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E-COURSE "INTERNET RESOURCES FOR CREATING MATHEMATICAL LEARNING AND GAME CONTENT FOR PRIMARY SCHOOL CHILDREN"

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Abstract: *The article presents the structure and content of the e-course "Internet resources for creating mathematical learning and game content for primary school children". The aim of the course is to introduce teachers to online services that help organize the distance learning of mathematics: services for creating a virtual classroom and filling it with interactive exercises and other educational content (LearningApps, Google Classroom, Classtime, Classdojo), services for organizing a distance lesson (Padlet), and services for conducting a distance lesson in the form of a conference (Zoom). The course is structured in 5 modules, each of which is dedicated to a separate Internet resource. Possibilities of using templates for the creation of tasks and class content in connection with separate kinds of mathematical tasks for an initial course in mathematics and realizing each of the stages of a math lesson in primary school are considered on specific examples within each module. E-course students received both theoretical knowledge about working in the service and practical advice from teachers who have experience with it. The course was attended by more than 400 students who provided positive feedback about it. The course is also implemented in the process of methodological training at the South Ukrainian National Pedagogical University named after K. Ushynsky, Vasyl Stefanyk Precarpathian National University and Izmail State University of Humanities. These universities take into consideration the results of non-formal education in assessing the academic achievements of students in the discipline "Methods of teaching mathematics in primary school".*

Keywords: ICT, e-course, online service, training for future primary school teachers.

INTRODUCTION

On August 10, 2018, the Order of the Ministry of Social Policy of Ukraine № 1143 approved the professional standard "Primary school teacher of secondary comprehensive educational establishments", which determines teachers' job functions as well as competencies that a primary school teacher must have to perform these functions. One of the job functions of a primary school teacher is to provide and support the education, upbringing and development of school children in the educational environment and family (job function B). To perform it, the teacher must have the ability to select appropriate methods, tools and forms of teaching in accordance with the set goals and objectives of the lesson, other forms of learning taking into account the specific content of educational material and school children's individual characteristics (On approval of the professional standard, 2018).

Scientists have proved in numerous studies that in the traditional organization of the learning process, the use of ICT significantly increases the efficiency of this process. Therefore, the set of teaching aids should include digital tools (Skvortsova, Britskan, 2019) (Kuzminska, Morze, Smyrnova-Trybulska, 2019).

In previous studies (Skvortsova, Ishchenko, Britskan, 2020) we found that 78% of primary school teachers in Odesa region (Ukraine) constantly use ICT in their work, 22% – periodically, but the usage of ICT generally means typing computer materials (93%), searching for information on the Internet (96% of teachers); conducting lessons using computer equipment (98%).

Obviously, in order for a teacher to use digital tools in his work, he must have ICT competency. To determine teachers' ICT skills, in the spring of 2019 we conducted a pilot survey of primary school teachers in Odesa region, they were students of advanced training courses of Izmail State University of Humanities (Skvortsova, Britskan, 2019). The survey involved 30 teachers who claimed that they all own a computer and have experience in using information technology in their professional activity. Although 80% have good skills (5 points on a five-point scale) of working on the Internet, only 10% have 5 points for the skills of working in a text editor Microsoft Word, 10% – for the ability to create presentations, 20% – for the ability to process graphics, 10 % – for the ability to perform calculations using a spreadsheet, 10% – for the ability to install the necessary software, 10% – for the ability to blog, 10% – for the ability to work in professional online networks, 10% – for the ability to create Web-sites. Thus, the ICT competencies of primary school teachers in Odesa region of Ukraine require development.

Studying the readiness of future primary school teachers and teachers of advanced training courses to use ICT, we found that 70% of students of advanced training courses (Skvortsova, Britskan, 2019) and 94% of future primary school teachers (Skvortsova, Britskan, 2018) consider it appropriate to use presentations in lessons, because they are a powerful tool that allows the teacher to visualize the learning content.

