 2019; Skvortsova, Britskan, & Haievets, 2020; Skvortsova & Britskan, 2021; Skvortsova, Britskan, Symonenko, & Haievets, 2022; Haitan, 2022); and the offline learning context studied by (Vanderlinde, Aesaert, & van Braak, 2015; Skvortsova & Britskan, 2018; Skvortsova & Britskan, 2019; Skvortsova, Onopriienko, & Britskan, 2019). We define offline learning as traditional learning that takes place within a classroom or school auditorium with the direct presence of teachers and students. Features of mathematical content creation using web services are explored by (Dziabenko & Budnyk, 2019; Aleksieva, 2021; Skvortsova & Britskan, 2021 and others). However, the question of developing a set of online services to help organise mathematics teaching is still open and requires further research.

The aim of the article is to prepare future primary school teachers to use a set of web services in the process of for the organisation of online and offline mathematics learning for primary school pupils.

The study of the set of web services for the organisation of online and offline learning of primary school children was carried out in two stages: theoretical and experimental. The tasks of the first stage were: 1) to conduct a comparative analysis of the possibilities of web services for organising learning for primary school children, taking into account the peculiarities of the structure of combined mathematics lessons and types of educational activities; 2) to develop a set of web services; 3) to provide appropriate recommendations for the use of individual templates in each service for specific types of mathematical tasks.

The purpose of the article is to prepare future primary school teachers to use a selection of online services for the organisation of online and offline learning in the process of teaching mathematics students.

In the process of work, we used a set of research methods: theoretical (analysis of scientific, scientific and methodical literature, synthesis, systematization, generalization and comparison) and empirical (confirmatory and formative experiment for diagnosis and verification of the effectiveness of the developed selection and its implementation in the methodological training of students, methods of mathematical statistics for the purpose of processing and summarising the obtained data).

The study of a selection of online services for the organisation of online and offline education of primary school children was carried out in two stages: theoretical and experimental. The first stage tasks: 1) to carry out a comparative analysis of the possibilities of online services for organising the education of primary school children, taking into account the peculiarities of the structure of the combined mathematics lesson and types of educational activities; 2) develop a selection of online services; 3) provide appropriate recommendations for the use of individual templates in each service for individual types of mathematical tasks; 4) introduce the developed selection into the methodological training of future primary school specialists.

We started the first stage of the research back in 2018. For 5 years, we conducted a survey of teachers in order to find out the relevance of the problem of using digital tools by primary school teachers and to determine the online services that are most used by teachers (Skvortsova, Britskan, Symonenko, & Haievets, 2022). Based on the needs of teachers, the list of online services was supplemented every subsequent year.

1.1. Comparative analysis of services according to the structure of the mathematics lesson

The main form of teaching mathematics is a lesson. Each lesson is designed according to the goal, and its content is subject to a number of tasks that ensure the achievement of the goal. Based on the goal of learning mathematics outlined by the standard, the general goal of each section is determined, which is specified for a separate series of lessons. Depending on the educational content of the section and programme requirements for its mastery, a series of lessons can realise the goal. The goal can be related, for example, to the formation of the concept of number, calculation skills, the concept of a problem, the ability to solve problems, etc. (Skvortsova & Onopriienko, 2019).

In primary school, mathematics lessons of the combined type prevail, in which several didactic goals are solved, and various methods of teaching organisation are used. According to the structure of the combined lesson, 5 stages are distinguished. Based on the types of work at each stage of the combined mathematics lesson, we selected a set of online services that will help the teacher organise the work of students in the lesson in online and offline learning conditions.

It should be noted that the comparative analysis of online services and work algorithms in each of the services are presented in the works (Skvortsova & Britskan, 2021; Skvortsova, Britskan, Symonenko, & Haievets, 2022).

The first and important stage of an online and offline mathematics lesson is the motivation of students' educational and cognitive activities. Based on the characteristics of primary school children – representatives of the digital generation (Skvortsova & Onopriienko, 2019), this stage of the lesson should be made clear, one that sets students up for activity and arouses their interest. During distance learning, without live communication in real time, the teacher must set the students to work, explain the purpose and tasks of the lesson. The teacher must tell which online services will be used and give specific instructions for using these services.

