**WorldSkills Competition as an Efficient Engineer Training Technology**

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**Abstract.** The article covers the phenomenon of the positive impact of the WorldSkills championship movement on improving the training of engineers at universities. Technologies of training young professionals developed in the WorldSkills championship movement have been effectively applied in universities in the last years. This applies to improve the content of educational programs and curricula.

WorldSkills movement allows future engineers to improve their professional skills in working professions related to the future profession of engineer. The training base and training ground for students are being improved, direct contacts with different companies and representatives from the government are being formed during competitions.

Experts claim that approximately every country in the world will encounter a lack of personnel in key sectors of the economy by 2025. We observe a rapid shift to the digital economy and see how new competencies are emerging and existing ones are developing. In 2020 the situation with coronavirus confirms the relevance of a rapid shift to the digital economy and improvement of existing competencies. Therefore, WorldSkills movement plays an important role in these processes.

The consequences of existing trends in the development of the global economy are job cuts, the appearance of new people, and retraining staff to the digital economy and destruction of the usual mechanisms «guarantees of the future» (career guidance, long-term employment, and decent pension). These statements were cleared up with the support of Young professionals [1].

On the other hand, there is a declining interest in engineering professions all over the world. Nowadays only a small percentage of young people choose technical specialties and engineering education. Therefore, one of the most important problems is the awakening of young people's interest in engineering specialties from school days and while studying in colleges [2].

All over the world technological and engineering universities try to persuade young learners and students to study technical studies and engineering professions as a possible future career. That is why it is important to make new informal and other methods of developing an interest in engineering professions [3, 4].

International Young professionals WorldSkills movement has a crucial role in the process of training and teaching youngsters to adapt to new realias. And also provide engineering universities with effective methods and technologies for attracting talented young people to engineering professions and training of future engineers.

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1 Background Goals and Problems

The purpose of our study is to study, analyze, and transmit the experience of engineering universities in conducting WorldSkills championships and the participation of students of pre-university programs, and then junior students of the university.

Kazan National Research Technological University has a successful experience in implementing various innovative projects to develop students' special competencies (e.g., in field of moral education, elite engineering education) [5, 6].

A working group was created within the framework of the project, which was developing specific mechanisms for its implementation, establishing links with government and representatives of the technology business.

We assume that the specific format of WorldSkills championships allows students of pre-university programs and first-year students to successfully improve their professional skills and competencies which are relevant to the modern economy. During the preparation for the championship future student masters the working profession which is close to his or her future engineering specialty. This suggests that WorldSkills methods can be successfully used not only with direct participants of WorldSkills competitions at various levels (regional championships, national championships, European championship, World championship, etc.) but also future participants can be trained directly in the departments and faculties of the university.

The WorldSkills championship is a non-profit movement that has been developing around the world since the mid-40s of the 20th century. However, some countries were involved in it only in the 21st century. Nevertheless, they already see and feel a significant effect of the WorldSkills championship in terms of increasing the prestige of working professions and the development of professional education. And it's not a coincidence because during the organization and holding of WorldSkills championship we can observe the best professional standards that occur in every country and the world in general.

Universities were engaged in the WorldSkills championship a little later than colleges and technical schools, but over the past 3–5 years, they have already gained experience in organizing competitions and qualified training for its participants.

The main purpose of the project is to develop the WorldSkills championship movement at the university and the formation of technological competencies and skills among future students, the involvement of high school students and college students, as well as first-year students in the process of mastering working professions, the basics of engineering activity in digitalization of Economics and Industry 4.0.

Another important goal of the project is to make working and engineering professions popular. A growing number of young people (about 42%) go to the vocational education system. This suggests that the importance of working professions is increasing, the prestige of this education is increasing. However, the domestic system
of vocational education requires changes taking into account modern standards and advanced technologies [7].

WorldSkills movements can influence the improvement of engineering training at the university, therefore, the project should implement the best WorldSkills standards in the educational process of the university.

