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Educational Process Organization of Bachelors in Physics of Pedagogical Course Using Interactive Learning Forms

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Abstract

The urgency of the problem specified in the article stems from the fact that within the scope of transition to Federal State Educational Standards of the third generation and to a new Unified Standard for Teachers, preparation of academically flexible teachers who will possess a certain scope of knowledge both in the subject area and in the allied sciences and well-versed in new achievements of various sciences, becomes a particularly important task. They should face professional problems and be able to independently develop and implement new active teaching methods and techniques in the educational process meeting the present-day needs of educational institutions. The purpose of the article is to study interactive forms application in the process of training of future physics teachers. Interactive teaching methods providing interaction not only between teachers and students, but also between students consist in giving opportunity to students of all-round education in the chosen field of study. The key methods of the research are theoretical analysis of pedagogical literature providing an overview of learning technologies' development and interactive teaching methods survey as applied to bachelor's students majoring in pedagogy. The core results of the research consist in describing the use of some interactive learning methods. They make it possible to organize practice-oriented educational process, assess students' knowledge quality in the subject area, as well as evaluate the level of students' basic professional competencies in accordance with the requirements of the Unified Standard for teachers.

Keywords: interactive forms, bachelor's programs, professional simulation, case study method, project activity, professional education.

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Introduction

1.1. Relevance of the problem. Bachelors in Physics specializing in "Teacher education" shall be well-versed in the primary and secondary (high) school curriculum in line with new programs. They should also be able to diversify and enhance pupils' cognitive activity in classes, as well as apply different learning methods and forms. Currently, the objective public needs necessitate the relevance of an overall developing student-centered educational technology implementation. In this respect, innovations in education are associated with interactive teaching methods. Their application is the most effective means of improving the quality of students' preparation and their development as future teachers. For that matter, the main problem of the research may be identified as the effective educational process organization for future teachers of physics with application of interactive teaching methods.

1.2. Literature review. Studies on general pedagogical issues in the educational process of training bachelor's students (Aganov, Nefediev, Garnaeva, & Nizamova, 2015; Betz, 2014; Makletsov & Khabibullina, 2016) may be highlighted particularly. Issues on the creation of academic flexibility at Russian universities have been discussed by many scientists from different aspects (Khabibullina, Shigapova, & Rusanova, 2016). We may also single out works on distinctions of future teachers' education (Khabibullina & Makletsov, 2016; Shigapova & Akhmedova, 2015). The learning process with the use of interactive teaching methods is revealed in the following works (Akhmedova & Khabibullina, 2014; Beauchamp & Kennewell, 2010; Grigorash & Trubilin, 2014; Hwang, Wu, & Ke, 2011; Papastergiou, 2009).

1.3. Problem Statement. The transformation of the educational process, based on the model that relies on a practice-oriented approach, led to the rise of technology and study methods, by which this practice-oriented approach will be reached. Active and interactive forms and methods of teaching play an important role in the training of psychics students majoring in pedagogy.

1.4. Research Questions. Implementation of the Federal educational standards of secondary and higher education of the third generation and the professional standard extremely change the focus of education in Russia. In this case, a teacher should be a competent specialist in the chosen discipline and have a completely different approach towards the educational process, analysis and the evaluation of quality education. The main research questions consist in describing the use of some interactive learning methods. They make it possible to organize practice-oriented educational process, assess students' knowledge in the subject area, as well as evaluate basic professional competencies of physics bachelor's students in accordance with the requirements of the Unified Standard for teachers.

Methodology

Purpose of the Study

The purpose of the article is to substantiate the effectiveness of some interactive teaching methods in the development of physics students' competencies demonstrating their commitment to the profession and compliance with requirements of the Unified Standard for teachers, as well as the development of students' academic flexibility.

Research Methods

Theoretical analysis of pedagogical literature is one of the key research methods used for dealing with this issue. It provides an overview of learning technologies' development and involves three forms of cooperation between teachers and students, i.e. passive, active and interactive.

Passive (traditional) form of education suggests that a key player who controls the learning process is a teacher. Whereas, students are only passive listeners subordinated to teachers' directives. Communication between a teacher and a student is arranged by surveys, independent and review works, and tests. Such training forms as lectures, narration, explanation, interviews and workshops are classified as traditional ones. This form of cooperation involves an active use of display techniques and exercises. The passive method is considered unproductive. But in some cases if a teacher is experienced enough, and the set goals are clear, achievable and aimed at studying the subject thoroughly, it may be very successful. Among the main advantages of passive learning for teachers is quick preparation. Besides, there is an opportunity to bring and clarify a relatively large amount of educational materials within a time limit using modern e-learning modalities. However, the following shortcomings of this educational pattern can be emphasized: teachers are focused on average students, opportunities for individual development are restricted by students' passive role, and theoretical knowledge and practical skills of a subject are transferred in isolation from the social aspects of professional activity.

