Special Aspects in Implementing the Project-Based Learning in Russian Universities

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Vasily Ivanov graduated from Kazan State Chemical and Technological Institute (today Kazan National Research Technological University, KNRTU) in 1976. He continued his research and obtained a Ph.D. in Engineering in 1986. At the same time, he held the administrative positions in the regional system of education management. He received the position of the First Vice-Rector of KNRTU for Academic Affairs in 1989, which he has held since then. He received the degree of Doctor of Science in Education for his dissertation "Designing the Contents of Professional Pedagogical Training for Faculty of Technical Universities" in 1996. Professor Ivanov enhanced the development of engineering pedagogy at KNRTU as a separate subject and a research discipline. He investigates the problems of engineering pedagogy in the following areas: continuing psychological and pedagogical education in an engineering university; teaching methods for engineering disciplines in an engineering university; innovative engineering education; continuing professional development programs. Vasily Ivanov chairs the Academic Council for Defense of Ph.D. and Doctorate Thesis in Engineering Pedagogy at KNRTU for degrees in "Theory and Methods of Teaching Chemistry in Schools and Universities" and "Theory and Methods of Professional Education". Under his supervision, 11 Ph.D. dissertations and 3 doctorate dissertations in engineering pedagogy were defended. Since 2012, Vasily Ivanov has been a member of American Society for Engineering Education, and has participated in ASEE Annual Conferences and International Forums. Professor Ivanov has been an active member of IGIP Russian Monitoring Committee since the day of its foundation in 1995. Under his leadership, in 1997, a Center of Engineering Pedagogy was founded at KNRTU with an accredited European Engineering Educator program. He was the key driver of the 42d IGIP International Conference "Global Challenges in Engineering Education" held in Kazan in 2013. Vasily Ivanov has published over 400 research and methodology works, including 20 monographs, 38 textbooks and study guides, 92 papers in the leading peer-reviewed journals, 35 papers in international journals.

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Dr. Sanger is a professor in the School of Engineering Technology in the College of Technology of Purdue University. His focus and passion is real world, industry based, senior capstone experiences both domestically and internationally. He has successfully developed this area at Purdue and at Western Carolina University. Prior to his career in academia, Dr. Sanger had a successful 30 year career working in and with industry managing and participating in broad range technology development and commercialization.

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PUBLICATIONS
Mostly, articles on educational and linguistic topics, as well as translations

PROFESSIONAL BACKGROUND
1995 - present time Teaching students and adults (German, English, Comparative Education, Psychology&Pedagogy) at various educational establishments, from high schools and private colleges through the Center for Professional Retraining and Advanced Training for University Professors at Kazan State Technological University.
1992 - present time Freelance and employed translator/interpreter working with English, German, French, and Russian in various companies in Russia and abroad. Since 2012, a member of the Union of Translators of Russia

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EDUCATION

1996-1999 Postgraduate at Kazan State Technological University On December 1, 1999, defended the thesis on Comparative Education and was awarded the degree of the Candidate of Education (a Russian equivalent of PhD)

1996-1997 Center for Professional Retraining and Advanced Training for University Professors at Kazan State Technological University Diploma of a professional teacher in higher educational institutions

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Dr. Irina Pavlova
Special Aspects in Implementing the Project-Based Learning in Russian Universities

Abstract: In the framework of activity approach within the system of higher technical education, the project-based learning starts playing a special role, as an innovative type of education that contributes to the formation of key competences of future specialists and boosts the mental activities of students.

Keywords: project-based method, active teaching methods, engineering education, activity approach.

Modern Russia is challenged with serious needs for highly qualified engineering personnel as a necessary resource of its economic development. Many social and economic problems were apparent in the context of modernization and promoting the innovation-based economy in Russia. They turned to be especially impactful on the labor market where the qualitative labor demand-supply gap had occurred in the recent years, which worked out in the discrepancy between the vocational education level/quality of human resources and the modern business requirements.