Assistance in the implementation of these goals of the project: partner-enterprises, future employers, governmental structures, ministries, and departments.

2 Stages of Project Realization

Representatives from the university have been participating in WorldSkills movement since 2016 for many years. For several years, the university has become one of the leaders in its region and country in several competencies at once, university students have repeatedly become winners in European and world championships. These results were the outcome of the tedious work of a large team: administration, teachers, and students.

A working group was created at the university, which was engaged in the development of specific mechanisms for its implementation, establishing relationships with interested partners, the dissemination of WorldSkills technologies and standards at different faculties of the university, college and lyceum as part of the project to develop the WorldSkills movement.

A working group consisted of representatives from the university, teachers, and many others who later became experts and received certification from Worldskills movement.

The development of the project in the university evolved through different stages within 5 years:

1st stage – planning and adjustment phase (2016–2017).
2nd stage – organizational phase (2017–2018).
3rd stage – competitive phase (2017–2020).
4th stage - disseminating the experience phase (2018–2020).

During the first stage, we were investigating world experience of WorldSkills movement, its development in our country. And we also made methodological documents about training college, junior students, and prepared documents about mechanisms of further participation of the university in the championship movement.

At the second stage, relations were established with partners, training sites began to be prepared both at the university itself and based on partners—industrial enterprises, companies, organizations, and ministries. And preparation of future participants in several competencies began, a pool of experts and trainers among the teachers was formed.

In the third stage, the university was intensively involved in the competitive process. For the first time in our country, a qualifying university stage was held at our base, during which a team of participants and professional experts - compatriots was formed. Since 2017, the university annually holds university qualification championships.
according to WorldSkills standards, at which university students, future engineers who also have a working profession, demonstrate their knowledge and skills.

The university team began to participate in regional and national championships. Several competencies were assigned to the university, according to which the participants showed themselves most actively and where the university was able to organize equipped training grounds and a base for competitions. For example, at a university college, regional championships “Young Professionals” (WorldSkills) are held.

At the fourth stage, the university generalizes the accumulated experience and extends it to all faculties of the university. Training grounds are beginning to be used in the educational process of the entire university. At the university, training is conducted for participants from other cities and from all over the country. University coaches and experts conduct classes not only with regional participants but also with national teams.

For example, university professors have become coaches of the national team in the fields of “Fashion Technology”, “CAD Engineering Design” competencies, and are preparing teams for the European Championships in Professional Excellence (EuroSkills 2018) and the World Championship.

For example, in 2019, the university becomes one of the country’s ten centers for training participants in the WorldSkills movement in the CAD Engineering Design competency. At the department of computer engineering and computer-aided design, training was held for the extended national team of Russia in the CAD Engineering Design competency.

As a result of tedious work, the university became the lead organization for the training of members of the national team from our region in some WorldSkills competencies. By the decree of the Government of the republic, several engineering competencies were assigned to the university: “Laboratory Chemical Analysis”, “Printing Technologies in the Press”, “CAD Engineering Design”, “Industrial Design”, “Production of Polymer Materials”, and “Entrepreneurship”, “Refrigeration and air conditioning”. “Fashion Technology”, and since 2019 – “Labor Protection”. This means that together with the supervising ministries, the university organizes not only competitions but also the training process of participants.

One of the strategic tasks of the university is to develop the championship movement.

3 Successes of Students at Worldskills Championships

During the preparation and participation in different competitions, university students became experienced participants and they moved from young professionals (from 14 to 16) to seniors (from 17 to 22).

University students have won all the necessary places in higher educational institutions in the world according to WorldSkills standards at the time when they studied at the lyceum in the university, at a technological college, at the faculty of secondary vocational education. Then they became university students.

For example, the participation of KNITU students in the world championship of working professions in Abu Dhabi in 2017 was a brilliant success: Vadim Polyakov in the refrigeration and air conditioning competency won the gold medal there.
In 2017, Fedor Shadrin, a student of the faculty of secondary vocational education of KNITU, became a member of the WorldSkills national team. Student Albert Mineev won the EuroSkills-2018 Championship of Workers.

