Distance Learning Approaches in the Mathematical Training of Pedagogical Institutes's Students

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ABSTRACT

Nowadays, the Information technologies are more and more widely used in the mathematical education system. The generalization of experience and its implementation by means of the open source software is of current interest. It is also important to address this problem due to the transfer to the new FSES (Federal State Education Standards) of high education. The use of open source software systems allows organizing an effective information environment to support the educational process at the lowest financial costs, including for the distance learning and training of persons with reduced mobility. Within this article we consider the results of mobile e-learning system development based on a Learning Management System (LMS) Moodle and some aspects of its application in the educational process of the Institute of Natural, Mathematical and Technical Sciences of the Lipetsk State Pedagogical University (LGPU). Based on a survey of lecturers and 50 graduates from the areas of "Teacher Education" and "Professional Education" it was found that the average value of the time that the respondents consider as appropriate to devote to the study of subjects by electronic educational resources is 37.5%. Taking into account the data obtained from the study, we substantiate the expediency of applying electronic educational resources as auxiliary tools of students training. The article focuses on the mathematical discipline due to the need to implement the Concept of mathematical education development.

Introduction

The use of computer technologies in the educational process creates opportunities for a sufficiently effective solution of many educational and upbringing tasks, such as: individualization and differentiation of learning process, increase of various kinds of students activities' motivation, activating of independent work and bringing it to a new stage of development, and formation

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of research skills. The distance learning is one of the promising areas of usage the electronic systems in the field of education, including self-education.

E-learning system is a system that allows simultaneously create study materials, control the learning process and organize the interaction between its participants.

The Concept of mathematical education emphasizes that "Without a high level of mathematical education it's impossible to accomplish the objectives on creating the country's innovation economy, to realize the long-term goals and problems of social and economic development of the Russian Federation…" (Concept of the Mathematics Education Development in the Russian Federation, 2013). One of the objectives of mathematics education is defined as the development of publicly available information resources, which are needed for the implementation of mathematics training programs, including those in electronic form, tools of the students and teachers' activities, application of modern technologies of the educational process. This determines the necessity of studying the problem of mathematical preparation of students in the pedagogical universities and its solutions through the useage of computer technologies.

In this regard, the following objectives are placed before the researchers:

– to form and develop the electronic information and educational environment, providing a mobility, publicity, and accessibility of mathematical education;

– to develop and use the mobile e-learning system based on the Learning Manage-ment System (LMS) Moodle and own web-services;

– to create the conditions for network interaction between the participants of e-Learning, including those to improve the level of work with the gifted children.

Results

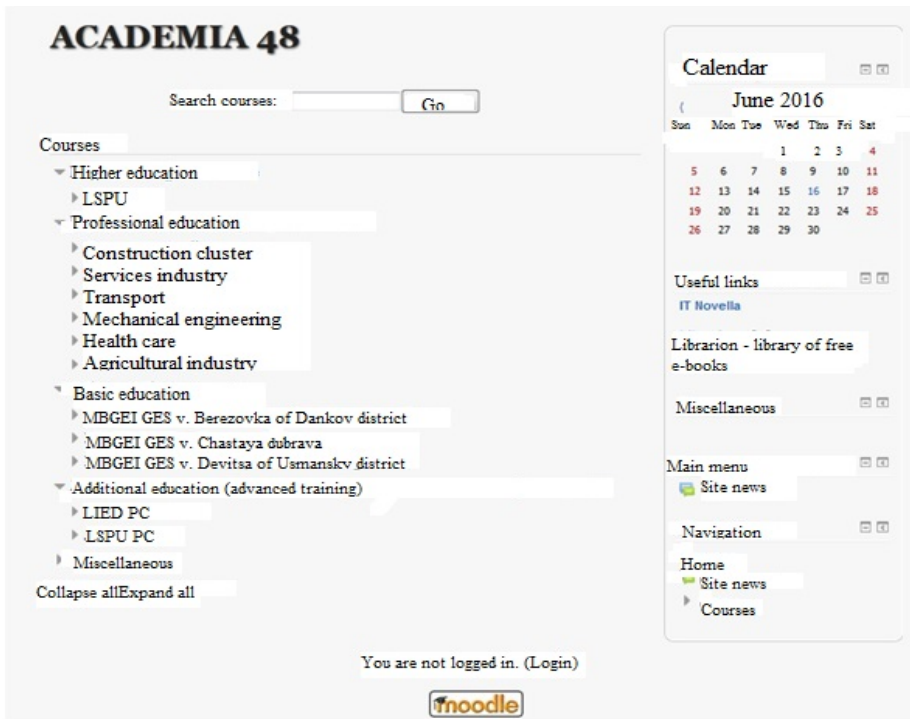### *Learning Management System (LMS) Moodle and its application*

Currently, there is a need of effective methods for organizing the extracurricular learning activities of students, allowing the interaction of all participants in the educational process (information exchange, getting advices, tips, and marks from remote teacher) and implementation of the requirements to a specialist, which can ensure the stable quality of educational outcomes (Anderson & Elloumi, 2004; Bhopal & Danaher, 2013; Mierin & Bykova, 2015). The distance learning system, one of which is the Moodle environment (Moodle. Official site. 2011), may assist in solving such problems (E-Learning Concepts and Techniques, 2006; E-learning methodologies, 2006; eLearning 101: A Practical Guide, 2016). The said environment has several disadvantages (Bogun, Kuznetsov & Smirnov, 2010), but it also has a number of advantages, such as: free use, friendly interface, ample opportunities for communication between the participants of teaching and learning process (Belousova & Soldatenkova, 2014; Bicheva, 2016; Cole & Foster, 2008; Singh, 2014).

