Advances in Economics, Business and Management Research, volume 47

International Scientific Conference "Far East Con" (ISCFEC 2018)

Perspectives of Engineering Education: Project-Oriented Experience of NEFU

S. Antsupova
North Eastern Federal University
Yakutsk, Russia
anzupowasg@mail.ru

G. Parnikova
North Eastern Federal University
Yakutsk, Russia
anzupowasg@mail.ru

***Abstract*—The purpose of this article is to describe some experience of project-oriented training of engineering students atNEFU. The task of the project is to construct an energy efficient individual house in Tiksi settlement (Yakutia). The prototype of full-life cycle training was business forum "Engineer" among students' innovative projects. Distribution, fixing and assessment of tasks were divided between students from departments ofArchitecture, Construction, Land management, Woodworking Technology. 16 teams participated in this full-life cycle project; each team is supervised by the moderator (a graduate student/an undergraduate). Hisduty isassistance to estimate such soft skills as system and critical thinking, communications, team work etc. Results of the project are estimated by heads of departments and stakeholders of the institute.**

Keywords— project-oriented training, engineering education, Arctic regions of Yakutia

I. INTRODUCTION

The problem of improvement of engineering education actualizes emergence of ideas for its decision including both local changes and paradigm complex modification [1].

The higher educational institution forms a set of competences corresponding to the directions of students' preparation. At the same time level of many competences seldom reaches the top of Blum's pyramid and allows only to apply the gained knowledge. We believe that only immersion in real working process allows to reach the necessary level of competences and motivate students to acquire knowledge.

Today many jobs assume work with computer, documents and information. Therefore, it is probable to create quite authentically working process in virtual space and thus application of project inengineering training is possible.

Project activity, along with research, technological, organizational and enterprise ones are fixed in current Russian federal state standards as main types of professional activity to which the university graduates are to be ready.One should mention that in developed countries of Europe project-oriented approach to training has been developing from 1970s [2].Researchers of active methods of training [3,4] consider that a project-oriented method is one of the highest steps of "ladder" in forms of education [5].Project training can be various: absolute reorganization of educational process according to project; special course which is partially integrated into the curriculum etc. [6,7].

The main components of project training in higher educational institution are: content (the subject of the project corresponds to the direction of students' training); acquisition of key competences (creativity, communicativeness, problem thinking etc.); involvement into educational process; problem requiring the solution; need of independent information search; independent solution of a task; continuous monitoring of results of project activity; public protection of results of the project [8-11].

Research work (work practice) of students at the Engineering Institute of NEFU is carried out as project-oriented training. It demands team implementation of full life cycle project. The annual competition of innovative students' projects "Engineer" served as a prototype of research work.

Research work is called "Engineering group". It is the educational module realizing team work of students from various specialties. Four directions of the institute were involved in the project: 07.03.01 Architecture – 27 students, 08.03.01 Construction – 121 students (profiles: Industrial and Civil Engineering; Building Designing and Constructions, Production and Construction Materials; Urban Construction, Heat and Gas Supply, Air Ventilation; Real Estate Administration), 21.03.02 Land Management and Inventories – 25 students, 35.03.02 Technology of Wood Processing – 9 students. There are 16 teams consisting of 11-12 students with strict distribution of tasks according to kinds of activity and professional competences. The score of work practice is 3 credits.

Task of the project is to build the energy efficient individual house in settlement Tiksi. The choice of basic data was caused by the following reasons:

First, Tiksi is one of the most northern settlements of Yakutia and Russia with severe polar climate. Prospects of development of the Arctic [12] in the conditions of modern social, economic and strategic character of the Russian Federation are very wide [13, 14].

Secondly, Russia possesses a huge potential of decrease in power consumption in many branches of economy. Energy consumption in the Russian Federation is still many times higher, than in the western countries [15, 16]. Introduction of

energy efficient technologies promotes decrease in both production expenses, and charges of real estate objects [17, 18].