It should be noted that the issue of creating and using multimedia presentations has been comprehensively researched in pedagogical science. In particular, the features of the process of information perception and means of facilitating the perception of

educational information, which requires a special design, were studied by Lin (Lin, 2018). According to the results of CSEM analysis, scientists have identified the 5 most effective tools for creating multimedia presentations: MS Power Point, Prezi, Impress LibreOffice, SlideDog, ClearSlide / SlideRocket (Smyrnova-Trybulska, Ogrodzka-Mazur, Szafranska-Gajdzica et al., 2016). The system of requirements for multimedia presentations was developed by Skvortsova and Haran (Skvortsova, Haran, 2018): *requirements for visual and audio series of multimedia presentations, requirements for the text presented on presentation slides, requirements for presentation design*.
Thus, teachers have access to the recommendations of scientists to create multimedia presentations, but, in fact, their creation requires from the teacher skills in Power Point, etc., which, unfortunately, are not sufficient to develop good educational content.
It is also possible to increase the efficiency of teaching mathematics in primary school by using online services for teachers. Our research (Skvortsova, Britskan, 2018; Skvortsova, Onopriienko, Britskan, 2019; Skvortsova, Britskan, 2019; Britskan, 2019; Britskan, 2020) focuses on preparing teachers to use Web 2.0 services: LearningApps, H5P, Plickers, GIMKIT, Google Form. Our work contains practical recommendations for teachers on the use of these services, in particular in the process of teaching mathematics. We organized and conducted experimental training of teachers to work in these services and obtained results that prove the effectiveness of these Web 2.0 services in teaching primary school children (Skvortsova, Britskan, 2018; Skvortsova, Onopriienko, Britskan, 2019; Skvortsova, Britskan, 2019; Britskan, 2019; Britskan, 2020).
Based on the fact that primary school teachers’ ICT competency is insufficient, the possibilities of them using various digital tools are quite limited. This thesis is confirmed by the analysis of primary school teachers’ questionnaires, where they had to assess their own skills to work in professional online services: only 10% of teachers are fluent in using some of them, 10% rated their skills as 4 on a five-point scale, 10% – as 3 , 20% – as 2 and 50% – as 1 (Skvortsova, Britskan, 2019). Therefore, it is not surprising that only 24% of primary school teachers create educational and game content using Internet resources (Skvortsova, Ishchenko, Britskan, 2020), but 80% of teachers (Skvortsova, Britskan, 2019) consider it effective to use interactive exercises in teaching primary school children – representatives of the digital generation. Thus, the appropriateness of using ICT as a means of improving the efficiency of the educational process is undoubtful, but the question of teachers’ readiness to work with digital tools remains unresolved. The results of the survey of primary school teachers (Skvortsova, Britskan, 2019), (Skvortsova, Ishchenko, Britskan, 2020), demonstrate the urgent need for taking measures to prepare teachers for the use of ICT in the process of teaching primary school children.
The urgency of training primary school teachers for the use of ICT in the educational process has gained new meaning in 2020, when the quarantine was introduced due to the Covid19 pandemic, and educational institutions had to turn to distance learning. Teachers were forced to increase their ICT competency in the context of conducting online lessons, creating interactive tasks, organizing a virtual classroom and keeping a virtual journal.

Based on the needs of the educational community in the spring of 2020, we prepared and conducted a distance course for primary school teachers in Ukraine, which aimed at familiarizing teachers with online services that will help organize distance learning in primary school, including mathematics.

The aim of the article is to present the content and organization of the e-course "Internet resources for creating mathematical learning and game content for primary school children", as well as the analysis of feedback from teachers – students of the course. To achieve the aim, a set of theoretical and empirical research methods was used. To understand the level of primary school teachers' readiness to use ICT in professional activity, empirical methods were employed – a survey (questionnaire) of primary school teachers. Among the theoretical, the following methods were widely used: analysis and generalization of the data of teachers' questionnaires, comparative analysis of research results on the use of ICT in the educational process; which allowed to determine the peculiarities of creating educational and game content in mathematics for primary school children; comparative analysis of available e-courses on the use of certain services in the work of the teacher, as well as synthesis and theoretical modeling in the process of developing an e-course. The leading role was played by the pedagogical experiment, which confirmed the effectiveness of the developed e-course.

1. E-COURSE "INTERNET RESOURCES FOR CREATING MATHEMATICAL LEARNING AND GAME CONTENT FOR PRIMARY SCHOOL CHILDREN"

1.1. The aim and objectives of the course. Course program

The aim of the course is to familiarize teachers with the possibilities of online services for organizing teaching mathematics to primary school children, including distance learning. As a result of taking the e-course, students of the course are expected to learn the following:

- selecting an online service with the required functions to create educational content;
- creating educational content and present it to school children;
- organizing training using online services;
- algorithms of school children's work with online services;
- methodological features of using the opportunities of online services for organizing mathematics lessons.