The state’s ambition to take a rightful place within the international labor division system would be impossible without providing the advanced training of professionals. Today, the new graduates will have to solve the problems of innovative development and consider both the current needs and the future challenges of industry and society in general. That is why the future specialists must have a well-developed set of competences that allow them to set and solve new problems, and propose prompt and non-standard solutions. In the context of fast updating information, a key aspect of training a competitive individual is the idea of repeated training and re-training a person during his or her entire working life.

The level of the economic and social development of the state is likely to depend on solving the problem of adult education, so this issue needs to be seriously analyzed theoretically and provided with reasonable practical recommendations.

One of the trends in the efficient modernization of the vocational education system, a vote of confidence in solving the problems set, may become the modern private-public partnership (PPP) that allows educational establishments to interact to customers as closely as possible for obtaining feedbacks, detect the real needs for the particular competences of trainees, quickly adapt the contents of educational programs or individual subjects, combine theory and practical studies during internships at a specific enterprise, jointly discuss the ways of improving the training of professionals, pool together the efforts in the development of the personnel of enterprises and companies, etc.

In the course of implementing the principle of continuity in education, the changes arise in the nature of motivation and knowledge necessary at each stage of human life. The core problem of education is not acquiring the continuously growing amounts of knowledge, but the ability to be up to speed on the increasing flow of information, as well as to generate knowledge that does not exist, but is felt by the person as being necessary. The rapid obsolescence of scientific information makes people search for the sources of new knowledge and develop the skills of independent using such knowledge in real manufacturing or personal situations. This is why the project-based learning is becoming a globally frequent practice: The project
developing skills acquired shall contribute to the professional timely adaptation to changing operation targets.

In 2004, Russia moved to two-tier education in line with the Bologna Process, which also necessitates further increasing the level and quality of training specialists and improving the whole variety of teaching/learning forms and methods. Experience of many countries has proven that active teaching/learning methods increase the students getting motivated to study.

Analysis of works published by Russian and foreign researchers allowed us to identify a wide range of challenges the Russian engineering education has faced recently. The most important of them are listed below:

- Increased requirements applied by employers to the quality of specialists training;
- Necessity to develop in students/trainees competences enabling them to see, identify, and solve problems in specialized and integrated areas of their professional activities;
- Necessity to teach students being differently prepared for and differently motivated to their studies; and
- Necessity to strengthen the activity-based part of the educational process and to involve students into that process.

Generalizing research results allows us to state the insufficient extent of prior research regarding the theory of and the practical recommendations on how to select and apply educational technologies and methods that allow responding the challenges communicated to the system of education by external and internal environments. In this context, it is necessary to find and apply efficient educational techniques to eliminate the said contradictions:

- Between the expected performance of training specialists in engineering and technology and the educational technologies applied at universities and insufficient for training a modern competitive engineer;
- Between the requirements of employers and the quality of training the graduates of engineering educational programs; and
- Between the possibility of applying advanced educational technologies and the growing bureaucratic requirements to organizing teaching/learning processes.

In the context of general availability of information due to Internet, changes in teaching/learning are inevitable: It will move from communicating large amounts of facts and other data to explaining basic definitions and increasingly independent search and collection of information. Developing such skills on the basis of new approaches contemplates obtaining extra results while completing the basic education. Thus, the problem-based method, one of the effective methods of new education, on the one hand, teaches students to search for and use new information and, on the other hand, develops entrepreneurial competencies.

Researchers make a wide range of arguments for project-based learning, such as:

1) Projecting is a variation of discovery and developmental teaching;

...
2) Projecting determines the new, modern, innovative image of an enterprise or company;

3) Projecting changes the way of thinking of the project participants, approaching it to the needs of the 21st century;

4) Projecting realizes the ideas of person-focused education; and

5) Projecting changes the competitiveness and allows acquiring the project-based, i.e. advanced, or time perspective thinking.

Education quality growth and increasing the competitiveness of Russian educational establishments are ensured in Russian innovative universities due to their integration into the global educational environment and applying actual teaching methods.

Thus, the professionals from the National Research Tomsk Polytechnic University propose to implement the project-oriented approach to teaching via expert workshops as a comprehensive system of successively and particularly organized educational techniques and methods of individual and team work, such as problem-based lecture, discussion, round table, brain storming, searching method, research method, individual studies, and teamwork of students, which allows ensuring the active efforts of students in identifying, analyzing and searching for addressing problem-based situations.