During research work students need to study long-term practice of construction of buildings with low energy consumption, including foreign one. Students are to offer the concept of the individual house with the correct combination of the materials, technical solutions and ways allowing to build houses of optimum planning to the reliable engineering systems, comfortable climate and ecology of housing, rational budget of construction and low operational costs in future.

The participants of the project are divided into internal and external. Internal participants include the project manager - Arkhangelskaya E.A., PhD in Technological Sciences, head of department "Real Estate Management"; the supervisor of the project - Kornilov T.A., Dr.Sci.Tech., director of the Institute; the project manager - Antsupova S.G., PhD in Technological Sciences, associate professor of the department "Production of Construction Materials; teams of the project (students) and their moderators (graduate students and post-graduates); experts - managers of the departments. External participants of the project (stakeholders) are the employers who assess level of training – business incubator of OREH and Educational Department of NEFU [19-21].

Attestation was carried out on the basis of three indicators: protection of the project (concept), project presentation and students' soft skills. Soft skills were important for the project as its success in many respects depends on personal qualities of each participant: an ability to analyze a problem situation, build hypotheses, generalize and draw conclusions; an ability to work in team and realize the importance of collective work for future result. The choice to moderate students' groups among graduate students and post-graduates is dictated by requirements of research and pedagogical activities of educational standards.

During practical training we revealed the most typical mistakes done by students: bad planning and forecasting of results of project activity; bad time-management although the working program with detailed description of practice was provided to teams beforehand.We also noted other causal facts related to soft-skills (Fig.1). Students are not fully aware of the personal responsibility associated with the work at the project stage. They do not consider the result as a set of interrelated elements. Then there are serious problems with team work, insufficient individual efficiency of students results in low productivity of cooperation. We also revealed contradictions between the presentability of the project (good design) and approaches to solving problems (lack of creative component).

Positive and negative sides of the educational project and SWOT analysis allow us to draw the following conclusions and mark out some successful criteria of project-oriented training.

Project training is better to realize within educational module as an independent unit of the educational program. The module can be used to assess a possibility of implementation of innovative projects, application of new engineering decisions, testing of new technologies and materials or solution of specific objectives of employers, i.e. customers. The format of the educational module is also designed to promote generation of new ideas, search of leaders and talented young specialists.

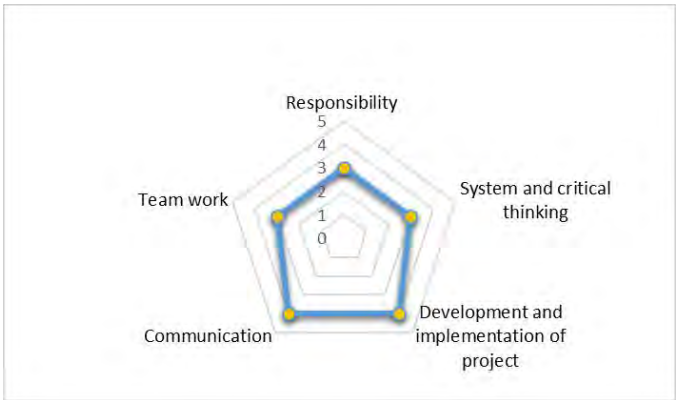

Fig. 1. Criteria of soft skills

It is essential to supply team approach with definite distribution, fixing and assessment of roles and tasks among students. At the same time activity of students must be directed to the solution of some problem connected with the received specialty, i.e. practice oriented and close to real conditions of future professional activity. Interdisciplinarity and integration of educational process allows to carry out complete professional activity of the students and creates space of professional and social interaction among teachers and students.

Attributability of training results in the module with results of development of the educational program in general is also important. Educational results are considered as abilities and skills of the student which can be demonstrated after the module is finished. Student must have positive motivation and personal interest in obtaining successful result of implementation of the project. Assessment of research work is equated to marks on disciplines of theoretical training and considered when summing up intermediate attestation of students

References

[1] Augusti G. Origin, modern conditionand perspective sof development of Europe an system of accreditation of engineering programs EUR-ACE. Engineering education, № 12, 2013, P. 22–31.