The course is structured in 5 modules; each of them is dedicated to a separate Internet resource (https://zmist.op.ua/courses/internet-resursi-dlya-stvorennya-navchalnogo-ta-igrovogo-kontentu-z-matematiki/?fbclid=IwAR2R_1Gwd4S39TIqf-1crX6OHBaKrIfUO0JMW8M2-7xU0bVqIC9FRsJ1zaQA).

Each topic is considered according to the plan:

1. Basic information about the service. Comparison of service opportunities with those discussed earlier.
2. Registration and profile settings.
3. Review of possible templates. Templates that should be used in teaching mathematics to primary school children.

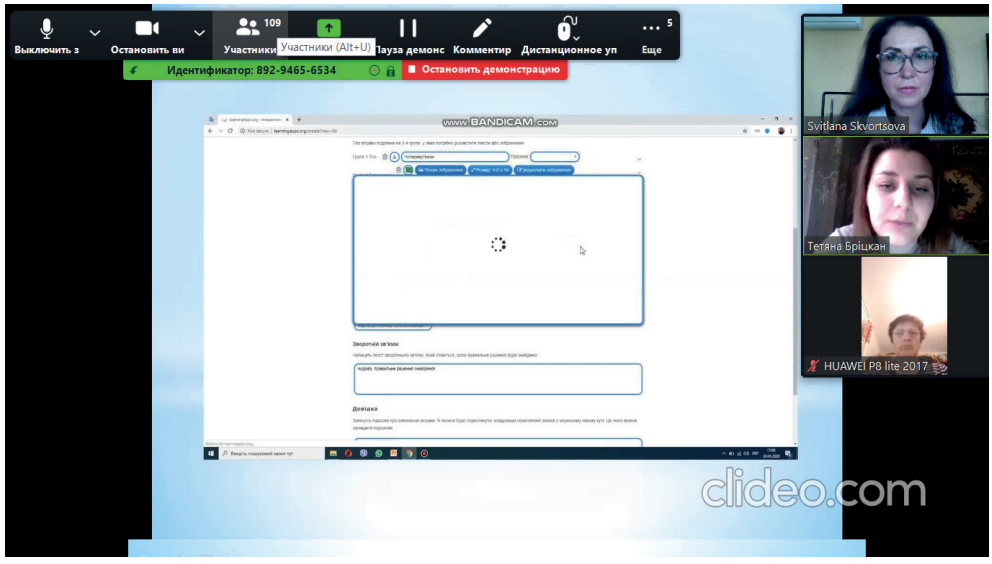
4. Learning to create tasks in each of the templates.
5. Organization of teaching mathematics using the opportunities of the service.
6. Organization of a virtual class (if possible).
7. Algorithm of the schoolchild’s work with the service.
8. Virtual magazine.
9. Presentation of the experience of using this service by a primary school teacher.

This course is addressed to primary school teachers, school methodologists, representatives of private educational institutions, educators of senior preschool groups, students of higher pedagogical educational institutions, parents of primary school children.

1.2. Teaching online the course “Internet resources for creating mathematical learning and game content for primary school children”

The e-course “Internet resources for creating mathematical learning and game content for primary school children” (hereinafter – the course) lasted from May, 4, 2020 to June, 1, 2020. The teachers of the course were Doctor of Pedagogical Sciences, Professor, Corresponding Member of the National Academy of Pedagogical Sciences of Ukraine, Head of the Department of Mathematics and Teaching Methods of the South Ukrainian National Pedagogical University S. Skvortsova, and postgraduate student of the Department of General Pedagogy, Preschool, Primary and Special Education of Izmail State University of Humanities T. Britskan.

120 teachers took part in the course. 110 people listened to the webinar on a regular basis (Figure 1), others – joined the webinars periodically due to unstable Internet connection. After the online webinar, the video of the webinar was uploaded on the Zmist.ua platform. Some teachers were trained by watching these videos. In total, as of August 2020, 715 students are participating in the e-course.



F i g u r e 1. Webinar screen dedicated to the LearningApps service

S o u r c e: own work.

The e-course learning has several stages:

- registration – the participants fill in the registration form and get access to the online broadcast of the course;
- mobility – the courses were held using the Zoom system;
- communication – in the chat, the participants asked questions to speakers, talked to other students of the course and quickly assessed their level of knowledge;
- confirmation of their knowledge – ordering a certificate of completing the course.

During the webinars, the speakers drew attention to the possibilities of the new service compared to those considered in previous webinars in paid and free versions, the organization of a virtual classroom and presentation of school children's results in a virtual journal, the possibility of creating both interactive exercises and exercises with open-ended answers.