Active form of education means that teachers and students interact with each other on equal terms, and students act as active participants of the educational process. Active teaching methods imply a democratic style of interaction and are aimed at developing students' independent thinking, creativity and competent solving of non-standard professional tasks. These methods are commonly used during seminars and laboratory classes. The advantage of active learning is an opportunity to deal with a problem under conditions of significant time reduction, group activity for working-up and making a decision, as well as focusing the participants on the main aspects of a problem. The major disadvantages of the active form include a more complicated preparation for classes and a higher concentration of attention in lessons. Teachers face a problem when some students are reluctant to participate in the learning process. Moreover, they perceive teamwork based on active methods just as a way to do nothing.

Interactive forms of education are focused at various interaction both of students with each other, with students of different years, with a particular academic subject teacher (project activity), and also between teachers (interdisciplinary links). The role of a teacher mainly consists in directing students' activity to achievement of educational objectives. Thus, they not so much reinforce the learned material, but study something new. The interactive learning implies cooperation. All participants of educational process (teachers and students) interact with each other in the atmosphere of goodwill and mutual support. They share information, solve problems together and simulate real-life situations. Interactive education enhances the effectiveness of educational process and achievement of higher results. Besides, it increases motivation to learn the subject well, develops students' communicative skills and reduces classroom work in proportion to independent students' work. Interactive forms are mainly used in classroom and individual students' work at all levels (Bachelor, Specialist and Master). Debate, brainstorming, professional simulation, case studies, workshops and training may be fairly referred to the major interactive teaching methods at universities.

Thus, active and interactive teaching forms and methods play an essential role in educating physics students with a teacher education major.

Results

The following interactive forms are used by the authors in the educational process:

- **professional simulation** is representation of professional environment for making managerial decisions in different situations (by acting out and role-playing). It is carried out according to certain rules and allows developing a behavioral pattern and professionally significant qualities among students;
- **project activity** is an activity aimed at acquiring knowledge and skills by students in the process of independent planning and implementing research and project work;
- **case study** is an analysis of specific situations for making decisions by students on the basis of their previous experience and knowledge gained in the process of learning physics;
- **information technology** implies participants' interaction through computers, modern information and communication technology (webinars, video tasks solving and online educational elements).

In the process of professional subject studying the authors arrange practical training in the form of **professional simulation "The Final State Attestation in Physics".** This form is aimed both at achieving educational goals and determining the students' competence level. This professional simulation represents a situation of holding a state examination in physics following all its maximum possible requirements. Herewith, students take on the following roles: a) examinee, b) supervisor in the classroom of examination unit, c) instruction and laboratory assistant, d) expert. The teacher acts as a supervisor in the examination unit.

Testing and assessment materials (TAM) used in the professional simulation are developed by students in the course of studies. The simulation process consists of three stages: 1) holding an examination; 2) check of work fulfilled; 3) expert examination of checked work. A teacher has to control the distribution of roles (students shall not use their own TAM or check their own work). The assessment criteria are as follows: TAM tasks solution, role performance, expert examination of work, and evaluation of expert work.

Students carry out planning, organization and evaluation of research, project work in the process of pedagogical internships at schools. It helps to develop proper organization skills in carrying out project and research activity among schoolchildren.

The following criteria are applied to evaluate the results of students' project activity: evaluation of research or project work by a schoolchild under a student's supervision; criteria developed by a student for assessing success in research or project work; student's opinion of a schoolchild's work fulfilled under his or her supervision (in compliance with the developed criteria); a review written by a physics teacher at school; public presentation by a schoolchild of research results or project work under the student's supervision (for instance, a certificate of participation in a conference or workshop).

One of the most effective learning forms is education through situations with **case technology** application. The case study method based on real situation patterns is one of the most demanded tools used in the development of educational techniques. In this case, education is carried out through a problem presented in a documentary form (for instance, a message) or even by verbal or visual means (for instance, video, slideshow). Students are offered to analyze a real life situation. It contains not only any practical problem, but also the one updating some definite body of knowledge, which becomes urgent for learning during the problem solving.

It should be noted that cases differ from common training tasks used at workshops and practical classes. They have some certain features:

- As a rule, a case is based on a situation, whether real or specially designed by a teacher.
- The material of a case is supported by special study results and statistical reports or other additional information.
- Clearly worded questions are not obligatory for a case.
- What is major and what requires a top priority is not always obvious in the case study. Thus, one of the most important and difficult stages in case study becomes the major problem definition.
- A case can have no clear-cut solution.
- If it is impossible to develop a solution (within general understanding of this word), then the identification and understanding of the problem, as well as its analysis and the line of behavior in the situation, will be considered as the solution.