Organisation of the motivation of students' educational and cognitive activities usually takes place in the form of a conversation. The content of this conversation, based on the topic of the lesson, contains interesting facts, historical information about the emergence or discovery of a mathematical concept, law, action, etc. or situations from the life of a modern person, which requires students to apply new knowledge or a method of action. It is advisable to illustrate this information with visual content, in particular video. In the format of both offline and online learning, a small video can be prepared using MS PowerPoint, Renderforest and Canva services to illustrate the need to learn a new concept or method of action.

The next stage of the mathematics lesson is the actualisation of basic knowledge and methods of action, which involves the revision of knowledge and skills that are the basis for perceiving, understanding and realising new educational material or a method of performing a new action.

Usually, a mathematics lesson in primary school starts with a “Geometric Minute” that allows students to focus and tune in to work. During the geometric moment, the students' attention is focused on determining essential and non-essential, common and distinctive features of geometric shapes, finding out the regularity in the location of a series of geometric shapes and its continuation, on a detailed examination of spatial shapes, their sweeps and methods of obtaining them, etc. To spend a geometric moment in both online and offline learning conditions, it is advisable to use interactive exercises that give the learner instant feedback. Interactive lessons with the above content can be created using the LearningApps and Wizer.me services.

Also, at the beginning of the lesson, mathematicians often use a type of work such as oral numbers. It is obvious that for oral arithmetic it is advisable to use interactive exercises that involve automatic checking of correctness. Such exercises can be created with the help of online services LearningApps, H5P, Liveworksheets and Wizer.me. One of the types of tasks offered to pupils at the stage of actualisation of basic knowledge and methods of action is mathematical dictation. Mathematical dictation is a special type of task, when tasks of mathematical content are offered in oral form, using mathematical terminology. Although the tasks offered during mathematical dictation are not difficult, but taking them by ear and at the pace set by the teacher causes certain stressful conditions in pupils. In order to avoid such situations, under the conditions of distance learning, it is possible to present the task of mathematical dictation in the form of a video or audio file, which the learner can listen to at a pace convenient for him. Also, tasks for mathematical dictation can be submitted in the format of interactive exercises created in the LearningApps, H5P, Wizer.me services.

At the stage of actualization of basic knowledge and methods of action, an oral survey of students is also conducted, the purpose of which is to revise the meanings of mathematical concepts, rules, laws of arithmetic operations, etc. To organise an oral survey on theoretical questions, in the conditions of distance or online learning, it will be appropriate to use the services ClassDojo, Padlet, H5P.

In addition, an individual survey is also conducted at this stage of the lesson. To this end, it is advisable to use interactive exercises created in the services LearningApps, Liveworksheets, Wizer.me, Classtime, H5P.

The third stage of the lesson is the formation of new knowledge and methods of action. Implementation of this stage in the conditions of distance learning can be carried out with the help of creating an interactive video (H5P) and performing tasks under the guidance of the teacher (LearningApps, Liveworksheets, Wizer.me, Classtime, H5P).

The next stage of the mathematics lesson is consolidation and formation of abilities and skills. At this stage, you can widely use interactive tasks created in the services LearningApps, Liveworksheets, Wizer.me, Classtime, H5P.

At the end of the lesson, there is a reflection and summary of the lesson. In the conditions of distance or online learning, reflection of educational and cognitive activity, as well as motivation, is implemented in the format: audio/video recording (MS PowerPoint, Renderforest, Canva, Padlet), offering students to continue the following sentences: "I know, what..."; "I can explain..."; "I understand..."; "I can do..."; "I'm checking..."; "I'm trying..."; "I feel that I need..." and others.

As a result of the conducted research, in accordance with the structure of the combined mathematics lesson, we have developed a selected set of online services, with the help of which you can implement all stages of the lesson and make certain types of mathematical tasks interactive.

2. EXPERIMENTAL TRAINING OF FUTURE PRIMARY SCHOOL TEACHERS IN THE APPLICATION OF THE SELECTION OF ONLINE SERVICES

2.1. The purpose, tasks and tools of the research

The second stage of the research involved the introduction of the developed selection into the methodological training of students majoring in Primary Education of the State Institution "Southern Ukrainian K.D. Ushynsky National Pedagogical University" (Ushynsky University) and Izmail State University of Humanities (Izmail University).

