A future teacher training for professional activity in a digital school

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Abstract — **The digitization of economics and education leads to the need to change the approaches to the process of education in schools and universities, necessitates the introduction of innovative teaching models, the implementation of which has a positive experience of introducing into educational practice of foreign and Russian universities. The purpose of the article is to analyze the introduction of elements of mobile learning technology in the training of future teachers and students' orientations to the further use of mobile technology in teaching in their professional activity after graduation. The basis of the study is the project technology for the development and presentation of electronic educational content by students of II – IV courses of pedagogical specialties of the Novokuznetsk branch-institute of Kemerovo State University, the technology of mobile learning while studying course materials. The study materials show the problems of implementing mobile learning in the educational process when training future teachers. The study found that, for the successful implementation of mobile learning technology, a different approach to distance course planning and, accordingly, redistribution of time for training and conducting classes and consultations, mastering the competencies of developing technical support for the course, organizing advanced training activities in the field of mobile learning are necessary. Surveying students showed that the main difficulty is the lack of readiness for self-learning using mobile technologies. Nevertheless, in the course of the study it was found that at present the conditions have been created for the successful implementation of mobile learning in the educational process of the university when training future teachers. The attitude of students to mobile learning technology was studied, the original courses of educational subjects using mobile applications were developed. The study materials are of interest to scientific and pedagogical communities that discuss mobile learning technology in higher and secondary schools.**

Keywords — mobile learning, distance learning, training future teachers, the educational process at the university

I. INTRODUCTION

The intensive development of digital technologies, the widespread use of mobile devices connected to the global network, the growing number of users of social services leads to the formation of a new information space in the field of economics, business and commerce, management, science and education, everyday life, social environment, on the level of which not only the quality of life of Russia's population, but also the national security and competitiveness of the country on the world market depends [1].

Under these conditions, the paradigm of education changes, not only the means, forms, but also the goals, objectives and technologies of education change, which is reflected in the national project "Education", within the framework of which it is planned to create a unified electronic educational environment at the federal level, personal learning environments that provide the choice of an individual training route and the technology of its mastering for both students with disabilities and intellectually gifted children [2].

The availability and variety of forms of educational content, the emergence of new tools and learning technology, including technology that makes it possible to study at any time and in any place, require a modern teacher to take a systematic approach to building the learning process, building a unified system of goals, modern methods and materials and learning technology which is especially important in the transition to distance learning of schoolchildren. Currently, school teachers, both in Russia and abroad, pay inadequate attention to this competence which reduces the effectiveness of the educational process [3].

Under the conditions of digitalization of education, the share of distance education increases, but in Russia and abroad, distance learning is mainly used to teach students in higher and vocational educational establishments [4, 5].

The widespread system of distance learning Moodle, characterized by memory expansion granularity and support for open protocols. Application for the implementation of online learning strategies is repeatedly found in publications [6].

The Moodle software environment contains a set of tools for organizing and providing conditions for the educational process, including the following components:

1) chats, forums, internal email;

2) a system for designing and implementing educational content;

3) testing systems,

4) means for demonstration of students' achievements - electronic portfolios, electronic grade books, electronic journals.

But the most important feature of LMS Moodle is that it is fully adapted for mobile devices and makes it possible to use your content anywhere and anytime.

With a good signal of access to the global network, the Moodle-based educational portal easily provides access to interactive learning materials as well as attending webinars and participating in video conferences, i.e. relatively easy organizing a personal learning environment.

Over the past decades, a broad experience has been gained in distance learning for students, creating personal learning environments (PLEs) which provides continuous learning by means of Web 2.0 services, such as databases of electronic educational resources in various formats (media, video, audio, biblio, photo, graphics, animations), information data files, educational portals, Internet sites; telecommunication technology: network and mobile environments, media, television, telephony, teleconference, hosting, mail services; the information security of the personal environment, the organization of personal and collective information space: testing results, content, website, blog, chat, forum, mail, database [7].

Analysis of modern teaching methods will be incomplete without such an approach as learning gamification [8]. Educational digital resources with this approach as close as possible to a computer game.

The combination of distance and in-class forms of education, the shift of learning tasks to the formation of students' self-study skills led to the emergence of such a notion as "inverted learning" [9,10].

The use of mobile devices for learning is becoming more and more popular, since the mobile device is always available, learning takes place at a natural pace for the student, learning results are confidential, quick access to educational resources and social networks where it is possible to share impressions of the educational process immediately. For a teacher, mobile learning provides an opportunity to provide psychological support to students at risk, to contact students at a convenient time and in any place which expands the possibilities of teamwork.

Despite these advantages, most Russian schools prohibit the use of mobile devices in class. This happens due to various reasons, such as copyrights to electronic resources, since the development of own materials requires quite high qualification; lack of ICT competency in the use of mobile devices, etc. On the other hand, the studies show that students are more motivated to study when they use mobile devices [11].

The importance of a timely grade not only from the teacher, but also from other students is emphasized in the works of foreign researchers [12].

