Distance Education on the Basis of Innovative Technologies. Problems of the Primary School Teacher Training in Ukraine

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Abstract: In the article, the authors analyze international experience of scientists, the Ukrainian realities and prospects for selection of expedient innovation tools. The purpose of such selection is to optimize distance education in the primary school teacher training in Ukraine on the basis of innovative technologies. The relevance of the topic is determined by a number of contradictions between the need for innovations in distance education and objective obstacles on the way to this. The purpose of the article is formulation of selection criteria, selection of the most urgent and most relevant accessible technologies and the theoretical substantiation of their application (on the example of teaching and learning the discipline "Mathematics"). The methodology involved includes the following methods: searching, sampling (according to relevance, effectiveness, regional features) and theoretical. Methods of modeling, generalization and forecasting were applied partly. The result of the work is substantiation of various types of innovative lectures as the best method of distance teaching and selection of specific technologies which (according to the didactic evidence) are the most effective. Also, the efficiency of the Moodle platform is described as the most universal access tool. Along with the literature review, fragments of discussion and comparison took place, which testified that the Ukrainian problem of innovative distance education belongs to the resource and psychological (stereotypes) area. International significance. The article is interesting for the reformers of education in developing countries and the scientists who follow the world tendencies in the education digitalization.

Keywords: *Educational environment, technologies of training, universal programs for teaching and learning, innovative forms of lectures.*

How to cite: Zaporozhchenko, T., Fonariuk, O., Popadych, O., Kliuieva, S., Ashikhmina, N., & Kanibolotska, O. (2022). Distance Education on the Basis of Innovative Technologies. Problems of the Primary School Teacher Training in Ukraine. *Revista Românească pentru Educaţie Multidimensională, 14*(2), 102-117. https://doi.org/10.18662/rrem/14.2/569

Introduction

Due to the need for distance education technologies, the pedagogical science and practice require solid scientific and theoretical research, experimental development and testing of the model of the future primary school teacher training using innovative technologies.

This topic is not new and acquired relevance in the early 2000s. At that time, James (2012) in his work "The Digital Flood: Diffusion of Information Technology Across the United States, Europe, and Asia" revealed the features of information and communication technologies, which provide for the development of the ability of their skillful and flexible use, as well as the development of relevant knowledge and skills in the learning process. The most common innovative learning tools in higher pedagogical educational institutions in the initial stages were the electronic editions and manuals, computer training systems, multimedia complexes, electronic testing systems, Web-based training courses (Zaporozhchenko, 2013).

The work by Bach, Haynes, Smith (2007) was dedicated to the peculiarities of development of distance education in Europe. The authors note that the main feature of distance education in higher pedagogical education is creation of a training-information environment, which includes computer information sources, electronic, video and audio libraries, books and tutorials. Listeners and teachers who interact with each other with the help of contemporary telecommunication facilities are an integral part of such a system. Such an educational environment provides unique opportunities to learn, to acquire knowledge both independently and under the guidance of personal tutors that are fixed for each student and carry out scientific and methodological assistance at all stages of independent work.

In their textbook Collis, Nikolova & Martcheva (1995) emphasize the diversity of pedagogical technologies in higher education.

Relevance of the article. In Ukraine, however, tutorship, online platforms for independent education have not been developed yet, but the innovative means for distance teaching are often used as forms of translation. Thus, there is a need to solve contradictions between: the need to introduce distance learning technologies in connection with contemporary requirements and insufficient theoretical and methodological development of means of innovative technologies; the need to form mathematical competence in the future primary school teacher training by means of innovative technologies and the lack of a specially designed model and organizational and pedagogical conditions in the science and practice for the

formation of mathematical competence in the future primary school teachers through the means of innovative technologies.

The purpose of the article is the selection of the most up-to-date innovative technologies for training of the primary school teachers, and for junior students for distance learning, taking into account the possibilities of Ukrainian education (on the example of learning-teaching the discipline "Mathematics"). The basic institution to achieve the goal was the Chernihiv National Pedagogical University named after T. Shevchenko.

