Available online at www.sciencedirect.com

ScienceDirect

Procedia - Social and Behavioral Sciences 206 (2015) 272 – 277

Procedia
Social and Behavioral Sciences

XV International Conference "Linguistic and Cultural Studies: Traditions and Innovations", LKTI 2015, 9-11 November 2015, Tomsk, Russia

Implementation of Federal Research Projects as a Tool to Enhance the Training Quality of Master's Program

Kirill Larionov*, Sergey Lavrinenko, Vladimir Gubin, Artem Kitaev

National Research Tomsk Polytechnic University, 30 Lenin Avenue, Tomsk, 634050, Russia

Abstract

Analytical study of the impact of Federal target programs (FTP) implementation with involvement of master's program students for the purpose of obtaining practical skills, identifying and developing organizational skills, increasing motivation to the educational process and competitiveness in the labor market. The result of a parallel implementation of the Federal program and training of students in the master's program has significantly improved the performance of students. The average point increased from 4.23 in 2014 to 4.55 in 2015. The publication activity increased by 64 %, the number of conferences with participation of students in the master's program increased by 75%. The growth of these criteria is caused by a large number of experiments carried out, analytical review, the practical relevance of the studied material and level of motivation due to payments to students from the Federal program funds.

Peer-review under responsibility of the Scientific Committee of LKTI 2015.

Keywords: Effectiveness; learning efficiency; increase of motivation level; involvement in research activities.

1. Introduction

In 1992, the higher education in Russia has been translated into a multilevel system, which is divided into three levels: incomplete higher education, complete higher education, confirmed by awarding the Bachelor's degree, higher education, confirmed by the Master's degree or a traditional qualification of specialist.

Russia's joining to the Bologna process in 2003 had a significant impact on the objectives and content of the Russian educational, economic and social reforms, which deeply affect the social, political and economic structures,

* Corresponding author.
E-mail address: laryk070@gmail.com (K. Larionov).

Peer-review under responsibility of the Scientific Committee of LKTI 2015.
doi:10.1016/j.sbspro.2015.10.024

affect the interests of communities and the state (Lavrinenko & Kitaev, 2015; Sokolova, 2011). The main objectives of Russia's participation in the Bologna process is to increase the Russian economy competitiveness due to its steady growth, transfer of the economic and social spheres to market relations, bringing up a new generation of promising and competent human resources who will be able to solve problems of different difficulty and develop key sectors of the country (Beresneva & Goreva 2013; Sokolova & Gil, 2014). This should also contribute to a favorable development of relations with foreign partners and promote exchange of experience between research teams (Achcaoucaou, et al., 2015).

According to the Order of November 21, 2014, Tomsk Polytechnic University adopted the Federal state educational standard (FSES). It is a set of requirements that are mandatory in the implementation of the basic professional educational programs for higher education, one of which is to train masters in the field 13.04.01 Heat and Power Engineering (Federal state educational standard of higher education. The direction of training 13.04.01 Heat power Engineering and heat engineering).

The scope of professional activity of graduates who have completed the master's program in this field, includes a set of technical means, ways and methods of human activity on application, control of flow and conversion of other energy types into heat (Lavrinenko, et al., 2015).

Upon graduation the graduates should master the following types of professional activity: calculation and design, process and production, research, administrative and teaching activity (Galloway, 2008).

The implemented two-tier system of training is relatively new and still not fully realized by the students and employers. For students who received a bachelor's degree, the question arises whether it is reasonable to continue training in the master's program, when they have diploma certifying higher education. Master's program implies the second final qualification work, which is more complicated and research-intensive. It should be noted that after awarding the Master's degree, the graduates are employed in the same positions as the bachelors, thus wasting two years of professional experience. On the other hand, employers are unsure of the level of bachelors' professional competences and consider masters more research-oriented.

Perhaps, if training in the master's program with less classroom hours was carried out in parallel with a partial employment at the core enterprises, students would develop more practical skills.

Since this approach has not found an application yet, for successful training of future graduates, it is necessary to organize the learning process so that they can get theoretical knowledge and practical skills at the University. This will make it easier to perceive the information and visualize the studied processes.

