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TRAINING TEACHERS OF THE FUTURE IN A HIGH-TECHNOLOGY INFOMATION-ORIENTED SOCIETY

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Abstract

The article describes the challenges facing pre-service teachers' training system in a high-technology information-oriented society. Nowadays, training teachers of the future is stipulated by knowledge redundancy, dynamic technological processes and uncertainty. The demand for elaboration of a flexible training model has redirected the teachers' training system to solution of real-life practice-based problems. The authors present a conceptual framework for student's learning activities; it was elaborated and implemented in the School of Education at Far Eastern Federal University. The article discusses the students' key positions in the process of organizing learning activities: professional development through self-realization, the fundamentals of system thinking through situational awareness and understanding of reality through reflection on professional performance. The key pedagogical conditions for the management of students' activity were experienced and identified in the FabLab. In the context of teachers' training system, using augmented reality technology, virtual reality technologies, educational robotics technologies, 3D modeling and prototyping technologies are regarded as upcoming spheres for educational system design and educational artifacts. The article embraces the first set of educational outcomes.

Keywords: Active learning environment, Bachelor of Education, FabLab, high technology information-oriented society, new technology, teachers' training system.

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1. Introduction

The impact of technological progress on the development of information-oriented society has substantially increased. Technologies penetrate into all spheres of our society in terms of computerizing and simplifying information processing and storage, enhancing the quality of information recording and accelerating its transfer (Aladyshkin, Kulik, Michurin, & Anosova, 2017; Gashkova, Berezovskaya, & Shipunova, 2017). Technology has become "the main tool" of a contemporary person in different fields: finance, health care, administration, management, engineering, communication, energy, etc. (Bylieva, Lobatyuk, & Rubtsova, 2018).

Technologies serve the basis for the new knowledge production. IT society leads to reimagining "knowledge" and "cognition" as concepts. Interpreted as "ability to act", scientific knowledge settles in the sphere of technology use and application. This "ability to act" understood as the form of objective knowledge allows creating new opportunities for human activities. Reality cognition is aimed at understanding and mastering these modes of activities (Kastels, 2000; Shtern, 2002).

Technology provokes emerging of a new branch of science – technoscience. Focused on the interests of a person, technoscience transforms the human being and the world around (Yudin, 2010). Scientific knowledge becomes vulnerable, rapidly loses its practical significance, entails unforeseen risks and becomes a source of uncertainty. Considered to be a subject of labor, knowledge results in social system changes as a whole (Bell, 2004).

Knowledge and technology become the basis for economic change (Moiseyev & Bakanova, 2017). Technologies change the activity of a contemporary person in the professional sphere; technologies become the basis for the new knowledge emergence in the professional environment. The key characteristics of the professional sphere of a contemporary person are:

- Redundancy of professional information.
- Dynamism and technological adaptability of processes in the professional field.
- Uncertainty in professional situations.

In the society of the future, there is a demand for a skilled practitioner ready to use his/her potential in solving problems which have never been described in his/her professional field before. This society requires a professional, able to create conditions for the emerging knowledge with its further understanding. Professional activity fixes on how to apply the technology to the creation of a completely new product prototype and completely new knowledge production in the field of its applicability and use. For example, the application of modern technologies to the creation of neural prostheses has been leading to the emergence of a new scientific direction in the field of their development and application – neuroprosthetics.

As a result, the system of higher professional education forms a model of specialists' training, which is characterized by the following features: learning process which provides a background for student's new subjective experience, professional development through understanding the problems and starting up projects to solve them, shaping student's motivation, creating opportunities for the real projects implementation in response to building student's individual learning trajectory, the deployment of the educational process within the logic of professional activity.

The existing system of professional preparation for teaching in a high-tech environment has to be focused on important components and characteristics of the society of the future. At the present stage, more

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acute than ever, there is a need to find models focused on training teachers who will perform under the conditions of advanced development and the implementation of scenario approaches into learning (Makarova & Drobotenko, 2014).