Inviting globally acknowledged professionals to Russian universities also allows applying the world’s best practices to teaching students and training/retraining teaching staff.

Recently, the project-based learning is increasingly used at Kazan National Research Technological University (KNRTU), Russia, as a method that enhances the studying motivation of its students. Implementation of the method into the teaching/learning processes in the University is largely determined by inviting a professor from the USA, who has been successfully implementing this method globally for very different audiences for many years. A special feature of his work at KNRTU is the use of the project-based method for differing academic purposes in different groups of trainees, such as bachelor-level students, master-level students, postgraduates, and teaching personnel.

Although the project-based method, as follows from its name, presupposes developing projects, such projects are not of purely educational nature – they are taken from the needs of social life, even from the personal life and experience of the project developer, and they are not performed in the course of educational activities, but through the educational activities.

Project-based education is the innovative type of education that presupposes obtaining new knowledge and solving a problem within the process of education, which changes its social function, since a teacher does not just transfer knowledge – he or she promotes generating thereof. Therefore, the value of project-based education is the person’s development while mastering the new ways of solving problems and generating new knowledge.

In implementing the project-based method in educational process, students/trainees shall research in the problem and propose the ways of solving it. This approach requires active work from each participant; everyone contributes to the process and is responsible for end
results. As compared to conventional methods, all participants are highly involved into the educational process.

While working on their projects, students and trainees are offered to perform, individually or in teams, the tasks strictly limited in time and aimed at describing and analyzing a problem-based situation, estimating the status/level/depth of the problem, assessing the evidence and indicators of the problem status, analyzing the specific problem status considering the actual data, and identifying the challenges and the ways of solving the problem.

As a result of the work performed, nine projects were implemented in the bachelor-level and master-level groups, on the following topics:

**Bachelor-Level Groups:**


Project goals:

- Getting acquainted with the representatives of various professions and with the main principles of career choice and planning;
- Getting acquainted with the special aspects of the modern labor market;
- Assisting in comparing one’s abilities to the requirements of professions chosen, and
- Assisting in understanding the difficulties in achieving professional objectives and finding the ways of overcoming such difficulties.

2. Teaching Children to Love Nature and Animals.

Project goals:

- Making children understand that it is necessary to love nature and animals, and their beauty;
- Cultivating in children the interest of animals and plants;
- Establishing in children a habit to visit zoos, parks, and other venues preserving untouched nature; and
- Drawing parents’ attention to the world in which their children grow.

3. Communication without Borders; Living with Everyone.

Project goals:

- Facilitating the communications for people with disabilities using social networks;
- Erasing the barriers of one-to-one communications; and
• Attracting and involving people from allover the world into achieving the goals of our project.


Project goals:

• Assisting foreign students with lack of the Russian language in understanding their peers and colleagues and in faster adapting to the social environment;

• Collecting slang words most commonly used by the university students in the Russian language;

• Translating such words into other languages, such as English, Turkmen, Uzbek, etc.; and

• Acquainting foreign students with the phrase-book developed.

Master-Level Groups:

1. Water-Jet Cutting Fire-Control Unit.

Project goals:

• Decreasing the impact of hazardous factors upon fire fighters, since the fire is handled from a safe position;

• Saving time due to the fast deployment of the fire fighting system and to its functioning at the early stage of flame propagation – cooling and lowering the reactivity of hot gases;

• Providing by the fire fighting system a higher flow rate under high pressure, which results in evaporating most water used when contacting hot gases or hot surfaces; and

• Improving the access to fire in closed spaces with limited availability, such as jacketed floors, walls, roof structures, attics, vent ducts, etc.

2. Naushochketka.

Project goal:

• Developing a protection device similar to a safety helmet, but based on a protective cap, which will have the same protective functions and, at the same time, be characterized by good appearance and comfort.

3. Website Adapted for Foreign Students. www.cityguest.help

Project goal:
• Creating a website for foreign students to facilitate their adaptation to living in Kazan.


Project goal:
• Waste sorting and compacting to facilitate its further processing.