The aim of this research is to examine the impact of large-scale Federal level projects on the basis of higher educational institutions on the level of competence and improving skills of master's program students.

2. Research methodology

In September 2014, the National research Tomsk Polytechnic University within the framework of the Federal target program has begun to implement the applied researches and experimental developments on the subject "Conducting applied research and experimental development aimed at development of solid fuels gasification plants for energy and industrial sectors".

The purpose of these works is the adoption of a final design and technological solutions for the building a new generation of gas-producing installations of in-line vortex and hearth gasification of solid fuels that enhance the resource efficiency of existing and upgraded energy facilities and reduce their anthropogenic impact on the environment.

This project calls for a large number of studies of various properties of coal that affect the processes of gasification. Students of the first year of the master's program were involved.

Types of professional activity, which students are being trained for in the program, agree with the main stages of the Federal program quite well (Table 1).

Table 1. The activities under the FSES and the FTP stages.

FSES	FTP
Calculation and design activities	
• preparation of assignments for design development, identification of the technological level parameters for the designed flow charts or facilities; • description of the main operating principles and arrangement of designed products and facilities with the feasibility analysis of the implemented solutions; • conducting engineering design, feasibility and cost-benefit analysis, calculation of design solutions efficiency.	• development of the expected technical and economic indicators for the designed gas installations; • development of technical documentation set for the laboratory bench for integrated testing of coal gasification.
Research activities	
• development of working plans and schedules for scientific research and technical developments, preparation of specific assignments for the responsible party; • collection, processing, analysis and systematization of scientific and technical information for ongoing research, selection of methods and means for solving the tasks; • development of method and organization for experiments and tests, analysis of obtained results; • preparation of reporting documents, reviews and publications based on the research results; • development of physical and mathematical models for researched processes, phenomena and objects related to professional area.	• analytical review of scientific, technical, regulatory and methodological literature; • study of morphological and thermal properties of coal; • study of operating parameters of the gasification processes; • study of composition and properties of the resulting synthesis gas in the gasification process of coal; • conducting patent research regarding patentability and infringement search for development objects; • development and verification of mathematical models based on the comparison of obtained results with the analytical solutions of similar model problems.
Managerial activity	
• carrying out organizational work, determining the works sequence; • search of the most beneficial solutions for the manufacture of products subject to the requirements imposed on quality, reliability and costs, as well as deadlines, life safety and environmental protection; • prevention of industrial injuries, occupational diseases and violations of environmental protection; • implementation of developer supervision when manufacturing, installing, testing and commissioning of developed products and facilities.	• implementation of projects in small working groups; • making collective and individual decisions for implementation of tasks; • optimizing the labor costs and consumables; • completion of tasks assigned by managers, according to schedule.
Production and technological activity	
• development of measures for compliance with technical procedures, improvement of methods for organizing teamwork and the production technology; • ensuring continuous operation, proper use, repair and modernization of power and heat engineering process equipment, electrical and heat networks, gas and product pipelines; • evaluation of production needs in fuel and energy resources, conducting feasibility studies for utilities development, reconstruction and improvement of energy supply systems.	• the manufacture of parts of the laboratory stand integrated tests; • installation of the component parts of the laboratory stand integrated tests; • development of programs and methods of research of processes of gasification.
Pedagogical activity	
• performance of duties of a laboratory assistant (assistant) in educational programs for professional training.	

As it can be seen from Table 1, the main objectives of the Federal target program are almost fully consistent with the professional activities of the master's program for the field 13.04.01 Heat Power Engineering. Teaching activities under the Federal target program can be organized through involvement of students in the project as laboratory technicians and teaching assistants in the research laboratory.

During implementation of the first stage of the program specifications together with the master's program students, divided in small working groups, the following works have been completed in accordance with the schedule:

- development of technical documentation for laboratory bench designed for integrated testing of coal gasification
- analytical review of scientific, technical, regulatory and methodological literature

- study of morphological and thermal properties of coal
- study the operating parameters of the gasification processes
- study of composition and properties of the resulting synthesis gas in the coal gasification process
- conducting patent research, including studies of patentability and infringement search for development objects
- development and verification of mathematical models based on comparison of the obtained results with the analytical solutions of similar model problems

For the first time, part of the above work was performed in the framework of the course design development by the group of 4 students studying in the field 13.04.01 Heat Power Engineering. As the result of joint work of students, under the guidance of experienced engineers, was designed the laboratory for studying the processes of coal gasification (Fig. 1), which will be mounted and put into operation according to schedule of technical specifications.