During the research, the reliability of the obtained results was checked using the K. Pearson agreement criterion (χ^2 chi-square). For this purpose, two hypotheses were put forward: the first is the null hypothesis (H_0), which states that teacher preparation for the use of ICT in teaching mathematics using a selected set of online services does not have any advantages – the differences between the developed selection and the standard use of ICT tools are declared equal to zero. In the second, alternative hypothesis (H_1), an assumption is made about the advantages of training

future primary school teachers for the use of ICT in teaching mathematics using the developed set of services.

At the stage of the ascertainment experiment for the selection of the experimental and control groups, an entrance test was conducted, which made it possible to determine the state of success in the use of ICT in the process of teaching mathematics to primary school children. For this purpose, testing of third and fourth year students of three universities – Ushynsky University, Izmail University and Vasyl Stefanyk Precarpathian National University, total of 70 subjects was conducted. The questions of the test related to the students’ awareness of various online platforms and services and the skills of working in them. Each correct answer was valued at 1 point. For each student, the test performance coefficient was calculated – the ratio of the number of points scored by the student to the maximum number of points under the conditions of correct completion of all test tasks. Next, the average coefficient of performance of the test for each university was calculated. So, as a result of the analysis of the entrance test at the ascertainment stage of the research, it was found that students of Ushynsky, Izmail and Precarpathian universities have approximately the same level of competence in the field of ICT (Table 1).

Table 1. Results of entrance testing of students

Levels of ownership of ICT tools	Low		Average		Sufficient		High	
	Number of students	%	Number of students	%	Number of students	%	Number of students	%
Ushynsky University	2	8.3	9	37.5	10	41.7	3	12.5
Izmail University	1	6.25	6	37.5	7	43.75	2	12.5
Precarpathian University	3	10	12	40	12	40	3	10

Source: Own work.

The study participants were conditionally divided into experimental (40 students of Izmail and Ushynsky universities) and control groups (30 students of Precarpathian University). Experimental training was conducted for 5 months in the II semester of the 2021/2022 academic year. EG students mastered the selection developed while studying at the Ushynsky University a separate module “Using information technologies in teaching problem solving” as part of the chosen discipline “Methodology of teaching problem solving”, at Izmail University – “ICT in teaching mathematics of primary school children” within the scope of teaching the normative discipline “Methodology of teaching mathematics in primary school”. CG students considered the use of ICT in teaching mathematics to primary school children from time to time, completing tasks in separate online services, without studying the developed complex.

2.2. Research progress

At the formative stage of the research, the following tasks were solved in the process of working with EG students:

1. exploration of the possibilities of online services for the organisation of online and offline training.
2. demonstration of the system of organising primary school mathematics lessons with a possible combination of online services, including in a distance learning setting;
3. implementation of individual creative projects: creation of tasks for a remote mathematics lesson in accordance with its structure and the possibility of combining online services; analysis of the quality of interactive student exercises created in specific services, the levels of interactive content development and the correctness of their combination;
4. determination of the level of formation of students' knowledge of the possibilities of online services and the ability to combine them;
5. analysis of the results of the student survey of the module students regarding their motivation to use the developed selected set of online services and regarding the reflection of the acquired competences for further work.

In lectures, students received general theoretical information about using services. In the seminar and laboratory classes, students mastered practical material aimed at highlighting the features of creating educational content with the use of various templates of individual services; they considered the templates to be used at each stage of the mathematics lesson and the algorithm for creating tasks in each of them; they received methodological recommendations on the specifics of using the created content in mathematics teaching; they became acquainted with teachers' experiences of using a separate service.

After a detailed introduction to the features of using the services, the students were shown a system for organising primary school mathematics lessons with a possible combination of services. By mastering the developed system, the students gained knowledge of the technical and methodological features of combining services in accordance with the structure of the combined mathematics lesson and acquired practical skills.

For the organisation of the first stage of the lesson – motivation of the educational and cognitive activity of primary school children, students learned how to create an educational video using MS PowerPoint, Renderforest and Canva services. They were given algorithms of several ways to create an educational video using the studied services: 1) create a presentation in MS PowerPoint with subsequent conversion in video format with audio background; 2) create a presentation in the Canva online service. Moreover, it can be downloaded in various formats, in particular in MP4 video format. When downloading a presentation in video format, it is possible to select only individual slides that will be presented in the video. It is convenient if the teacher uses the presentation not only of a separate stage of the lesson, but of the entire lesson. 3) create a 3-minute educational video using images and audio background for each animated scene in the Renderforest online service.