In 2019, university students at the regional championship won the entire pedestal in the competence “Printing Technologies in the Press”, also assigned to our university. KNITU was also represented at the championship by Evelina Altunyan, Oscar Arslanov, and Emil Miftakhov. Professor Anzhe Khayrullina became a part of international certified experts. Representatives of the university won half of all the medals of all participants from the region.

Nikita Baryshev won the gold medal of the 45th WorldSkills World Championship in August 2019 in Kazan, Russia, in the competence “Industrial Design” from the technical college of our university.

4 Preliminary Results and Effects of the Project

Every year, the number of competencies in which college and university students take part is growing, the number of participants from universities is growing, and the championship's geography is expanding.

Students participating in the competitive movement demonstrate in the learning process, not only good training in the chosen professional field but also mobility, the versatility of knowledge.

According to the Minister of Labor, Employment and Social Protection of our region, the WorldSkills championship is aimed primarily at creating and strengthening the prestige of working professions, however, the results of admission campaigns to universities in recent years have shown a steady tendency to increase the competition for engineering areas. Representatives of the leadership and the government of the region have repeatedly expressed satisfaction that universities, which are training professional teams, as well as the expert community, have joined the young professionals movement.

As a result of the development of the WorldSkills movement, the professional community develops and improves professional standards. These changes are accordingly reflected in the educational programs for the training of engineers and further in the curriculum for training students in the relevant specialties.

Meetings and discussions of such changes take place among representatives of the university community with WorldSkills experts and employers. In the future, these changes in the curriculum will affect teachers of both foundation and special courses.

As for the impact of WorldSkills technologies on the exam system and the educational process of the university as a whole, it is obvious that the results of the training work of students, as well as the winners in competitions at various levels, are obvious. The methodology of evaluating the results used in WorldSkills can be directly applied to the system for evaluating university courses (in points or in another way). In the educational process, first of all, in the organization of practical and laboratory classes, methods of organizing the training of participants, as well as testing the assessment of professional skills, can also be applied. Universities and its pre-university structures
also successfully use the training base for preparing for the championships in their educational process.

Universities and its pre-university structures also successfully use the training base for preparing for the championships in their educational process. Partner universities and employers provide their facilities for the preparation for the championship and holding it. Besides, some employers and sponsors, as well as government agencies, purchase the necessary equipment, simulators, etc. for the university. All this helps to improve the practical training of young professionals - participants in competitions, as well as university students in general, who can use this equipment in the educational process.

It is difficult to overestimate the educational effect of participating in competitions for students themselves. They gain valuable professional experience, develop new competencies necessary in future professional activities, immerse themselves in the real environment of professional activity, learn about professional standards. They train and work in real professional facilities and simulators that maximally recreate the production process. The best teachers in the university become certified as WorldSkills experts, as a result, they significantly enrich their practical experience, which they can successfully pass on to all students of their courses.

5 Summary

We tried to summarize this experience based on our university and partner universities. Our observations and analysis, which we constantly update with new examples, demonstrates that during the WorldSkills championships new standards are set for working professions, as well as engineering professions close to them. Besides, WorldSkills formats can affect the educational process and exam system in colleges and universities.

Our experience shows that the training base and training ground for students are being improved, direct contacts with different companies and representatives from the government are being formed during competitions.

The experience of universities in organizing and holding WorldSkills championships proves its positive impact on improving the training of engineers at universities.

Technologies for training young professionals evolved in the WorldSkills championship movement have been effectively applied in recent years both in pre-university structures and in the university itself.

This applies to improve the content of educational programs and curricula, the practice of assessing the knowledge and skills of students. WorldSkills formats allow future engineers to successfully improve their professional skills in the working professions associated with their future engineer specialties. They gain professional experience, learn necessary competencies, find out professional standards. Teachers become certified as experts and transfer their practical skills to all students.
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