Summarizing the listed changes in the pedagogical conditions of education in connection with the digitalization of the surrounding reality, the following problems arose in the training of future teachers:

– insufficient compliance of the training of future teachers with the demands of modern school;

– the need to use in the process of learning new forms, methods and tools, and to train future teachers;

– insufficient level of application of ICT capabilities by subject students who are not studying on the profiles that include informatics.

Purpose: to solve the above problems, an educational technology is needed, based on the use of LMS Moodle basic tools for organizing students' project activity in developing electronic educational content, including for mobile learning.

We set the following objectives:

– to confirm the assumption that the development of electronic educational content will increase the level of digitalization of general education; stimulates the use of distance forms of educational work, including on the basis of mobile applications, in future professional activities;

– to describe the technology of using distance learning environment for organizing project activity for the development of electronic educational content, including for mobile applications.

II. RESEARCH METHODOLOGY

To eliminate the above-mentioned problems, the department of computer science and general technical disciplines of the Novokuznetsk Institute (branch) of Kemerovo State University uses e-learning methods based on the LMS Moodle, and most importantly, the group and independent work of students in designing and implementing electronic educational content for secondary school in all basic and specialized subjects as well as mobile learning technology and project method.

Classes were held in the traditional in-class form, based on the functionality of the distance educational portal of the Novokuznetsk Institute (branch) deployed on the basis of the Moodle DES, located in the network at: moodle.dissw.ru.

Lectures were conducted using electronic presentations and video materials placed on the portal as part of the course. Tasks for practical and laboratory work are also fully contained in a digital form on the portal. Organizing the project activity on the development of electronic educational facilities based on the school curriculum, in the study of subjects directly related to the specialized training of students was particularly relevant.

The students were tasked with developing e-learning tools and posting their results on the LMS Moodle. The teachers offered tasks for project activity and provided consulting support, intermediate and final control. The opportunities provided by the distance education system were used in the preparation of project topics: lectures, four forms of tasks (one file as an answer, several files, an answer on a page and an oral answer), testing, inquiry, survey, compiling a glossary and wiki.

The main difference in the educational technology we have introduced was the training of future subject teachers in the development of electronic educational content, including on mobile electronic devices.

The training was conducted on educational programs for the training of computer science, technology and maths teachers. The possibility of streaming training appeared, while assignments were provided for both individual and group projects in the process. In addition, the development of educational content is extremely popular in course projects in such subjects as "Information and communication technologies in education" and "Teaching methodology (in subjects)". Initially, the learning outcomes were quite satisfactory, but no statistical evidence was obtained for this, because at this stage it was important to work out the organizational issues and form

a bank of project topics for developing electronic educational content.

We furthermore set the task to organize the educational process which allows us to more accurately assess the applicability of the developed educational technology and confirm its effectiveness. It was necessary to determine for it:

- a list of teacher training profiles for participation in the experiment,

- a list of subjects for the implementation of project training,

- the most effective forms of development of electronic educational content.

The choice of teacher training profiles for experimental training was based on the following grounds:

- electronic means for educational purposes were used when teaching these subjects in schools;

- the level of subject training of students, necessary for the development of educational content;

- the personal interest of students in the experimental activity and in the further promotion of the results, in the application of the developed materials in future professional activity.

An expert analysis of 28 educational programs made it possible to select 5 that meet the requirements (table 1).

TABLE I.   EDUCATIONAL PROGRAMS SELECTED FOR EXPERIMENTAL TRAINING

Profile (orientation) of teacher training	A number of students
1. Maths	26
2. Computer science	38
3. Physics	12
4. Technology	15
5. Economics	32

An analysis of educational practice, the presence of complex tasks and projects in the study of a particular subject was conducted for the selection of subjects. All this was necessary for the implementation of ideas for the development of various forms of electronic educational content. An expert analysis of all subjects of the curriculum was carried out, and 6 subjects were chosen out of 246 for the experiment (table 2).

TABLE II.   SUBJECTS OF EDUCATIONAL PROGRAMS SELECTED FOR EXPERIMENTAL TRAINING

The name of the subject	The length of the subject in credits (credit hours)	A number of semesters per subject	Summary reporting form
1. Information and communication technology in education	2 (72)	1	Exam
2. Methodology of teaching subjects (computer science) (maths) (technology)	4 (144)	2	Test, exam
3. Information systems	2 (72)	1	Test
4. Information modeling	2 (72)	1	Test
5. Networks and Internet technologies	2 (72)	1	Test

Various forms of educational content were selected from a large list of digital educational resources used in modern school. Those forms that could be optimally used to implement the ideas of distance learning, an individual approach and a specialized emphasis were preferred. There are the electronic educational facilities and the requirements for the content and technological component in table 3.