For real-time online lessons using Zoom, Google Meet, and other services, the prepared presentation and video can also be used at this stage of the lesson, voiced directly, and provide “live” communication with students. And when teaching at a distance, the created videos can be placed in virtual classrooms / virtual whiteboard. Traditionally, the second stage of a mathematics lesson includes various types of learning activities for students, one of which is the “Geometric Minute”. To organise it, students created interactive exercises on LearningApps and Wizer.me. These services allow the use of images with pre-prepared geometric shapes. In the LearningApps and Wizer.me services, such exercises can be created using the “Quiz” templates, choosing the correct answer from the ones proposed, and “Match the pair”, combining elements according to a certain feature. Note that in the LearningApps service, this template allows you to create pairs of elements of different formats, and in Wizer.me, creating pairs involves connecting their elements using a curved line. The only difference between such exercises in these services is that in LearningApps all elements are arranged randomly, while in Wizer.me all elements are divided into two groups and it is impossible to connect elements of one group. Also, when creating such an exercise, a setting must be used so that correctly formed pairs do not automatically disappear, and the number of elements for selecting a pair does not decrease.

In a traditional education setting, the teacher can offer the students to scan the QR code of an interactive task with the help of a gadget, or go to its link and do the exercise. Students receive immediate feedback – they get to know the results of their own work. In the case of distance learning, links to tasks of this type will be posted by the teacher in a virtual environment in which the entire class works. In a real-time online lesson, the student needs another digital device to complete the interactive tasks. This is due to the inconvenience of opening a new browser tab to do the exercise.

Also, at the second stage of a mathematics lesson, students are offered oral numeracy exercises. Oral arithmetic exercises were created by EG students in the LearningApps, H5P, Liveworksheets and Wizer.me services. To create interactive exercises for oral counting, we recommend using the “Omissions” template, which involves typing in answers. In these services, the templates for entering the answer have corresponding names: LearningApps – “Cloze text”, Liveworksheets – “Textboxes”, Wizer.me – “Blanks”, H5P – “Fill in the Blanks” and “Flashcards”. Note that the exercises created with the help of such templates have certain variations: the student fills in the blank by typing in the answer, or chooses the correct option from the drop-down list. The exception is the tasks created using the Textboxes template in the Liveworksheets service, which only requires writing the correct text answer without a choice. If in the LearningApps, H5P services the teacher must independently type in tasks for oral numeracy, then in the Liveworksheets and Wizer.me services you can use photos or screenshots of fragments of pages of textbooks or textbooks, where oral numeracy tasks are given. Note that a slightly different presentation of the task for filling in the blanks – in the form of a card with a picture, under which the answer should be written in the text field, can be presented in LearningApps services using the “Freetext input” template and in H5P using “Flashcards”.

Oral numeracy tasks can also be created in all of the above services using the “Quiz” template. This template allows you to submit tasks for oral counting in the form of images – excerpts of textbooks or study books. The “Quiz” template in each service has its own name, in particular: LearningApps – “Matching Pairs of Images”, Liveworksheets – “Multiple-Choice exercise”, Wizer.me – “Fill in an Images”, H5P – “Find the Hotpot or Multiple Choice “.

Obviously, it is advisable to use interactive tasks for oral numeracy both in the conditions of traditional education and during distance education.

Also, one of the types of learning activity at the second stage of the lesson is the students’ performance of mathematical dictation. EG students learned to create interactive mathematical dictations using PowerPoint, Renderforest, and Canva. The created materials were then uploaded to the Padlet virtual whiteboard, or to a virtual classroom.

It is no less appropriate to use interactive exercises for mathematical dictations, the condition of which is presented in the form of video or audio: LearningApps – “Freetext input” template, Wizer.me – “Fill in an image”, H5P – “interactive video”. In our opinion, the most interesting form of submitting mathematical dictation is an interactive video in the H5P service – a video with stops for performing interactive exercises. An interactive video is created on the basis of a previously prepared video (PowerPoint, Renderforest, Canva) and contains interactive tasks. The student watches the video and performs the exercises independently. The student can perform interactive exercises sequentially or in random order; the service can either enable the student to complete the next task without answering the previous one, or require the sequential execution of all tasks, depending on the teacher’s settings. Note that the possibility of creating an interactive video is provided only in the paid version of the H5P service.