The mathematical disciplines occupy a special place in the overall system of vocational training of the contemporary specialist in the fields of Teacher Education (Mathematics and Physics, Physics and Mathematics, Computer

Science and Mathematics), Applied Mathematics and Information Science. The mathematical disciplines, which constitute a basic mathematical training of Bachelors, include: "Discrete mathematics", "Theory of Probability and Mathematical Statistics", "Theory of Games and Operations Research", "Optimization Methods", "Numerical Methods" and other. All of those disciplines are included in basic or variable part and mandatory for studying (Federal State Educational Standard of the basic general education, 2010).Considering the urgency and practical significance of mathematical disciplines, it was decided to create an electronic educational resource of mathematical disciplines.

At the Department of Mathematics of Lipetsk State Pedagogical University there is an experience of using Moodle learning system as a remote support for the full-time lessons in many mathematical disciplines.

Working with the resource provides for registration of users and their access to the selected structural units, possibility of communicating with the resource admin (teacher), possibility to control the acquisition of knowledge via the built-in control system. For the resource Admin resource structure is open (access to the materials for their editing and changing, access to the statistical information).

Figure 1. Academia48.ru home page

By following a link http://www.academia48.ru/, the user goes to the home page of resource, which provides the main resource components browsing (Figure 1), in particular, the list of disciplines for studying (Figure 2).

Figure 2. Section of the LGPU on academia48.ru

After selecting the discipline one will be directed to the desired page, where the structure and contents of the selected course are shown (Figures 3, 4) (Attetkov, Zarubin, & Kanatnikov, 2013).

Figure 3. A fragment fragmentof Course "Optimization Methods" on academia48.ru

System capabilities provide simplicity and convenience of work with the course, increase the efficiency of learning process, provide students with the opportunity to use the textbook either for the direct study of material or as a reference and methodological guide.

Figure 4. A fragment of Course "Theory of Games and Operations Research" on academia48.ru

The experience has shown, that the application of computer technologies makes possible to intense the educational process, increase the motivation of learning, activate cognitive activity and improve efficiency of lessons.

But it should be noted, that the training package posted in the distance learning system will never replace the teacher. The developed electronic resource is an addition to traditional forms of learning and does not replace the work of student with a book, synopsis, and problem book. Only the teacher can qualitatively verify the performance of creative tasks and organize the discussion. We must also remember about the disciplinary component of education process, when the teacher personality is essential.

Electronic information and education environment in the teaching process

The great opportunities for improving competence of future teacher are provided by the electronic information and education environment of the University, that gives access to the lesson plans, practices and disciplines steering documents publications of the electronic library systems and electronic educational resources specified in the steering documents; possibility to record the educational process progress, intermediate certification results and bachelor programs mastering results; possibility to conduct all kinds of training, learning outcomes assessment procedures, the implementation of which is provided with the use of e-learning, distance learning technologies; possibility to form an electronic portfolio of student, including the preservation of student's works, reviews and assessments for these works by any participants of the educational process; and interaction between the participants of educational process, including both synchronous and asynchronous.

On-line learning can be applied not only in mastering the educational disciplines, but also in passing the teaching practice by students. Our University is taking part in the pilot project "Master Class" (within the modernization of Teacher Education). The project envisages the creation of Internet portal "Master Class", which will allow to accumulate the best educational experience of teachers in the region, students of the LGPU; to ensure the openness of regional professional teachers community (interschool and other kinds of professional interaction), opportunity for a wide range of users (parents of school students, university entrants, interested parties) to get acquainted with the general and higher education system in the region, and to carry out a professional (expert) and public assessment of educational activities of the educational institutions, etc.

In 2016 as a part of teaching practice for the students in the field of "Teacher Education" (Mathematics and Physics major), such a work has already been started. In February, 2016, under the described project the first lessons of Mathematics teachers were recorded in automatic mode. Those lessons were discussed on-line by the Teachers Community, and lessons' elements are being analyzed on advanced training courses. Lessons of the new entrants into the teaching profession (students) have been also recorded within the project. Also there had been conducted a comparative analysis of lessons carried out by the "masters'" and the youth. By utilizing the "time stamps" in the lesson records, the certain elements were allocated, and the comparative analysis of selected elements in different lessons was conducted.