TABLE III.   ELECTRONIC EDUCATIONAL CONTENT FORMS

The name of educational electronic means	Structure requirements	Development platform	Reporting forms
Electronic textbook	Presentation component, training, test tasks in an interactive form, the presence of hyperlinks, various forms of teaching material (audio, video, etc.)	HTML, CSS, Google site	Defence of the project, presentation at the annual student conference, conducting a class while practicing, presentation to the EER competition
Electronic presentation	Presentation component, interactive component, the presence of hyperlinks, various forms of teaching material (audio, video, etc.)	MS Power Point, network presentation	
Educational film	Slides, titles. Action video capture on the screen, editing and transitions between fragments	Moviemaker, SonyVegas, VideoPad	
Teaching game	The presence of levels, academic performance rating, structured educational material	Google site, MS Power Point, SCRATCH,	
Training program	The presence of levels, academic performance rating, structured educational material	SCRATCH, MS Power Point, Google site	
Electronic handbook	The coverage of educational material on this subject, structuredness, the presence of hyperlinks, the presentation of information in various forms	HTML, CSS, Google site	
Electronic book of problems	The coverage, structuredness, the presence of hyperlinks, variety of problem types	HTML, CSS, Google site	

Students not only developed content and created electronic educational resources, but also placed them into a distance learning environment for further discussion and cross-grade in the process of learning.

III. RESULTS OF THE RESEARCH

In the course of the experimental training conducted, the statistical data collected that were processed. The data collection process was ensured by using accounting capabilities in the computer programs used. The data were collected and classified into various categories and characteristics, depending on the tasks. This article presents only the learning outcomes from 2016 to 2018.

An integral estimate of the results shows an increase in the effectiveness of training in the development of electronic educational content in project-based training using the LMS Moodle as compared to the traditional training (table 4). An integrative estimate was calculated on a five-point scale, on the basis of the additive convolution of the current grades in the discipline, grades for the developed content as well as grades in the defense of coursework.

TABLE IV.   ELECTRONIC EDUCATIONAL CONTENT FORMS

Profile of educational teacher training programs	An estimate of the effectiveness of training on a five-point scale in the control groups (an integral estimate of all the tests)	An estimate of the effectiveness of training on a five-point scale in the experimental groups (an integral estimate of all the tests)
1. Maths	3.565	3.711
2. Computer science	3.240	4.1
3. Physics	3.123	4.2
4. Technology	3.323	4.01
5. Economics	3.442	3.9

In addition, a pattern was established that when working on a project at the LMS Moodle, students spent less time on work than when working in the traditional form. Online consultations, discussions were used and, in some cases, the project was defended in an electronic learning environment. The dependence of work time on the profiles of educational programs was revealed. For example, more independent work time was seen in future teachers of economics and technology. But, as shown by a deeper analysis, this dependence was associated with different entry levels of students in different profiles.

Besides, during the experiment, teachers and students were twice surveyed to identify their attitude to the development of electronic educational content using the Moodle distance learning environment, shortcomings and suggestions for improving learning. Students were asked questions to estimate their satisfaction with the teaching and qualifications of teachers. According to the results of the survey, improvements

were made which then made it possible to improve the technology.

Students communication in forums and in chats as well as during the teleconferences with their participation was analyzed. Cases of demonstration of the e-learning tools work created by students were of particular interest. As it turned out, the ability to test online capabilities of educational software tools has significantly improved their quality and performance. This made it possible to carry out a kind of technological and methodological adaptation and thereby contribute to the growth of the digitalization level of educational space.

IV. DISCUSSION OF RESULTS

The study has been repeatedly condemned at scientific seminars held at the department of computer science and general technical subjects of the Novokuznetsk Institute (branch) of the Kemerovo State University. The results of the work were presented at scientific and practical conferences which made it possible to make the necessary amendments to the developed technology and to improve the quality of the electronic educational content developed by students.

On the basis of the above, it can be concluded that the tasks are solved: It was confirmed the assumption that the development of electronic educational content enhances the digitalization of general education; stimulates the use of distance forms of educational work, including on the basis of mobile applications, in future professional activity; the technology of using distance learning environment for the organization of project activity for the development of electronic educational content, including for mobile applications, was presented.

The proposed technology of learning, the results collected can be reproduced during the training of teachers in other educational institutions.

V. CONCLUSIONS

The study materials show the problems of implementing mobile learning in the educational process when training future

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teachers. The study found that, for the successful implementation of mobile learning technology, a different approach to distance course planning and, accordingly, redistribution of time for training and conducting classes and consultations, mastering the competencies of developing technical support for the course, organizing advanced training activities in the field of mobile learning are necessary.

As a result of the study, it was revealed that students have much greater difficulty in selecting and structuring educational material, selecting forms and presenting them, than using information technology for its development; mobile technology and devices are successfully used for discussion and grading of work, but they are practically not used for studying lecture material and preparing for in-class learning. At the same time, the creation of electronic educational resources and further collective work on them is of interest to modern students.

The practical significance of the results presented in the article is that the involvement of students in the educational process based on the proposed model makes it possible for students to acquire the skills of collective distant work, critical re-evaluation of the problems and methods of their solution, the use of mobile devices and technologies in the learning process.

The conditions for the formation of the necessary professional competence under project activity were revealed, the positive dynamics of increasing the knowledge of digital technology and the competence of organizing a single digital space was shown.

In the course of the study it was found that at present the conditions have been created for the successful implementation of mobile learning in the educational process of the university when training future teachers. The attitude of students and teachers to mobile learning technology was studied, the original courses of educational subjects using mobile applications were developed. The study materials are of interest to scientific and pedagogical communities that discuss mobile learning technology in higher and secondary schools.

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