Methods of selection and data analysis. We used the following methodology for data collection and analysis: a) monitoring of the basic world trends in the distance education innovations and applying these data in Ukrainian realities; b) studied the Ukrainian experience of distance training of teachers based on innovative technologies; c) by the method of empirical selection (the experience provided by the teachers of the above establishment) and anticipation of the didactic efficiency was equipped with the most valid innovation.

The main thesis supported by the authors. The spread of the COVID-19 pandemic has sharply increased the demand for distance educational services. The emergence of digital multimedia technologies even further increased the distance between the teacher and the student; therefore, the distance education is not a form of education, but the natural development of classical forms. In this regard, our main thesis is as follows: within the framework of one article, it is necessary to analyze the methodical innovative toolkit both for future educators and their students. Part of this toolkit can be used both to teach students, and to work at school.

The problem of choosing innovation support for distance education in Ukraine

We conducted a review of the recent literature to analyze possible reforms in the innovative provisions for distance education. Optimization of the distance education space is possible provided there is high-tech and free access to the tools and availability or development of multivariate software (Bukhkalo, Ageicheva & Komarova, 2018). Familiarization with these parameters on the basis of the Chernihiv National Pedagogical University named after T. Shevchenko showed: they are approximately consistent with the current requirements.

In developing countries, there is a stereotype: traditional contact education is better than the distance one. The social and individual image in such countries is determined by the in-person training. Scientists suggest transformations of education by joining international projects, such as TIDE

1 (Lane & Gregson, 2019). So, Ukraine should use international highly rated platforms. We have taken this into account when substantiating using the Moodle platform.

Last year discussions were conducted on the so-called virtual education, which includes distance, mobile, mixed, individual forms of education. This will allow to reasonably combine different shapes and fill the methodical gaps (Al-Malah, Aljazaery, Alrikabi & Mutar, 2021; Honcharuk, 2021; Povidaichyk, 2021; Zhurat, 2020). For our study such approaches are expedient as we cannot still refuse the traditional elements. Ideally, Ukraine needs to preserve, as far as possible, the traditional elements of training, especially lecture and interactive interaction, within the framework of the distance innovation education. In this regard, in the paragraphs to follow, we also held discussions and methodological selection of tools.

Remote classes in special computer laboratories are practiced in many countries. This solves the issue of ergonomics, individual access, independent work (Seffah, Kuhail & Negreiros, 2021). Such approach allows to isolate the educational group, but it is not suitable for distance education in full sense, and does not prevent the spread of the COVID-19 epidemic.

Sociological international network studies of student prerogatives by the tag "*the scale of technological innovations*" have revealed that students are mostly prone to self-deployment and supplement, open education resources rather than using artificially created online courses. Mobile learning applications are also less popular (Okon & Okon, 2021). We expect that such a trend will be also monitored in Ukraine: students are not yet ready to self-organization of distance education with the help of innovative technologies. Educational studies on the background of COVID-19 pandemic showed that the distance education should develop contextually: taking into account the regional situation, participation of parents, the society, the educational institutions (Cahapay, Lorania, Labrador & Bangoc, 2021). In Ukraine, this is implemented by adopting their own provisions for distance education at the universities.

We took into account the above considerations, analyzed a number of methodological sources (Aleksyuk, 1998; Turkot, 2011; Gurevych, 2020; Shahina, 2017; Berbets, 2021; Melnyk, 2021; Komogorova, 2021) and selected the following criteria of effectiveness for electronic tools:

– psychological - how the software will affect the motivation to learn, the attitude to the subject, increase or decrease interest in it, whether students will have self-doubt due to difficult, unclear or unconventional requirements proposed by the program;

– pedagogical - to what extent the program corresponds to the general direction of a school course and promotes development of correct representations of the world;

– methodical - whether the use of a computer contributes to better mastering of the material, whether the choice of tasks offered to students is justified, whether the material is presented methodically correctly, etc.

– organizational - or rationally planned lessons with the use of computer and new information technologies.

The use of innovative technologies and appropriate teaching methods is possible when organizing various forms of learning. The main form of organization of educational activities in the Ukrainian higher school is a lecture (Aleksyuk, 1998; Kurlyand, 2007). In addition to the traditional lecture, which provides an oral presentation by the lecturer of educational information, now there are new varieties. We consider it appropriate to review the innovative types of lectures that can be carried out distantly.