Teachers had the opportunity to observe the actions of their tutors to configure the teacher-user profile, together with the speakers to view libraries of ready-made exercises, to analyze a bank of templates for creating tasks.

The templates of each service were compared with similar templates of other services, emphasis was placed on common and different features, on the ease of recording. Templates were also analyzed to create tasks in different formats (text, picture, video, etc.). During the course, students analyzed the possibilities of creating various mathematical problems for organizing oral questioning of schoolchidlren, mathematical dictation, oral counting, problems on restoration of true equations, problems on finding values of expressions in several actions, finding unknown components of arithmetic actions, solving equations and inequalities, work on problems of geometric content. Also, the speakers analyzed the possibilities of using the tasks created in each of the services at certain stages of the mathematics lesson: (1) updating basic knowledge and methods of action; (2) formation of new knowledge and methods of action; and (3) formation of abilities and skills, as well as consolidation.

During the webinars, the course students followed the actions of the speakers to create exercises in each of the templates, followed the QR-code to the created task, and in the webinar chat asked the speakers about the features of displaying certain tasks in the service.

It was noticed that due to the peculiarities of the services, it is not always possible to submit a task / interactive task in the form as it is presented in a textbook, study or workbook. Some templates provide only the text form of the task, some templates require reformatting the image with the task screen, and so on.

Attention was also paid to the advantages and disadvantages of various templates of a particular service to perform a particular task. Students had the opportunity to directly review the options created in different templates of tasks and draw conclusions about the feasibility of a particular template for a particular type of mathematical problem.

After creating a task online in a separate template, course the participants received practical advice on choosing a specific template for creating tasks depending on the type of task and the stage of the lesson. The speakers gave recommendations on the peculiarities of the options for setting the task, on how to move students to this task. All these recommendations were positively assessed by the teachers and they

gratefully responded with comments in the chat. Suggestions, as well as the procedure, were reflected in step-by-step algorithms for creating tasks in a specific template following which teachers could develop tasks independently. It should be noted that the step-by-step algorithms were accompanied by screenshots from the screen, which illustrated the steps to create tasks.

Also, during each webinar, students learned about the algorithms of creating a virtual class or group of users, and inviting students to it. The nuances of getting school children to the service, receiving tasks and options for sending school children’s work, if the tasks were not interactive, the possibility of involving parents in the results of the child’s learning were revealed. Some attention was paid to the analysis of the form of presentation and functions of the virtual journal, teachers were offered life hacks on its use. Teachers positively assessed the provided step-by-step memos and algorithms for creating tasks and algorithms for school children in the services LearningApps, Google Classroom, Classtime, Classdojo, Padlet, Zoom.

2. CONDUCTING THE E-COURSE “INTERNET RESOURCES FOR CREATING MATHEMATICAL LEARNING AND GAME CONTENT FOR PRIMARY SCHOOL CHILDREN”

During the webinar on topic № 1. “Creating interactive exercises in mathematics with the help of the LearningApps service”, it was noted that modern primary school children are representatives of the digital generation and some key educational problems caused by their stay in the virtual world were outlined. It was proved that moderate use of ICT in the educational process facilitates the assimilation of educational material by primary school children. It was also noted that the maximum duration of continuous work with computer equipment for students of grades 2–4 is 15 minutes with mandatory performance of a set of exercises for eye rest in accordance with state sanitary rules and regulations “Arrangement and equipment of computer rooms in educational institutions and the mode of school children’s work on personal computers” of Ukraine (DSanPiN 5.5.6.009-98). Next, the basic material on registration and use of the LearningApps service was provided. The features of working with each template were determined in the guides and algorithms for creating interactive exercises. Each template was supplemented with QR codes of the created interactive exercises. It was mentioned that the created interactive exercises in this service can be used only at the stages of the lesson of mathematics “Updating basic knowledge and methods of action” and “Consolidation. Formation of skills and abilities”. It was shown which templates can be used to create interactive exercises for the above mentioned stages of the mathematics lesson and the corresponding QR-codes of interactive exercises were demonstrated. The peculiarities of creating a virtual class in the LearningApps service were outlined and the QR-code for the created virtual class, where all materials and examples of interactive exercises were placed, was provided.