2. Problem Statement

The penetration of technologies into the sphere of education leads to the emergence of a variety of forms and methods of training (mobile learning, adaptive learning, personalized learning, foresight learning, etc.), change of learning models delivery (network learning, corporate learning, blended learning) and improvement of technical support while learning (online distance learning, offline, MOOCs). Rapid development of visualization technologies, remote access and collective interaction contributes to sustainable changes in the educational system (Tennyson & Sisk, 2011; Revilla, Penalba, Sánchez, & Santos, 2017; Monitoring the effectiveness of the school. What has changed in the work of teachers in recent years (2014-2017), 2018).

The demands of the modern society are focused on preparing teachers, who will be ready to implement activities in the face of redundancy of the educational environment, agility and adaptability of learning management as well as uncertainty of the educational situations they encounter. In our modern society, there appeared a demand for a proactive and self-directed teacher, able to determine and implement goals that go beyond the standard requirements. The ability to understand global processes in terms of public policy strategy, readiness to manage systems and processes in the educational ecosystem are defined as the key professional competences of teachers in the nearest future (Montiel-Overall, 2012; Headden, 2014; Luksha, Kubista, Laszlo, & Popovich, 2018, Frumin, Dobryakova, & Barannikov, 2018). Training teachers of the future, ready to perform in a high-technology information-oriented society, is understood as a key task at the present stage.

Nowadays, the process of teacher's training provokes a lot of criticism from the part of the scientific community and society as a whole. The researchers (Yakovlev & Krasilov, 2016; Pinskaya, Ponomareva, & Kosaretsky, 2016) note the insufficient level of professional training, which is the cause of the main problems faced by young teachers in real practice. The obtained education does not allow teaching in accordance with modern requirements, solving practical pedagogical problems and applying modern pedagogical technologies. The issue is solved through the inclusion in the plan of the system of practices and internships that allow a student of a pedagogical University or a young teacher to work independently, to form his / her own pedagogical style. It is necessary to allocate priority directions of work with students of pedagogical HEIs: the organization of the address preparation of the student focused on educational institution in which it is necessary to work with the novice teacher; formation and creation of measures for "soft" immersion of the graduate into profession; providing the background for professional and career growth; "soft" return to profession (Kasprzak, 2013). The gap between theory and practice, between the University and the school in which the teacher will work, is considered to be the main reason preventing a young teacher from shaping his/her professional experience, sufficient to work in a modern school.

However, it should be noted that a real school, at the moment, cannot be considered as a platform for the formation of sufficient professional competences of teachers, focused on the upcoming future. A request for a teacher with new educational experience, which is not possible to get in practice in a real

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school, is being formed. The contradiction between the demands of modern society and the existing educational experience causes distrust or rejection of the school, as well as distrust of the system of teachers' training on the basis of pedagogical Universities.

We believe that the contemporary training of a teacher should be predominantly oriented to finding mechanisms of inclusion of a student into pedagogical activity under the upcoming conditions.

3. Research Questions

In the process of developing a mechanism for the formation of the readiness of the student of pedagogical University to perform professionally in the near future, key research issues were identified:

- Identify the key professional deficits of a student in the regional educational system.
- Develop a conceptual model of activity of a student, focused on overcoming professional deficits.
- Determine the conditions for experiencing focused on the redundancy of information, dynamic and technological processes and uncertainty of situations in the professional sphere.

4. Purpose of the Study

The research is aimed at elaborating conceptual and content aspects within active learning environment for preparing students to perform under the conditions oriented to redundancy of the pedagogical information bank, dynamic technological educational processes at schools and uncertainty of pedagogical situations.

The aim of this research is encouraged by the discrepancy between theoretical grounds for forming teachers-to-be readiness to perform in redundant highly technological environment and their implementation practices. The lack of elaborated techniques for training students in pedagogical HEIs at present justifies the need for research in this direction.

5. Research Methods

The research was executed with the help of empirical study, situational modeling and forecasting, educational systems design and modeling of organization training processes in pedagogical HEI.

6. Findings

In the course of the study, the key deficiencies preventing the formation of professional competencies were identified on the level of the regional educational system; the structure was described; the conditions for the organization of students' activities in key areas of training were determined; approaches to the organization of the educational process were formed.