EG students learned to use the ClassDojo service to organise an oral survey), in which the teacher can create a task with a video-answer format. During the performance of such a task, the pupil’s device camera is instantly turned on and video recording begins. A similar task can be created on the Padlet virtual whiteboard, specifying in the task description that there should be a video or audio response. Giving permission to students – participants of the virtual board, to create their posts, the student clicks on the “Create a post” mark and chooses an audio or video format. So, instantly on the same device, the microphone and/or camera is turned on and the recording starts. It is also possible to record audio answers to tasks in the H5P service. Another form of work at this stage of the lesson is an individual survey, which can be organised with the help of interactive exercises, created in the services, which contain templates for choosing the correct answer from a drop-down list and dragging and dropping (LearningApps, Liveworksheets, Wizer.me, H5P).

EG students learned to organise the stage of formation of new knowledge and methods of action in two formats: 1) execution of an interactive video in the H5P service; 2) performing tasks under the guidance of the teacher, created with the help of services, LearningApps, Liveworksheets, Wizer.me, Classtime, H5P. It should be noted that the use of online services at this stage of the lesson is somewhat limited, as it requires feedback from students, which to some extent only interactive video can

provide. At the same time, recently more and more researchers, developing mobile applications for learning mathematics, create short educational videos to explain new material, and the knowledge gained after watching the video is consolidated during the game.

EG students gained experience in organising the next stage of the mathematics lesson – consolidation and formation of abilities and skills by creating interactive exercises. Such tasks can involve step-by-step commentary and are performed under the guidance of the teacher (H5P, Canva services), or offered as independent work by students (LearningApps, Liveworksheets, Wizer.me, Classtime, H5P).

To implement the reflection and summary of the lesson, EG students created videos using MS PowerPoint, Canva, Renderforest, and Padlet services. The created video was then placed in a virtual classroom or on a virtual Padlet board, where students watch it and give audio or video responses. At the same time, students can give audio and video responses, continuing the specified statements, which are presented in text format either on the Padlet virtual board or on the ClassDojo service bulletin board. Thus, in the process of experimental training, EG students explored the possibilities of using online services at different stages of the primary school mathematics lesson. They have gained experience in delivering a remote mathematics lesson in Google Classroom / ClassDojo or on Padlet / Lino.it virtual board. It should be noted that the acquired knowledge regarding the organisation of distance and mixed learning using a selected set of online services was applied by EG students during the simulation of future professional activities in practical classes.

Meanwhile, practice shows that over the past two years, teachers mostly use distance learning in real time, conducting online lessons. Google Meet, Zoom, MS Teams, Skype are the most common services for conducting an online mathematics lesson. These lessons also involve the performance of interactive exercises that can be placed in the above-mentioned services, and therefore the option of reverse communication with the teacher can be the same.

As a result of mastering the specified module, EG students completed creative projects – creating tasks with the help of online services in accordance with the structure of the combined mathematics lesson in elementary school. While completing the task, students demonstrated awareness of using online services and templates for creating interactive exercises of these services, understanding the features of selecting appropriate service templates for the implementation of a certain task; the possibility of combining online services when organising a distance lesson, compensating the disadvantages of certain services with the advantages of others. It should be noted that CG students also performed projects that involved creating interactive exercises in mathematics, but without special training in the use of the specified set of online services.

2.3. Research results

The creative projects created by students were evaluated according to the following criteria: content-related, practical, methodological, technical, aesthetic, and systemic. According to these criteria, the students' levels of mastery of the ability to apply the

developed complex in the educational process were determined: low, average, sufficient and high (Figure 1).

Only 10% of CG students demonstrated a low level of mastery of the ability to use online services to implement the stages of the mathematics lesson. An average level was demonstrated by 25% of EG students and 50% of CG students. 60% of EG students and 40% of CG students achieved a sufficient level. Only 15% of EG students achieved a high level.

At the end of the experiment, we find that $\chi^2_{emp} = 18.67$. Given that $\chi^2_{0.05} = 7.815$ for this case as well, we get $\chi^2_{emp} > \chi^2_{0.05}$. In summary, the characteristics of the compared samples in EG and CG after the experiment differ with 95% confidence. Therefore, the null hypothesis (H0) is rejected and the alternative hypothesis (H1) is accepted.