The webinar on topic № 2. “Peculiarities of using Google Classroom in teaching mathematics to primary school children” began with coverage of the results of research by domestic and foreign scientists on the impact of gadgets on child development. Information on the positive and negative impact of gadgets on child development was

provided. Summarizing all the results, preference was given to the use of ICT in the educational process in primary school. Afterwards, the basic material for registering and creating a training course in the Google Classroom service was provided. The example of covering all stages of a mathematics lesson in the 2nd grade on the topic: "Discovering the method of multiplication and division by ten" demonstrated the templates for creating tasks in Google Classroom and the ability to fill the course with other content. The peculiarities of creating a virtual class in the Google Classroom service were outlined and the class code, where all the tasks of the specified lesson were placed, was given. The peculiarities of entering an electronic diary in this service were outlined.

The webinar on topic № 3. "Peculiarities of using the Classtime service in teaching mathematics to primary school children" began with presenting basic information about this service based on the comparative characteristics of already studied services, including LearningApps and Google Classroom. Peculiarities of working with each template were outlined in the guides and algorithms for creating interactive exercises and open-ended tasks. The comparative characteristics of the templates of the studied services, in particular LearningApps, Google Classroom and Classtime, were presented; with the help of them it was possible to create interactive tasks and open-ended tasks. A link to the created session, which contained examples of tasks created in Classtime, was provided. The webinar ended with a speech by a primary school teacher, NUS coach Hanna Zastavska, who demonstrated the created sessions in mathematics and underlined certain peculiarities of working with the service.

The webinar on topic № 4. "Peculiarities of using the online Padlet board in teaching mathematics to primary school children" began with the presentation of basic information about this service based on comparative characteristics of already studied services, including LearningApps, Google Classroom and Classtime. The peculiarities of the choice of virtual board templates and the technology of filling it with educational material and interactive tasks were highlighted. The algorithm for preparing a mathematics lesson in the Padlet virtual board was demonstrated. There was a link to a mathematics lesson in 2nd grade on the topic: "Learning the rules of how to perform actions in expressions", created on the Padlet virtual board. The webinar ended with a speech by primary school teacher Ryma Rudenko, who used this service during distance learning in the spring of 2020, and showed her own virtual boards in the Padlet service.

The webinar on topic № 5. "Classdojo in teaching mathematics to primary school children. Zoom service for online mathematics lessons" began with a comparative description of the studied services according to the following criteria: lesson organization, filling the lesson with tasks, school children's answers, checking tasks by the teacher. The students received basic information about working and creating tasks with answers of various formats in the Classdojo service. The speakers provided a link to a mathematics lesson in 2nd grade on the topic: "Complex problems for multiple comparison", created when using the Classdojo service. The review of this service ended with a speech by primary school teachers Oksana Zamosyanchuk and Yulia Grzegodska, who shared their experience of work with this service. The webinar

continued with a presentation of basic information about working in the Zoom service and a demonstration of presenting tasks based on a mathematics lesson in the 2nd grade “Solving problems to find the sum”. Algorithms of school children’s work in this service were described. The review of this service ended with a speech by a primary school teacher Victoria Galushkina, who shared her experience of work with the Zoom service in the paid version.

It should be noted that each webinar lasted more than 2 hours. After the main part, teachers stayed in to exchange views, give practical advice and solve problems on working with online services.

Thus, the distinguishing feature of the course is: (1) comparative analysis of the opportunities of each service with others, which was considered in previous webinars; (2) comparative analysis of templates for creating exercises in each service; (3) step-by-step algorithms for creating tasks in each task of the service; (4) algorithms for creating a virtual class; (5) algorithms of school children’s actions; and (6) analysis of the structure and functions of the virtual journal and life hacks on its formation.

Also, a significant difference between our course and other similar courses is that at the end of the webinar, after reviewing a service, there was a presentation of practical experience by primary school teachers of Ukraine: Elena Popkova and Anna Zastavskaya from Zaporizhzhia, Julia Grzegodska from Lviv, Oksana Zamosyanchuk from Odesa region, Vita Galushkina from the city of Kyiv, Ryma Rudenko from the city of Kryvyi Rih.

The participants of the e-course positively assessed the fact that the speakers highlighted both the advantages and the disadvantages of using these services; difficulties they may face in using them. On the example of primary school teachers’ performances in webinars, the participants could see that the selected services can be implemented in the educational process of primary school, reviewed the tasks created by the teachers, electronic journals in mathematics, children’s work. The feedback provided in the chat indicated the content and availability of information on working with online services.