Lecture-visualization (from Latin visualis - visual) arose as a result of the search for new opportunities for the implementation of the principle of clarity (Kushnir & Manzhula, 2013; Preston, 2004). It involves the demonstration of phenomena and processes in a form convenient for visual perception. However, the teacher must use such demonstration materials, such forms of clarity, which would not only supplement the verbal information, but also themselves would be meaningful messages.

Preparation for the lecture-visualization in a certain course (e.g., "Mathematics") is aimed at maximizing the conditions for the successful formation of mathematical competence and consists in reconstructing, recoding its content or parts into a visual form for submission to students through technical means. Visualization of mathematical material studied at lectures allows to involve both auditory and visual analyzers of students that promotes complex mastering of knowledge (Hyland, 2001; James, 2012).

Reading such a lecture is reduced to free, detailed commentary on the prepared materials. It is important to determine the visual logic, the rhythm of teaching the material, its dosage and style of communication with the audience. At the same time, the peculiarity of the lecture-visualization in mathematics is not only the illustration, but also the structuring of the content of education, the construction of structural and logical schemes of mathematical concepts, step-by-step illustration of algorithms, etc. A characteristic feature of the lecture-visualization is the mandatory visualization of educational material through visualization (Bach, Haynes & Smith, 2007; Collis, Nikolova & Martcheva, 1995).

In the process of lecture-visualization we widely use information and communication technologies, in particular the demonstration of electronic visualization, and problem-based learning technology, which allowed students to critically process mathematical material. Examples of such lectures are presented in the distance education system Moodle, posted at www.moodle.chnpu.edu.ua.

The lecture together involves a problematic presentation of material in a dialogue between two teachers, which simulates real situations of discussion of theoretical and practical issues by two researchers (for example, representatives of two different scientific schools, a theorist and a practitioner, etc.). The presence of two sources of information stimulates students to compare different points of view, make choices, join one of them, formulate their own views.

In the process of conducting a lecture together, information and communication technologies are widely used, in particular, the demonstration of electronic visibility for constructing structural and logical schemes of mathematical concepts, and the technology of problem learning, the manifestation of which was the method of processing problem situations. Students try to find solutions to practical problems, and only then to compare the results of their own research activities with the theoretical information of the lecturer. Examples of such lectures are presented in the distance education system Moodle, posted at www.moodle.chnpu.edu.ua.

A lecture with pre-planned mistakes requires the inclusion in its text of a certain number of pre-selected errors of a semantic nature. The task of students is to identify them in the process of listening to the lecture and record in the notes. Discuss the identified errors at the end of the lesson. Such a lecture simultaneously performs educational, stimulating, control, corrective and diagnostic functions.

In the process of conducting such a lecture, we can use the technology of problem-based learning, since students must independently actualize the previously acquired knowledge, correlate it with the text of the proposed lecture and find errors. Examples of such lectures are presented in the distance education system Moodle, posted at www.moodle.chnpu.edu.ua.

The lecture-press conference is based on the questions received from students. Having named the topic of the lecture, the teacher asks students to formulate in writing questions on a particular topic, which he sorts by content. He answers them in the form of a coherent lecture text. At the end of the lesson the teacher analyzes the students' questions.

In order to ensure the process of formation of mathematical competence at the Faculty of Primary Education, we consider it appropriate to hold lectures-press conferences in several methodological variants: the teacher answers the questions of the audience prepared in advance for the lecture; a group of teachers answers students' questions; a group of pre-trained students answers the students' questions (Bykov, 2015).

One of the forms of interactive lecture today is a webinar, which provides an interactive training session using the Internet, in which participants of the educational process make reports, ask questions, participate in discussions, discuss.

The network nature of the training, which allows classes to be conducted, is the main advantage of a webinar in comparison with a traditional lecture, which requires the physical presence of all participants in one classroom. At the same time, such a lesson is as close as possible to direct interaction, since it allows the teacher to conduct a dialogue with students in real time.

Therefore, a distance lecture can combine traditional and innovative advantages and create the effect of a common team work or the work of the entire term.