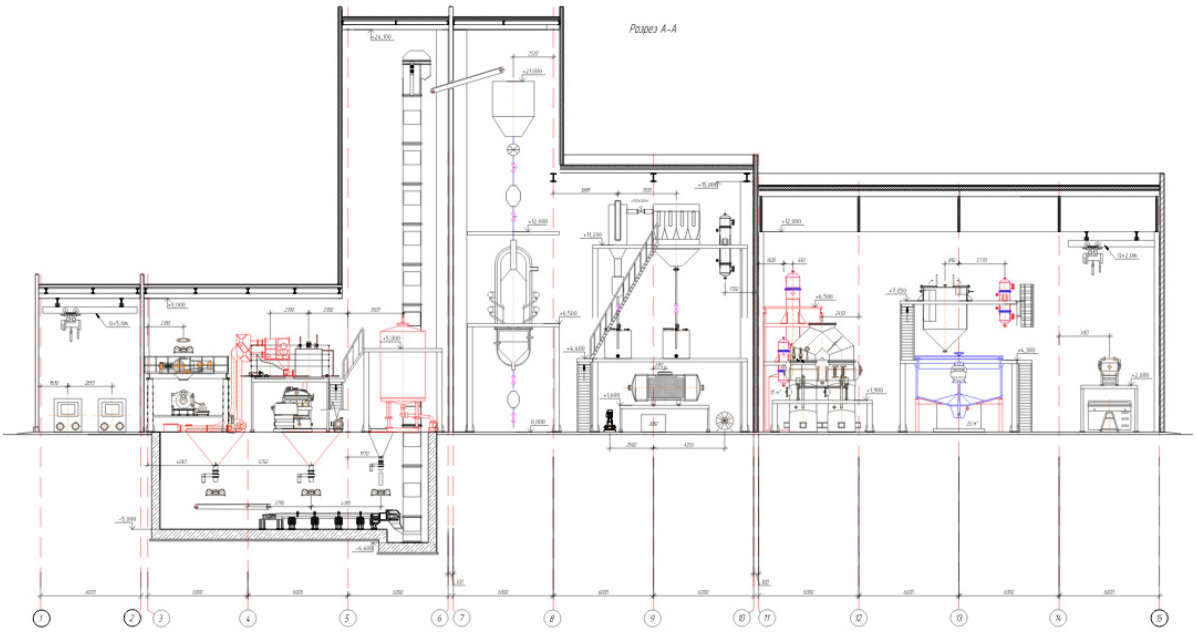

Fig.1. Design of laboratory for studying the processes of coal gasification.

3. Results

Involvement of students to the FTP implementation allowed them to gain the opportunity of carrying out experiments on a wide range of research and analytical unique equipment. The results, obtained during the experiments, were taken as a basis for theses and publications in conferences of different levels, which led to publication activity increase and raised a number of other performance indicators (Fig. 2). Students work on the project in a small group allowed them to demonstrate their organizational skills, which correlate well with the results of psychological testing (Lavrinenko & Kitaev, 2015). In addition, part of the Federal program funds was directed to pay the students who actively participated in the project.