After each webinar, the course students left their feedback in the chat. In the reviews, the teachers noted the benefits of the information obtained for their own practical activity (Vira Kovaliova: “Thank you for this course and for your work! The benefits of knowledge I gained with colleagues during this course can not be overestimated”, Irina Kulak: “Thank you! Very interesting and useful information. There is something to work on”, Svitlana Sheiko: “Thank you! What we need now is to master it”, Natalia Mozhaieva: “We will learn to use these services. Very exciting and interesting”…), accessibility, logic and systematic presentation information by speakers (Olha Davydenko “Thank you! Very interesting and accessible”, Svitlana Stepanovna: “Thank you! It was very interesting! A lot of useful information”, Polina Sokolovskaia: “It was a series of the most meaningful and detailed webinars on distance education”, Stella Stolper: “Dear speakers! Thank you for the tremendous work you have done to familizarize us (teachers) with various services”). Teachers noted that although they had some experience of work with a particular service, they learned a lot for themselves.

Feedback from teachers proves the relevance of the work and obtaining specific recommendations for the use of these services in teaching mathematics in primary school. It should be noted that the students of the course were not only primary school teachers of Ukraine, but also future teachers from the South Ukrainian National Pedagogical University named after K. D. Ushynskyi, Precarpathian National University named after V. Stefanyk and Izmail State University of Humanities. These universities take into account the results of non-formal education in assessing the academic achievements of students in the learning course "Methods of teaching mathematics in primary school"; thus, the certificates they are awarded by the platform Zmist on completing the course "Internet resources for creating mathematical learning and game content for primary school children" will be taken into consideration during the final certification of students in the discipline "Methods of teaching mathematics in primary school". The questions of recognizing learning outcomes obtained in non-formal education are regulated by the university regulations. In particular, in Izmail State University of Humanities it is the "Regulations on the organization of the educational process" (paragraph 8.17) and the "Regulations on study according to the individual schedule of higher education students of Izmail State University of Humanities". Within the block of elective disciplines, a higher education student can be rewarded with credits obtained during mass open online courses posted on the platforms of Prometheus, Coursera, EdX and others, including Zmist.ua, with a certificate. On the basis of the application and the certificate submitted by the applicant for higher education, the dean's office issues an order appointing a board, which determines the form and term of certification to recognize the learning outcomes acquired during the course. The results of the attestation are entered by the board in the credit-examination list issued by the dean's office and the individual study plan of the higher education applicant. Similar normative documents have been approved in South Ukrainian and Precarpathian universities. Students of these universities took the e-course as an individual task in accordance with the study program of the discipline "Methods of teaching mathematics in primary school".

CONCLUSION

The professional activity of a modern primary school teacher is impossible without the use of ICT, in particular online services. The results of teacher surveys we conducted in the previous stages of the study indicate that they have basic knowledge, ICT skills and abilities, but herewith they demonstrate the lack of ability to work with online services for creating educational and game content.

We studied the possibilities of free online services or services that provide a free version: LearningApps, Google Classroom, Classtime, Padlet, Zoom, Classdojo, Liveworksheets, Wizer.me, H5P, Lino it, etc .; and outlined both the advantages and disadvantages of their use in teaching mathematics to primary school children. Peculiarities of presenting mathematical problems by means of the specified services were analyzed. The aspect of combining these services was considered and the question which services can complement or replace each other was discussed.

Thus, for the optimal use of various online services by teachers, we developed and conducted a course “Internet resources for creating mathematical learning and game content for primary school children”. The aim of this course is to familiarize teachers with online services that help organize distance learning in mathematics: services for creating a virtual classroom, its filling with interactive exercises and other educational content (LearningApps, Google Classroom, Classtime, Classdojo), services for organizing a distance lesson (Padlet) and services for conducting a distance lesson in the form of a conference (Zoom).

The developed e-course was of interest to primary school teachers, school methodologists, representatives of private educational institutions, educators of senior preschool groups, students of higher pedagogical educational institutions, parents of primary school children. After the webinars in the chat, we received listeners’ positive feedback on the topic and the course as a whole.

Videos of the webinars are posted on the Zmist.ua platform. As of August 2020, the participants of the e-course are 715 students who took an active part in the discussion of the material during the webinars and left positive feedback on the work done. The course is also introduced in the process of methodological training at the South Ukrainian National Pedagogical University named after K. D. Ushynskyi, Precarpathian National University named after V. Stefanyk and Izmail State University of Humanities by taking into account the results of non-formal education in assessing students’ achievement in the discipline “Methods of teaching mathematics in primary school”.

We see prospects for further research in continuing to study the peculiarities of other online services, which can also be used to create educational and game content in mathematics for primary school children and develop the next course for primary school teachers in Ukraine.

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