Project-based learning technology as means of self-development for a prospective specialist in automated machine building

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Abstract. This article studies self-development of a prospective specialist in automated machine building as the key personal feature in the course of his professional formation in the higher education system. Information-based learning technologies assist in the formation of the creative approach to understanding professional activities among students and develop their independence of thought and the ability to make optimum situation-specific decisions. Project-based learning technology serves as an effective means of professional self-development for a prospective specialist in automated machine building.

1. Introduction
The modern system of higher professional education is the result of notable changes that have recently occurred. It is currently being modernized: its content is updated and new educational technologies are introduced. Market economy repeatedly imposes new requirements on graduates. The employer needs not just a young specialist but a professional with special knowledge in his chosen professional activities. As a result, modern trends in the development of Russian education define new priority tasks set by the education process at higher education institutions. The increased role of internal determinants in securing personal and professional human growth identifies the formation of the specialist’s personality with one’s need for self-actualization, self-development and creative potential realization as the supreme value.

Scientific literature analysis shows that personal self-development represents the conscious process of personal formation aimed at effective self-realization based on internally significant intentions and external influences. We examine self-development in terms of professional formation. Thus, it is justifiable to refer to professional self-development. V.A. Slastenin regards professional self-development as the process of integrating external professional training and internal movement and personal human formation [1].

2. Materials and methods
An ascertaining and forming experiment was conducted among students of the Nosov Magnitogorsk State Technical University. 78 students of the Institute of Metallurgy, the Machine engineering and metal processing participated.

The study was conducted in three stages. The first stage involved theoretical analysis of the problems
of self-development of a prospective specialist of automated engineering through project based learning technology and the study of philosophical, sociological, psychological and pedagogical literature on the problem under consideration. The main methods at this stage were theoretical (theoretical and conceptual analysis, generalization, structuring and abstraction) and empirical (direct and indirect observation, interviews, questionnaires and ascertaining experiment) methods. The second stage involved designing and experimental testing of the discovered pedagogical conditions and developing methodological apparatus for their implementation. The main working methods at this stage of the study included the diagnostic method (interviews, questionnaires, and testing), methods of mathematical statistics, modeling and formative experiment. The third stage involved analysis and improved insights based on the obtained findings. The main working methods included qualitative and quantitative analysis of the obtained findings, the methods of pictorial representation of experimental data and computer methods of data processing.

3. Results and Discussion
The learning environment that exists at a higher educational institution does not fully secure the addressing of tasks related to professional self-development of a prospective specialist in automated machine-building: it does not sufficiently activate and utilize the internal resources of parties involved in learning activities and their creative potential, is not focused on their comprehensive personal self-realization and does not provide the conditions for continuous self-improvement of students and teachers.

Therefore, the implementation of innovative approach to managing learning process and the use of information technologies, to be more specific, is becoming one of the currently important focus areas for higher educational institutions related to training prospective specialists in automated machine-building [2]. Such technologies as developing and using lecture-based multimedia tools and electronic teaching aids, using specialized software, computer-based testing, using Internet resources, business and role-playing games, problem-based research methods, case method, educational and personal training courses, module-and-ranking technologies of educational process management and project method are presented in theory and practice of modern higher education [3, 4].

Project-based learning technology plays a special part in professional-and-creative self-development of students (I.A. Kolesnikova, V.D. Simonenko et al.). In the course of this technology implementation, students, together with the teacher, design a certain profession-specific situation with problematic context, which is associated with the content of studied discipline or future activities, and then independently address any inconsistencies built in such activities. This technology’s focus on the formation of a student’s axiological thinking and his ability to find the answers to important profession-based questions of moral, ethical and aesthetic nature represents its important advantage.

All types of projects (educational, education-and-research and scientific-and-research) are aimed at the development of students’ personal traits, the formation of creative activity experience and the understanding of various professional-and-academic, worldview, moral-and-ethical and other critical problems. The specifics of project-based learning lies in the fact that learning process is built within the activity logic bearing personal meaning for the student. Project-based learning technology has a developmental target, designs the content of education in isomorphically prospective professional activities, is built on party-to-party interaction between learning process participants, presents training materials as a system of cognitive and practical tasks and motivationally ensures professional teacher training based on the subjective experience of prospective specialists.

Learning project represents independent creative activities completed by the students corresponding to their age-related abilities and performed in line with the generalized design algorithm starting with the idea and ending with its manifestation.

During the project implementation, specific challenges of their own arise for a student, which, however, have objective nature and their overcoming is one of the major academic goals set by the project method. Overcoming challenges triggers creativity among students and develops their imagination. The digestion of new information underlies the design but this process is carried out in the
field of uncertainty and it must be organized and modelled since students find it hard to set major and current goals and objectives, find ways to solve them and choose the optimum ones.

Project implementation largely involves independent student or student group activities. Therefore, the teacher becomes an independent consultant who provides academic support to the students.