[2] Rummler M. Innovative Lehrformen: Projektarbeit in der Hochschule: Projektbasiertes und problemorientiertesLehren und Lernen. Beltz Verlag, 2012, P. 178.

[3] Lander E. 10 Best Games for ESL Teachers Abroad [Electronic Resource]. – Mode of Access: http://www.gooversees.com.

[4] Mishchenko E., Shelenkova I. Innovative language curricula at technical university: experience and results. Proceedings of the 42 International IGIP Symposium "Global challenges in engineering education". Kazan, 2013, P. 474-478.

[5] Wildt J. «Wasist gute Lehre? [Electronic Resource] – Mode of Access: http://www.phil.unigreifswald.de/fileadmin/mediapool/bildung/rv0.pdf.

[6] Winzker M. Projekt orientierte Lehre. [Electronic Resource] – Mode of Access:

https://www.fhmuenster.de/wandelwerk/weiterbildung/Winzker_FHMS_Projektorientierte_Lehrformen_Winzker_2013.pdf.

[7] Ruud Duvekot&Kees Schuur. Building Personalized Learning: A handbook for building a common theoretical background on concepts regarding personalizing learning Editors Published by EC-VPL, Jagersweg 23, 5262TM Vught, the Netherlands Publishing date November 2014.

[8] Buck Institute for Education Project based learning. [Electronic Resource] – Mode of Access: http://bie.org/about/what_pbl.

[9] A Guide to the Project Management Body of Knowledge (PMBOK Guide), ANSI/PMI-2000 ed.

[10] David I. Cleland, Lewis R. Ireland. Project Management. Strategic Design and Implementation / McGraw-Hill – 4th ed, 2002, P. 656.

[11] John M. Nicholas. Project Management for Business and Technology: Principles and Practice / Prentice-Hall – 2nd ed, 2001, P. 603.

[12] Hintsala H., Niemela S., Tervonen P. Arctic potential – Could more structured view improve the understanding of Arctic business opportunities? Building and Environment, Volume 89, July 2015, P. 160-169.

[13] Leksin V. and Porfiriev B. Scientific and Institutional Capacity for Complex Development of the Russian Arctic Zone in the Medium and Long Term Perspectives // Studies on Russian Economic Development, 2015, Volume 26, № 6, P. 55–60.

[14] Novoselov A., Novoselova I., Gassiy V. Selection of priority investment projects for the development of the Russian Arctic, Polar Science, Volume 14, December 2017, P. 68-77.

[15] Persson J., Gronkvist S. Drivers for and barriers to low-energy buildings in Sweden, Journal of Cleaner Production, Volume 181, April 2018, P. 33-41.

[16] Vinha J., Manelius E., Korpi M., Salminen K., Kurnitski J., Kiviste M., Laukkarinen A. Airtightness of residential buildings in Finland, Resources, Conservationand Recycling, Volume 101, August 2015, P. 105-121.

[17] Beattie C., Fazio P., Zmeureanu R., Rao J. Experimental study of air-to-air heat exchangers for use in arctic housing, Building and Environment, Volume 93, Part 2, November 2015, P. 128-140.

[18] RisbergD., Vesterlund M., Westerlund L., Dahl J. CFD simulation and evaluation of different heating systems installed in low energy building located in sub-arctic climate, PolarScience, Volume 14, December 2017, P. 68-77.

[19] J. Barrie Thompson, Helen M. Edwards Preparing Graduate Student for Industry and Life Long Learning: A Project Based Approach // Conference: World Conference on Computers in Education - WCCE, 2009, P. 292-301.

[20] Study of the Achievements of Tempus IV Projects in University-Enterprise Cooperation in the Southern Mediterranean Region // Education, Audiovisual & Culture Executive Agency: URL: https://eacea.ec.europa.eu/sites/eacea-site/files/2016_12_01-_sm_report_univ_enterprises_final_tcs_rmc.pdf.

[21] WISE Education Survey: Connecting Education to the Real World. Doha: Qatar Foundation, Gallup, 2015. URL: https:// www.wise-qatar.org/sites/default/files/asset.