Project goal:
• Designing a scraping brush to quickly clear a car of snow and ice.

The results of working on the projects were delivered as presentations in Russian and English.

Upon completing the lessons with Professor Sanger, a poll was taken among students that showed that 80% of the respondents had liked to work on their project. 74% pointed to their keen interest to working in a team. 78% of students are sure that they will further use the knowledge they have gained when working on their project.

Some innovations were introduced into applying the project-based method at the Russian university. Thus, professor also used the project-based learning for one-time “exchange” lessons with students studying law in English. Questioning these students demonstrated the usefulness of this method even when applied in such a manner. Using project-based learning implements the principles of interactivity, performance, independence, and students’ involvement in the educational process, contributes to training the key competences of future professionals, and essentially activates the students’ mental activities regardless of the levels of their preceding preparation or motivation.

Wanting to and having a real opportunity to apply their competencies in place, the students realize why certain theories, concepts, and rules are important and perceive them as useful tools in their educational and vocational activities rather than as just abstract models. At all stages of their studies, they feel the necessity of proactive communications and establishing partner relations with the teacher, their course-mates and experts in the area of the problem to be solved, in order to exchange opinions and discuss hypotheses and results obtained.

However, the experience has shown that the implementation of the project-based learning involves some problems of organizational, methodological, and personal nature. For instance, the students that had participated in one-time lessons involving project-based method noted in questionnaires that they felt it necessary to involve in such lessons a teacher being the carrier of new information that would later be translated into the project-based learning format.

Under a conventional program, students start their studies with being told what they have to know and then showing what knowledge and skills they have acquired. In traditional teaching, the process is linear and it is the teacher who is the center of that process. In PBL, the learning starts with a problem. Students identify what they have to know and how to study to solve this problem. This generates more problems and a higher need for studying. This is a cyclic process.
Thus, the existing knowledge is an important factor that defines the amount and the type of new knowledge that may be integrated, and such existing knowledge must be activated in the context of information to be learnt. Starting from setting a problem, students can identify their needs for learning and structure their acquisition of new knowledge. The conventional approach contains a contradiction where students cannot practically apply the knowledge obtained from lectures or textbooks. Within the framework of the problem-focused teaching method, this contradiction is eliminated, since students decide themselves what information they would need to implement the project, i.e. they can directly apply their theoretical knowledge to practice.

Some difficulties also occurred when trainees, the university teachers, were mastering the project-based method – they had preferred to regularly communicate with a native English speaker in the real-life mode rather than to grind away at their projects. This could be considered a purely Russian problem, but the criticism toward project-base teaching/learning has also started to sound at international conferences.

However, in general, using this method as an experiment at KNRTU has shown the necessity and possibility of applying new teaching methods that serve to activate both the students and the teaching staff. Being in need of and having a real possibility of applying the competences developed, students realize why particular theories, concepts, or rules are important and perceive them not as abstract models, but as useful tools in their educational and vocational activities. At all stages of training, it becomes necessary to proactively communicate to and form partnerships with the teacher, co-trainees, and experts in the field of the problem to be solved to exchange opinions and discuss hypotheses and the results obtained.

Introducing the project-based learning at KNRTU has got its logical, practice-oriented continuation. Thus, the idea of creating a website for foreign students for the purpose of accelerating and facilitating the process of their adaptation to living in Kazan, along with the idea of developing a students’ slang dictionary has aroused the interest of the representatives of some of Tatarstan’s ministries, such as the Ministry of Education and Science and the Ministry of Youth and Sports. Considering the increasing tourism draw of the region, the development of a similar website is planned, focusing on youth travel.

The projects of Water-Jet Cutting Fire-Control Unit, Waste Compactor, and A Heated Scraping Brush for Snow/Ice Car Clearing were offered to small enterprises – the residents of the Khimgrad technopole. There exist preliminary arrangements on introducing and manufacturing the products. Publishing a study guide based on their experience in implementing project-based learning at KNRTU and on original proprietary technologies has become equally important for the teachers participating in training students using project-based learning. The collaboration of the KNRTU teaching staff and the professor from Purdue University on introducing project-based learning can be deemed successful.

References


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