6.1 Key deficiencies preventing the formation of professional competencies on the level of the regional educational system

Research reveals that, generally, immersing in professional real life novices do not advance in teaching, and sometimes professional reality causes their withdrawal from it. During their field practice, regional students were challenged by the number of factors. The data obtained with the help of interviewing

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students after their field practice at regional secondary schools in the period between 2014 and 2017, 85 teachers of mathematics, computer science and physics participated in the interviews. The data detected the following challenges that our regional students faced during their practice: the absence of a mentor, the lack of or poor software and IT facilities at schools; mentors lacked experience or professional competencies which did not allow to use new teaching methods and technologies in the classroom, the teacher-mentor was not interested in solving pedagogical problems but preferred to focus on the "reflection" of the student in the learning process (the teacher ignores the student in the learning process, if all the efforts made on his part are unsuccessful). Describing the process of interaction with the teacher-mentor, students mentioned such problems as lack of assistance, limiting the activities of the student through active intervention in his/her teaching in the classroom, low level of IT competency or lack of experience in mentoring interns.

In the further study of this issue, the collection and analysis of students experience in all areas of training in their first field practice, allowed us to identify major challenges. The survey involved 60 people (2018). The main deficiencies in the regional system were identified as following: lack of mentors (4 %), low level of mentors competency (12 %), "excessive guardianship" by mentors (9 %), insufficient level of material and technical support, provision of means of communication and communication (8 %). Among 13 % of students, who took part in the survey, emphasized the fact that they had not been perceived as teachers at schools. It is to mention that, in the traditional format, field practice activities of initial teachers do not contribute to the formation of an emotionally positive experience of independent teaching.

The analysis revealed the professional deficiencies of the young teacher:

- Insufficient positive emotional experience of independent pedagogical activity in real-life educational process.
- Lack of experience of the design elements of the educational environment with the use of modern technology and modern logistics.
- Lack of experience in using modern learning formats.

The identified deficiencies actualize the need to provide the background for immersing a student in professional environment and shaping his/her experience of independent pedagogical activity in conditions of sufficient material and technical and methodological support.

The existing contradiction between modern requirements to the conditions for the organization of the teachers' training system and real (possible) conditions for the organization of pedagogical activity of the undergraduate at school is the basis for development of the mechanisms focused on creation of these conditions on the basis of pedagogical Universities. Creating conditions for the formation of emotionally positive professional experience of students on the basis of pedagogical University has a number of advantages. Namely:

- Establish initial contact with children in the framework of professional activities in the conditions of informal interaction.
- Organize the educational process without taking into account the formal conditions and protocols of interaction that must be observed in the school.
- Design the educational process in the conditions of free creative search (without reference to the teacher's planned and prescribed work) and sufficient material and technical support.
- Give classes in a non-aggressive environment, interact with a mentor.

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- Independent decision-making and being a “real” teacher.

6.2 Conceptual model of student activity, focused on the formation of primary professional experience

The conceptual model describes the practical activity of a student of a pedagogical University, focused on the formation of experience of independent work with students through immersion in real activity and the formation of primary professional experience on the basis of the University.

Creating conditions for independent, creative design in the modern information and educational environment is a prerequisite for the organization of activities. Within the framework of the model, the key positions are defined as the following:

- Professional development through self-realization.
- Formation of the system thinking fundamentals through the possession of the situation.
- Comprehension of reality through reflection of the outcomes.

The model is supposed to be focused on research and modeling of the objects in the educational environment; design of key elements of the educational environment and design of new "educational" prototypes. The key stages of students' activity concentrated on the creation of educational prototypes are identified as:

- Problem grounding on the basis of empirical data.
- Fixing the project idea and its schematization.
- Internal audit and content analysis.
- Design of software product (educational artifact).
- Educational project design (educational event).
- Creating of an educational situation.
- External evaluation.
- Reflection on performance.

We emphasized the following key activities of the students’ active learning: educational robotics, augmented reality, 3-d modeling and prototyping and design of simulators. The choice of these activities of students is due to the need to develop a new paradigm of learning and education, which is based on technology-oriented knowledge.

The conceptual model of student’s activity is based on the design and technological approach to the elements of the educational system learning and design. Design and technological approach to training involves the design and implementation of educational projects in real-life practice through the creation of an educational event. Construction in the educational sphere is focused on the creation of a unique educational product, the formation of personal experience as a project of actions to create a product, the study of the limits of its applicability in the educational process.