The problems of online access for students during distance learning

The Ukrainian researchers Andriievskyi and Vinnyk (2015) believe: an important aspect of the teacher training is formation of the ability to analyze the program tools and select the most effective. The first factor of effectiveness is the access. In this section, we will consider the most accessible and most effective innovative resources for students and their future pupils.

One of the basic concepts of the student educational environment is the course. Within the environment, the course is not only a means of organizing the learning process in its traditional sense. All courses within the environment are divided into categories. The names of the categories are links, when you go to which you can see a list of courses only in this category with extended information, including a list of teachers of the course and its description.

The type of course and the peculiarities of the organization of work with it depend on what format of the course was chosen during its creation and adjustment. There is a possibility to choose one of the following formats: weekly - allows you to distribute funds for the study of educational material by weeks, during which you plan to study the course; thematic - allows you to distribute funds for the study of educational material by topic;

format-forum - the construction of the course is based on forums (Strilets, 2015).

Electronic methodological complexes developed in the Moodle environment have the structure defined by the Regulations on distance education of the Chernihiv National Pedagogical University named after T. Shevchenko, in particular (Strilets & Zaporozhchenko, 2015):

– general information about the discipline (work program, assessment criteria, printed and Internet sources, glossary);

- teaching materials from each module:

- theoretical material (multimedia presentations of lectures, structured electronic teaching materials, electronic lecture notes, list of printed and Internet sources);

– practical work (content, guidelines for their implementation, a list of individual tasks, the form of presentation of performance results, evaluation criteria);

- tasks for independent work of students (additional theoretical material, tasks, methodical instructions concerning their performance, the list of individual tasks, the form of representation of results of performance, evaluation criteria);

– modular control (control questions, tasks with evaluation criteria and the form of presentation of performance results, tests for control);

- materials for the final control (control tasks to control the student's knowledge for the course);

- additional materials.

However, this structure may vary depending on the characteristics of the discipline and in order to provide maximum convenience for use by students. Given the peculiarities of the discipline "Mathematics", the electronic methodological complex may contain practical examples of mathematical tasks, samples of mathematical tasks, etc.

Access to e-course server resources is personalized. Students and teachers receive a login and password from the server administrator. Each student and teacher has access only to those e-learning courses in which he is registered to participate in the learning process. Users are personally responsible for the confidentiality of storage of logins and passwords. Registration of students in the e-learning course is also carried out by the server administrator. At the end of the session with the e-course server, the teacher is obliged to log out in order to prevent other users from working in the "Teacher" mode.

In Ukraine, the most affordable and practical environment is Moodle. The introduction of electronic methodological complexes

developed in the Moodle environment in the educational process of higher pedagogical educational institution, promotes the involvement of students in individual educational activities, forms an interest in self-mastery of clearly structured educational material.

In the system of organization of distance learning from the courses "Mathematics" and "Methods of teaching the educational field of "Mathematics" it is important not only to create an electronic methodological complex, but also to teach students to use it. In order to solve this problem, a textbook was developed "Fundamentals of work in the environment "Moodel" (Strilets, 2015), created for students, graduate students and teachers of pedagogical universities to support full-time and part-time education, it promotes deeper understanding students of the main aspects of work in the Moodle system, allows the creation of electronic methodological complexes in other disciplines.

Thus, electronic methodological complexes developed in the Moodle environment can be aimed at the development of independence, initiative, professional interest and the formation and further development of mathematical competence of the future primary school teacher. However, it should be noted that the development and implementation of electronic methodological complexes is not enough for the successful formation and development of mathematical competence of future primary school teachers. These complexes are only one of the means to improve this process, but the effective formation of mathematical competence is considered possible only in the system of integrated use of various teaching aids, including tools of innovative technologies.

In order to attract students to the use of innovative technologies at distance mathematics lessons in the primary school it is relevant to familiarize students with the current software that can be used in the teacher training and directly during the on-the-job training. The Faculty of Primary Education of Chernihiv National Pedagogical University named after T. Shevchenko uses a number of software aimed at development of the mathematical competence of future primary school teachers and the ability to use them in the distance work with students. Here are the software and the evidence of their effectiveness and trouble-free access.