The analysis of the conducted research therefore leads to the conclusion that the developed and theoretically justified selected set of online services, which formed the basis of the experimental training, produces higher results than during traditional training.

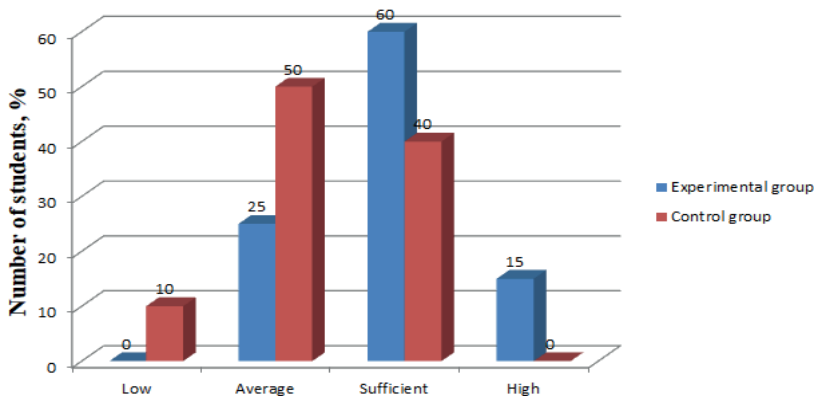


Figure 1. Results of evaluation of individual projects of EG and CG students

Source: Own work.

CONCLUSION

We investigated a selected set of web services for the organisation of online and offline mathematics education for primary school children, which includes such popular services as LearningApps, Classtime, Liveworksheets, Wizer.me, H5P, Google Classroom, ClassDojo, Padlet, Lino.it, MS PowerPoint, Renderforest and Canva. It was found that in traditional and distance learning settings, the main form of mathematics teaching is a lesson. In primary school, the predominant form is the combined-type mathematics lessons, in which several learning objectives are solved and various methods of teaching organisation are used. According to the structure of the combined lesson and based on the types of work at the different stages of the combined mathematics lesson, we selected a set of online services to help the teacher organise students' work in the lesson.

To organise the motivation of the students' learning activities, we propose the use of an educational video, which can be created using MS PowerPoint, Renderforest, and Canva.

At the stage of updating the basic knowledge and methods of the activity, we recommend using such services as LearningApps, Liveworksheets, Wizer.me, H5P, Renderforest, ClassDojo, Padlet.

For the third stage of the lesson, in a distance learning setting, we propose the creation of an interactive video (H5P), and while learning online or offline, along with the communication with the teacher, the completion of tasks under the teacher's guidance. The consolidation and formation of skills and abilities, in an online or offline learning environment, can be achieved through teacher-guided tasks (H5P, Canva) and self-directed interactive exercises (LearningApps, Liveworksheets, Wizer.me, Class-time, H5P).

In distance or online learning settings, the reflection of the learning and cognitive activity is realised in audio/video recording (Padlet, Renderforest, Canva, H5P) or in text format (Padlet, ClassDojo).

The second stage of the research involved the introduction of the results of the work into the system of training future teachers of the "Primary Education" specialty – at the Ushynsky and Izmail universities. Students were shown a system for organising primary school mathematics lessons with a possible combination of online services, including distance learning.

The results of the experimental training testify to the effectiveness of the introduction of the developed selected set of online services in the process of training future teachers with a view to applying the acquired skills and abilities in further professional activities in teaching mathematics to primary school children. The training of future primary school teachers using the developed set of online services proved to be more effective, compared to the traditional one.

Further research may involve expanding the range of online services for creating educational content in mathematics, including a complex of research environments, in particular Phet.

REFERENCES

- Aleksieva, L. (2021). Electronic resources for online mathematics primary education – specifics, types, quality. *Mathematics and informatics*, 64(1), 62–83. <https://doi.org/10.53656/math2021-1-5-ele>.
- Basogain Urrutia, J.X. (2021). The management of e-learning platforms and online assessment in primary education through the prism of school engagement and school culture. In E. Smyrnova-Trybulska (Ed.). *E-Learning in the Time of COVID-19*. "E-Learning" 13 (pp. 89–99). <https://doi.org/10.34916/el.2021.13.08>.
- Borysenko, I., Bykonja, O., Rembach, O., Shumna, L., Oliinyk, O., & Anishchenko, V. (2020). Experience of ICT implementation in primary curriculum in Ukraine and the United Kingdom of Great Britain and Northern Ireland. *Information technologies and learning tools*, 75(1), 42–55. ISSN 2076-8184.