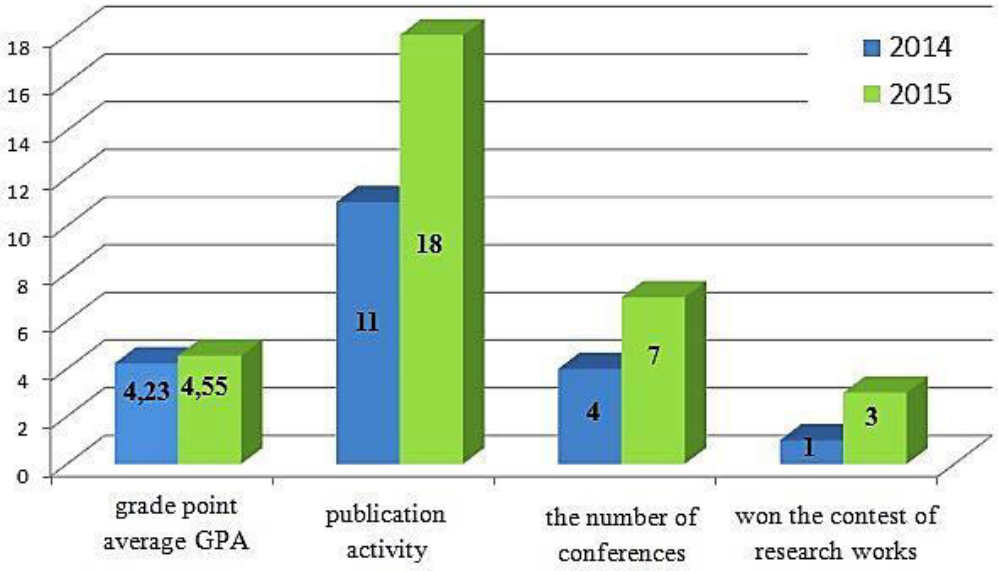

Fig.2. Performance criteria for the Master's program implementation.

4. Conclusion

As a result of training, students in the program for field 13.04.01 Heat Power Engineering in parallel with the implementation of the Federal target program significantly improved their performance criteria. The average point increased from 4.23 in 2014 to 4.55 in 2015. This criterion increased because of higher motivation and practical relevance of theoretical material studying, as well as remuneration from the funds of the Federal program. Publication activity increased by 64 %, the number of conferences with participation of maser students of this profile increased by 75%. The increase in these criteria is due to a large amount of obtained results from the experiments, analytical review, the patent researches and development of the mathematical model. The attraction of budgetary funds for payment of travel expenses and the registration fee also contributed to the increase of academic mobility of students. The described experience of involving students in the master's program to completion of large-scale research projects on basis of higher educational institutions shows an increase in the level of training of future graduates and increasing their competitiveness in the labor market. It should be noted that results of our work can serve as a good basis for further training in postgraduate school.

Acknowledgements

The work was carried out at the National Research Tomsk Polytechnic University within the Federal Target Program entitled "R&D in priority areas of development of Russia's scientific and technological complex for 2014-2020" (unique ID: PNIER RFMEFI58114X0001).

References

Achcaoucaou, F., et al. (2014). Competence assessment in higher education: A dynamic approach. *Human Factors and Ergonomics in Manufacturing, 24*, 454-467.

Beresneva, E. V., Goreva, I. V. (2013). Technology of using of training chemistry experiment in professional preparing of bachelors and masters of chemistry. *European Social Science Journal, 9(3)*, 171-178.

Federal state educational standard of higher education. The direction of training 13.04.01 Heat power Engineering and heat engineering. http://cdnimg.rg.ru/pril/107/89/40/35221.pdf.

Galloway, P (2008). The 21st century engineer. *ASEE Annual Conference and Exposition, Conference Proceedings*, 16-16.

Lavrinenko, S. V., et al. (2015). Preparation of students to professional activity by the nuclear industry on the basis of laboratory complex and interactive whiteboards. *Modern problems of science and education*, 4. http://dx.doi.org/10.17513/spno.127-21152.

Lavrinenko, S. V., & Kitaev, G. A. (2015). Structural-logical scheme as a didactic foundation of modern information technologies. *Modern Research of Social Problems*, *4*, 3-11. http://dx.doi.org/10.12731/2218-7405-2015-4-1.

Sokolova, I. Yu. (2011). Specialist training quality in vocational education; its estimation and providing from a perspective of comprehensive and competency building approaches. *Tomsk State Pedagogical University Bulletin*, *13*, 162-168.

Sokolova, I. Yu., & Gil', L.B. (2014). Analysis of the correlation between secondary school students' intelligence, style of problem solving and the quality of specialist training. *Fundamental research*, *6(7)*, 1513-1517.