Implementation of the new does not mean the denial of previous experience. In order to better prepare the future teachers to work in the school and out-of-school education institutions, we are undertaking the attempts to adapt to the

modern realities of such previously disseminated method as "continuous teaching practice". Our students take an active participation in the various activities carried out by the schools and out-of-school education institutions of the region, and Lipetsk Department of Education. In most cases it is the local school activities, but the students are also involved in carrying out the various Olympiads, Mathematical battles, and other training activities. Before they go to the children, in the university they hold the interactive lessons, which allow, in the form of business game at student audience, plan this or that event, starting from the ordinary lessons to various intellectual extracurricular competitions.

In the described cooperation students are introduced to distance learning from the "opposite" side - side of teacher. Students take part in drafting the teaching materials and remote assessment of works by the students of part-time school "Gifted Child" of the Department of Education and Science of Lipetsk region.

After analyzing the above noted features of electronic educational resources application, we have allocated some stages (Figure 5), which are typical for the use of those resources in the Pedagogical University.
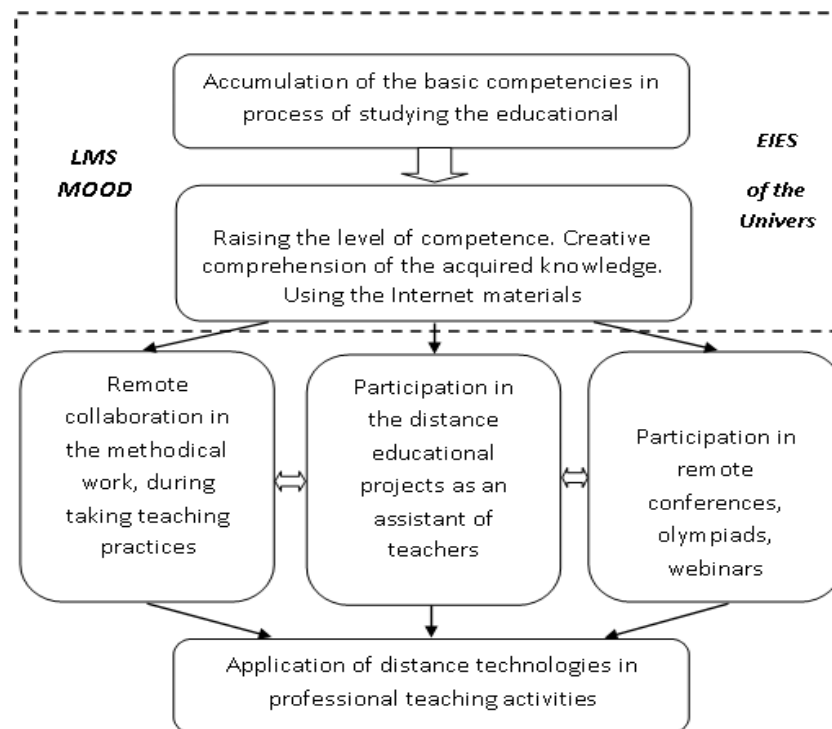

Figure 5. Stages of the electronic educational resources application by the future teacher

At the first stage the accumulation takes place, including accumulation by means of LMS MOODLE and electronic information and education environment of the University, of basic competencies as a part of the educational disciplines mastering (1-2 year of study).

At the next stage students, who have accumulated the required amount of knowledge, can more creatively use the opportunities of electronic educational resources for the preparation of essays, term papers, participation in off-campus projects. For teachers the use of electronic educational resources offers the opportunities of operational guidance and control of the students' activities (2-3 years of study – in case of the four-year learning, 3-4 years of study – in case of the five-year learning).

In the future range or the application of information and educational resources will be expanded by the greater involvement of students in the creative project activities, participation in the education environment activities of region, remote conferences, olympiads, webinars (3-4 years of study - in case of the four-year learning, 4-5 years of study - in case of the five-year learning).

In case of systematic implementation of scheme described, as the students "leave" the university, they have the competencies required for their professional activities, including for the multiple application of electronic information and educational resources in teaching activities.

Among the graduates in the field of "Teacher Education" and "Professional Education" of Lipetsk State Pedagogical University named after P.P. Semenov-Tyan-Shanski there was conducted a survey about the role and place of e-learning courses in the formation of future teachers' competences. The students were to point out, which part of the total time, spent on learning, it is advisable to implement by electronic educational resources. The range of responses was significantly great: 15% to 90%. Average value is 37.5%. The survey involved 50 graduates.

Conclusion

The experience of LMS Moodle application in the study of disciplines "Theory of Probability and Mathematical Statistics", "Theory of Games and Operations Re-search", "Optimization Methods", "Numerical Methods" and some other allows us drawing the conclusions about the advisability of continuing studies on the given subjects.

LMS allows activating the students' independent work by planning its implementation within each unit.

The electronic educational resources are one of the auxiliary tools of students training, they contribute to the key competences deepening and expansion (communicative, informative, cognitive and special), conditions creating for the professional staff training, improving the efficiency of students self-study, and continuous education implementing.

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Disclosure statement

No potential conflict of interest was reported by the authors.

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