Project method refers to a set of techniques and operations related to the acquirement of particular scope of practical and theoretical knowledge in certain type of activities. This is a method of learning and a way to manage the learning process. Thus, when we refer to the project method, we particularly imply the way to achieve the didactic goal through elaboration of the problem (technology) that must be accomplished with fully realistic and tangible practical outcome presented in one form or another. The project method implies the acquirement of knowledge and skills in the course of learning and the existence of tangible outcome, which can be seen, understood and applied in real practical activities.

The following requirements apply to the project method application:

- the presence of socially or personally significant problem requiring integrated knowledge and researcher’s search for solution;
- theoretical, practical and cognitive significance of assumed outcome;
- independent (individual, pair and group) student activities;
- structuring the informative part of the project (indicating step-by-step results);
- using research methods: defining the problem and the resulting research objectives, hypothesizing, discussion of research methods, presentation of findings, analyzing obtained data and conclusions.

Several stages of project activities have been identified through the analysis of academic references [5,6,7]. Here is a brief review of the scope for different stages and the conditions for creative self-realization of the student at each identified stage. Exploration stage includes searching for and analyzing the problems, selecting the project subject, planning project activities on step-by-step basis, collecting, studying and processing information on the project subject, as well as conditions for creative self-realization of the student. Besides there are joint activities performed by the teacher and students in the analysis of subjective experience.

The next stage is presenting a problem-based situation. It also contains training in independent challenge overcoming (e.g. gap) by reflexion and initiating the effort to perform learning actions regardless of the established stereotypes.

The constructive stage is as follows: seeking the optimum solution for the project objective, preparing engineering and technological documentation and conditions for creative self-realization of the student, training in activities planning with the maximum use of one’s own abilities. Developing volitional powers in the situation of exploration, modelling and creating one’s own types of activities are actual for this stage. Developing feelings accompanying exploration, discoveries and inventions and generating susceptibility to creative aspects of learning activities are an initial part of the process. Expanding subjective functions of students is of great importance. Developing creativity, flexibility and consistent thinking and creative imagination.

The technological stage reflects planning practical project implementation, selecting required information, materials, tools and equipment, performing scheduled technological operations, quality monitoring, design and technology modifications, if necessary. Presenting results, project presentation are also necessary. In addition to that there are conditions for creative self-realization of the student: academic student support, initiating non-conventional methods of learning activities, independent behavior in academic situations and apportioned assistance. This secures the understanding of research methods, techniques and means by students, develops the ability to perform evaluation among students.

The reflexion-and-evaluation stage includes not only the project implementation process and result analysis but also conditions for creative self-realization of the student and mobilizing students to reflect their behavior and communication. Practicing and reinforcing students’ skills in integrated analysis are applied in the reflexion of problem solution. Self-perception as a creative individual, recognition of
one’s own role in academic and professional activities and understanding one’s own creative potential.

To ensure the fulfillment of each step, the teacher must possess specific training techniques used in special forms of education. Conventional training techniques assume working directly with the subject material, i.e. the addressed objectives and problems are included in the scope of problems specific to the studied science. Such training normally pursues purely academic goals such as memorizing, finding, understanding and describing. The predominant motivation is external towards the activities and stimulated by external control. The scope of creative self-realization is extremely small. That is why pretend play can be referred to as the major form of project-based learning since it represents the most natural form of personal immersion into the existing (or imaginative) reality in order to explore it and to display one’s own ego, creativity, activity, independence and self-realization.

4. Conclusion
Studying mechanisms and theoretical justification of the conditions for students’ self-development in the course of learning activities provided at educational institutions are the priority focus for pedagogical science. When studying self-development, its following individual aspects are revealed by researchers: development of personal self-identification when choosing profession, actualization of creative abilities and personal initiative and development of creative thinking among students. Project method promotes student’s creative self-realization in academic-and-professional activities. This predominantly refers to the student’s independent activities, focused on solving a problem that is important to one and performed in simulated or existing reality.

References
[1] Slastenin V A 2004 Pedagogical Education and Science 1 43-49
[2] Ardashkin I, Martyushev N, Bezborodov V 2015 Procedia - Social and Behavioral Sciences 166 227-231
[3] Kameneva G A, Bondarenko T A 2018 Novosibirsk State Pedagogical University Bulletin 4 172-186
[4] Saigushev N Y, Vedeneeva O A, Melekhova Y B 2018 Journal of Physics: Conference Series 1015(3) 032119
[5] Mikhailova U V, Saigushev N Ya, Vedeneeva O A, Tsaran A A 2018 Journal of Physics: Conference Series 1015(3) 042054
[6] Savva L I 2015. Professional and personal formation of a university students (Ufa: Aeterna).
[7] Kabasheva I, Rudaleva I, Bulnina I, Askhatova L 2015 Mediterranean Journal of Social Sciences 6 435-439.