The student's activity is integrative and exploratory; it is focused on obtaining a specific result when solving a real problem for a particular consumer; the student's activity is correlated with personal experience and it is aimed at the formation of a value attitude both to the activity itself and to the outcome. Activity is carried out within the educational process (educational practice), the organization of research work of the student, in extracurricular activity (Zhigalova, 2018).

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The conceptual model of undergraduate's activity is focused on achievement of the following results:

- Gaining experience in organization of experimental and constructive activities in the group.
- Development of modern methodological approaches to the organization of training.
- Formation of professional portfolio as a set of software products (educational artifacts) and educational projects (events).
- Professional development through building the trajectories of educational events.
- Reflection on the results of activities as an assessment of the functional component of the knowledge.

Managing students learning activities, it was defined that pedagogical conditions would be understood as a following set of strategies necessary for the organization of activities: accessibility and openness of the environment (space for design), informal communication "on equal terms", scientific, methodological and organizational support from the part of the mentor and activity and interest on the part of the students.

6.3 Practice-based approach to teachers' training

The model was implemented in the FabLab installed in the School of Education at Far Eastern Federal University in 2015. Student's Project Bureau "Center for Interactive Learning" as an educational production laboratory is available to all students (FabLab for Education). Software and IT facilities of the laboratory are used to support students learning and research as well as to manage their extracurricular activities. Students have the opportunity to design unique educational projects using modern equipment: 3-D modeling and prototyping laboratory, video studio, printing studio, interactive learning tools studio and robotics studio. Academic staff and graduate students perform as mentors in the projects. Within the FabLab, there was launched the design of software products (artifacts), design and original educational events. Students from the Project Bureau "Center for Interactive Learning" developed and implemented a set of key competitions and educational projects for regional students. These activities were aimed at engaging more regional students in research and technical creativity within the extended learning system. A set of education-oriented events designed by our students outreaches high technology program for students during the holidays. Undergraduate students gain self-study experience through immersion in real activity with schoolchildren.

Since 2017, activities are redirected into identifying the scope of ICT in education, forecasting and research of the implementation outcomes; experimental and constructive activities are implemented through interaction in several areas:

- Educational systems using augmented reality technology,
- Educational systems using virtual reality technology,
- Educational artifacts created by 3D modeling and prototyping technology.

Students do experiments developing new applications for educational needs, explore the scope of their application in a real educational process and identify the risks of use. For example, they created a virtual simulator "Manage Your Classroom". The project is original and unique by its value within the Russian system of pre-service teachers' training. During the implementation of the project, students explore the existing reality, identify typical situations faced by the student in teaching practice at school, identify

alternative solutions, predict the results of their application, analyze expert opinions, model situations, give a formal description, prescribe a user scenario and design an application. A distinctive feature is the fact that students independently open a new area of knowledge related to the use of 3D simulators in education, identify the possibility of using 3D simulators in the teacher's training system, try to assess the risks of use and reflect on.

7. Conclusion

The changes taking place in our society are associated with the rapid development of technology. In this article, we justified the need to implement an approach aimed at shaping professional competencies conditioned by information redundancy, dynamic and technological processes and uncertainty of educational situations. Based on the theory of active learning environment, the approach is focused on the successful entry of young teachers-to-be into the regional education system. The key components of designing an active learning environment are defined. The first component of the active learning environment examines and identifies professional deficits of students at regional pedagogical Universities. The second component was devoted to the development of a flexible conceptual model of student's learning. The third component represented the conditions for shaping competencies and professional development trajectories.

The integrity of graduates' learning activities is aimed at designing the educational system and searching the solution to a real-life social significant problem affecting the future professional activity. The construction of the educational process in the logic of the project activity is considered to be a mechanism that allows organizing students' learning activity effectively, focusing on the readiness for the implementation of design and constructive functions in the future pedagogical activity.

Implementation of the mechanism to shape initial professional experience in the framework of educational activities contributes to the successful entry of the student into the future profession by creating conditions for independent, creative design in the modern high-tech information and educational sphere.

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