The educational software "Pedagogical software of the educational field of "Mathematics": Mathematics 1, 2, 3, 4 grades" is focused on the use in secondary schools and covers the curriculum. The whole course consists of a certain number of lessons, which corresponds to the curriculum. The software also contains guidelines, a glossary, an alphabetical index, the application "Writing numbers", which facilitates the work of the teacher.

Advantages of the software: it is based on contemporary forms of education with compatibility with traditional educational materials in full compliance with the documents governing the content of education. It can be used by the teacher: to prepare for the lesson; to explain new material; to create one's own lessons; to form and consolidate the skills of solving the exercises provided by the program; for individual and optional classes.

The software product "Steps to Informatics" was created by a team of teachers, psychologists, programmers, artists, animators. It has repeatedly passed the scientific-methodical and psychological-pedagogical examination and testing in educational institutions of Ukraine. Its advantage is in figurative approximation of the material for students of primary school and the interdisciplinary nature. This software package for grades 2-4, with which students together with cartoon characters learn the basics and consolidate knowledge in subjects: computer science, mathematics, science, Ukrainian, English.

The "Tower of Knowledge" is a developmental program offered in the form of a developmental game, during which students demonstrate their knowledge and practice exercises in various subjects. The advantage of the game is that it develops students' thinking, the ability to find answers to questions on their own, to solve problem situations on their own.

Fourth, "Fantasy Country" - a set of programs designed specifically for primary school. The complex presents training programs in mathematics, writing, fine arts, etc. Its effectiveness is of different aspects: tasks are designed for the development of creative, spatial, logical thinking and are proposed taking into account the age characteristics of students.

5. The software GeoGebra is useful in the process of teaching the course "Mathematics". This software is a program of dynamic mathematics for all levels of education, which combines geometry, algebra, tables, graphs, statistics and calculations. Its advantages include: the use of the specified program allows to improve the process of perception by the students of mathematical knowledge, promotes activization of cognitive activity of students. "Lesson Designer" is the program, with which the teacher can create lessons according to their own methods, as well as according to their own methodological preferences to edit the lessons suggested by the developers.

6. We will focus on the feasibility of this innovative tool. The software "Lesson Designer" is focused on contemporary forms of education with compatibility with traditional educational materials in full compliance with the documents governing the content of education. The use of pedagogical software allows to achieve the following pedagogical goals:

support of group and individual forms of learning in the classroom system of the educational process; create comfortable conditions for computer support of traditional and innovative learning technologies. This package increases students' cognitive interest; to provide a differentiated approach to the study of the subject; to form skills of solving problems of practical and research nature; to structure the content of training and to activate basic knowledge.

Conclusions

The study of the Ukrainian and foreign experience allowed to formulate the criteria for the effectiveness of electronic tools and their structure for use in the Moodle environment at Chernihiv National Pedagogical University named after T. Shevchenko.

Familiarization of the future primary school teachers with the proposed software in practical classes involves mastering the knowledge and skills necessary for professional activity. However, the growing interest in the use of e-learning tools and its distance forms should not reduce the teacher's attention to the student's personality, on the contrary, it is the computerization of education that saves the teacher from the routine work on the translation of educational material, allowing them to focus more on the formation in children of fundamental foundations in the spiritual life of the individual. Under such circumstances, the role of the teacher in the learning process does not diminish.

We have proved that it is effective to use innovative forms of lectures in distance education: lecture-visualization, one-to-one lecture, lecture with pre-planned mistakes, lecture press-conference, lecture-webinar, etc.

The problem of choosing the software on which the information and educational environment will be built is crucial and this choice depends on a number of factors: ease of access, free of charge, efficiency, etc., therefore at the Faculty of Primary Education of the above-mentioned university the Moodle environment is widely used – a dynamic object-oriented learning environment, which is a software package for organizing distance learning on the Internet. For the distance interactive work, we selected (according to the requirements) and theoretically proved the effectiveness of the following software: "Lesson Designer", GeoGebra, "Fantasy Country", "Knowledge Tower", "Steps to Informatics", "Pedagogical software of the educational field of "Mathematics": Mathematics 1, 2, 3, 4 grade". Their feature is the possibility of distance application by students and teachers-practitioners.

Research limitations. In the article, the authors highlighted only some of the problems identified in the topic and did not make empirical measurements, which should be done in further research.

Acknowledgements

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