Stages of organizing the learning process are the following:

- preparative (teacher specifies the didactic goals, elaborates an appropriate "specific situation" and classes' scenario)
- introductory (involvement of students takes place in the process of a lively discussion of a real professional situation. Thus, it is of greatest importance to present information in the most effective form)
- analytical (solutions are developed at this stage)
- final (time for a dispute and correlation of the results)

The use of this technology shows the following results:

- it generates greater motivation in students for learning. Such motivation is realized through own experience of solving and perceiving a problem;
- it makes learning effective;
- it develops thinking, an ability to analyze and diagnose problems, as well as make conclusions;
- it forms an approach to life as to a constantly changing system with an extremely large number of variables. In turn, this makes it easier to adapt to the professional activity;
- it develops communication skills, an ability to cooperate, a sense of leadership and ethics in business;
- it also develops a set of values in students, their professional stance, approach to life and professional opinion.

The expertly developed cases can also serve as an evaluation tool for the quality of education. The analysis of case solutions and the way students solve a case make it possible to assess the level of basic professional competencies. The authors have used the following evaluation criteria: in-depth study of a training task reflecting all its possible solutions; in-depth study of the proposed solutions from the point of their feasibility; degree of the proposed solutions' novelty; quality of presentation design and performance.

The interactive forms of the educational process imply the use of **information technology,** namely, computers, modern information and communication technology: online education, webinars, Internet resources, electronic textbooks and reference books, video tasks, virtual laboratory work etc.

Holding webinars in class, at different conferences on pedagogical practice allow all members of the educational process to see and hear each other, exchange data and process materials together interactively, thus bringing online communication to real and live one. It should be noted that all aspects: technical, organizational and content-related, must be taken into account in preparation for video conferences.

The authors implement online education elements in independent work of students for reinforcement of acquired knowledge. This contributes to the development of students' professionally significant skills, their ability to self-development and self-education.

At the teacher's discretion practical and laboratory classes are held using video tasks, virtual laboratory work, electronic textbooks, casebooks etc. Video tasks can be used by teachers for "case" development, their solution being carried out through students' interaction in small groups. It is assumed that in the end students will learn to create their own original "cases" both to describe a problem and find its solution.

The experience in holding webinars, online education and video tasks solution classes organization for teachers of Physics education has manifested that such forms of education put additional requirements to a teacher's competence. Among them: psychological, pedagogical, methodological preparation of a teacher and the level of his information competence. Interactive dialogue held during webinars and online education makes it possible to ensure the transition to a new level of quality in pedagogical activity. Thus, it significantly increases didactic, informational, methodological, technological opportunities and contributes to professional competencies' formation.

The authors note that interactive forms used for training of physics students specializing in pedagogy play a special role in the development of core professional competencies. Such competencies are formed in the following types of activity:

1) Professional simulation (ability to design, manage and investigate the process of subject learning; ability to work out testing and assessment materials in physics);

2) Project development, organization and evaluation of students' research work (ability to work out and control various kinds of students' extracurricular activity; ability to develop and control scientific, research and experimental activity of students studying physics);

3) Problem analysis or case study (willingness to interact with the participants of educational process; ability to organize students' cooperation, support their activity, leadership and self-reliance, develop creative skills);

4) Information technology application (team work skills; use of modern methods and learning technologies; willingness to interact with various actors in the educational process).

Discussions

The interactive teaching methods mentioned above enable one to organize the educational process on a practical basis and estimate the quality of students' knowledge in a subject area. They show the level of competence development, demonstrating students' willingness to professional activity and their compliance with the requirements of Unified Standard for teachers.

The main difficulty in teaching physics students specializing in teacher education with interactive learning forms is associated with two factors. Firstly, it is particularly labor-intensive, extracurricular and creative work of a teacher for preparation of necessary materials. It requires time expenditures and

teachers' innovative and creative thinking. Secondly, the implementation of these methods do not always fit into an established timeframe of educational process.

Conclusion

In conclusion, it should be mentioned that one of the main priorities of modern education is a need to improve the efficiency of learning of educational material, which is aimed at improving the quality of modern education. The education quality improvement should be carried out through updating all learning forms and methods. Moreover, educational content shall be thoroughly selected through implementation of educational technologies focused not so much on ready-made knowledge transfer, but on the formation of students' personal qualities.

In particular, it is observed that in terms of interactive learning students demonstrate an increase in perception and mental efficiency, such intellectual and communicative skills of personality development as stability of attention, observation power, an ability to analyze and summarize. Interactive learning forms facilitate the ability to make decisions and take responsibility for them. Moreover, it enables one to work together with a team and communicate successfully with colleagues, as well as extend the potential of educational environment.

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