- Dukić, D., Petrić, S., & Pinjarić, P. (2020). ICT in the Primary school: Practise and Attitudes of Informatics Teachers. *Tehnicki Glasnik-Technical Journal*, 14(3), 257–264. <https://doi.org/10.31803/tg-20200403052511>.
- Dziabenko, O. & Budnyk, O. (2019). Go-lab ecosystem: using online laboratories in a primary school. In L.G. Chova, A.L. Martinez, I.C. Torres (Eds.), *EDULEARN19 Proceedings* (pp. 9276–9285). Spain: IATED Academy. <https://doi.org/10.21125/edulearn.2019>.
- Haitan, O. (2022). Comparative analysis of possibilities of using the toolkit of webinar-based platforms Zoom, Google Meet and MS Teams in online-learning. *Information Technologies and Learning Tools*, 87(1), 33–67. <https://doi.org/10.33407/itlt.v87i1.4441>.
- Skvortsova, S. & Britskan, T. (2021). Distance mathematics lessons in primary school: services for creating interactive exercises. In E. Smyrnova-Trybulska (Ed.), *E-Learning in the Time of COVID-19. “E-Learning” 13* (pp. 225–237). Katowice–Cieszyn: STUDIO NOA for University of Silesia. <https://doi.org/10.34916/el.2021.13.19>.
- Skvortsova, S. & Onopriienko, O. (2019). *Nova ukrainska shkola: metodyka navchannia matematyky u 1–2 klasakh zakladiv zahalnoi serednoi osvity na zasadakh in-tehratyvnoho i kompetentnisnoho pidkhodiv*. Kharkiv: Ranok. ISBN 978-617-09-6042-9.
- Skvortsova, S. & Britskan, T. (2018). Training for future primary school teachers in using service learning apps teaching mathematics. *International Journal of Research in E-learning*, 4(1), 59–77. <https://doi.org/10.31261/IJREL.2018.4.1.05>.
- Skvortsova, S. & Britskan, T. (2019). Training for primary school teachers in using service Plickers teaching mathematics. *Mathematics, information technologies and applied science (post-conference proceedings of extended versions of selected papers)*, June 20–21, 2019. Brno, 74–87. ISBN 978-80-7582-123-2.
- Skvortsova, S., Britskan, T., & Haievets, Y. (2020). E-course “Internet resources for creating mathematical learning and game content for primary school children”. In E. Smyrnova-Trybulska (Ed.), *E-learning. Innovative Educational Technologies, Tools and Methods for E-learning. “E-learning” 12* (pp. 65–76). Katowice–Cieszyn: STUDIO NOA for University of Silesia. <https://doi.org/10.34916/el.2020.12.06>.
- Skvortsova, S., Britskan, T., Symonenko, T., & Haievets, Y. (2022). Interactive tools for creating educational content for primary school students. In L.G. Chova, A.L. Martinez, I.C. Torres (Eds.), *INTED2022 Proceedings* (pp. 9005–9014). Spain: IATED Academy. <https://doi.org/10.21125/inted.2022>.
- Skvortsova, S., Onopriienko, O., & Britskan, T. (2019). Training for future primary school teachers in using service H5P teaching mathematics. In E. Smyrnova-Trybulska (Ed.), *E-learning and STEM Education. “E-learning” 11* (pp. 277–294). Katowice–Cieszyn: STUDIO NOA for University of Silesia, <https://doi.org/10.34916/el.2019.11.18>.
- Tuparova, D. & Kaseva, M. (2016). Information technologies in primary school-state and perspectives. *PEDAGOGIKA-PEDAGOGY*, 88(3), 320–337.
- Vanderlinde, R., Aesaert, K., & van Braak, J. (2015). Measuring ICT and contributing conditions in primary schools. *British Journal of Educational Technology*, 46(5), 1056–1063. <https://doi.org/10.1111/bjet.12282>.