

*Kinga Korniejenko*

**Cracow University of Technology, Faculty of Mechanical Engineering, Institute of Materials Engineering**  
al. Jana Pawła II 37, 31-867 Kraków, Poland, [kinga.korniejenko@mech.pk.edu.pl](mailto:kinga.korniejenko@mech.pk.edu.pl)

**AN ASSESSMENT OF THE EFFECTIVENESS OF SUPPORT FOR UNIVERSITY PROGRAMS FROM THE HUMAN CAPITAL OPERATIONAL PROGRAM IN YEARS 2013-2015 IN THE DEVELOPMENT OF STUDENTS COMPETENCES IN ENTREPRENEURSHIP**

**Abstract**

The article presents the ways of support from European funds in the development of student competencies and organizational innovation in the field education. It is based on a case study of the project 'Inżynieria materiałowa – inżynieria przyszłości' (Material engineering – engineering of the future'), financed by the European Social Fund in Poland. The project was implemented at the Faculty of Mechanical Engineering of the Cracow University of Technology in the years 2012-15. The research methods used are critical analysis of literature sources, surveys and a case study of the project mentioned above.

**Key words**

enterprise and entrepreneurship education, innovation in education, student competencies, European Social Fund

**Introduction**

Education, especially in the field of engineering, is the spine of development and economic growth of a country. STEM (Science, Technology, Engineering and Mathematics) fields are the most critical sciences for a nation and are key to strengthening the global economy [1]. For those reasons it is essential to develop a new, modern way of supporting education that meets contemporary market requirements and predicts future trends. Entrepreneurship is an important element of innovative education, especially for engineering/STEM graduates. They are not only demanded for technical and scientific careers, but also in other sectors such as finance, where they very often hold managerial positions [1, 2].

Entrepreneurship is also complex problem because there are many definitions in the literature and many theoretical and practical cases connected with this topic. Based on literature review, for the purpose of this article, entrepreneurship is defined as a way of thinking and acting by the author of article. Entrepreneurs are people who can notice opportunities or face problems responsibly [3]. They are people who can create new values and are agents of change that have impact on others. They are also creators of companies or projects and possess the basic skills of creativity and innovation [3, 4]. This kind of education is crucial for the engineering profession, where complexity and interdisciplinary cooperation increase together with the development of the world economy. Most companies require equipping engineering graduates with a set of non-technical skills such as communication, decision making, management, and leadership [5, 6, 7]. Entrepreneurial training can enhance the acquisition of relevant skills for graduates. It is important because research shows that engineering students and graduates in the US, Europe, and the Asia Pacific region have these skills at a very low level [5, 6, 7]. This kind of problem applies to Polish students and graduates as well [8, 9, 10].

**Development of enterprise and entrepreneurship education**

Enterprise and entrepreneurship education can help students to succeed in their future career by learning to think like entrepreneurs, facilitating corporate entrepreneurship and to address global competition and technological changes [3, 11]. These classes also develop other soft skills such as creativity and divergent thinking that are important for identifying new business opportunities [12]. In this case, creativity is especially important because it is perceived as the prime source for innovation [13]. They should give the proper knowledge and skills as well as create positive attitudes to entrepreneurship [14]. Thanks to this course, students may learn how to recognize the opportunities and follow them through with new ideas and determine the necessary resources. This is important not only in private business but also in project applications in many

areas, including scientific activities. Enterprise and entrepreneurship education also give them the possibility to improve their critical thought and managing abilities [11]. Implementing differential learning experiences into the educational process is crucial for enterprise and entrepreneurship education, such as business exhibitions, conferences of successful entrepreneurs, and company visits. Such experiences increase the effectiveness of this kind of education [3, 15].

It is also worth pointing out that entrepreneurship education is relatively a new topic for university courses. It was born in the United States of America in the 1940s and 1950s. The first academic course on entrepreneurship was launched in 1947 at Harvard Business School [16]. For many years, enterprise and entrepreneurship education has evolved significantly. Today, most universities offer the courses of entrepreneurship and many of them are focused on innovation topics [17]. Moreover, the development of enterprise and entrepreneurship education is supported by national and international policies, especially in the field of STEM education. The entrepreneurship initiatives in this area are very important for economic development. Grants funded by the National Science Foundation (U.S.A.) for North Carolina Central University launched in 2014 are exemplary of this sort of education. They are implemented as 'DREAM STEM'. The main goal of this program is to identify scientists and integrate entrepreneurship into scientific education. This program is worth over \$1.75 million [18]. Other exemplary came from Latin America is Fondo Emprender (Entrepreneurship Fund). This fund was created to finance business projects, having as beneficiaries students who are about to finish their undergraduate or postgraduate programs and with no more than two years after completing their studies. Between 2003 and 2015, 3,494,185 companies in 607 municipalities have been created per year with public funds, with 102 million dollars and generate 39,817 jobs [3]. The calculation shows that average number generated jobs per 1 company was about 0.011 work position.

Entrepreneurship education should empower post-graduation opportunities in modern society. It should also ameliorate some socio-economic problems, especially unemployment [19]. The article shows how enterprise and entrepreneurship education is supported from European funds. Thanks to a grant from the Human Capital Operational Program in years 2013-2015 it was possible to develop students' competencies in this area and at the same time the development organizational innovation in the area of education.

### Research methods

The article based on the case study of the project 'Inżynieria materiałowa – inżynieria przyszłości' (Materials engineering – engineering of the future'), especially research activities undertaken during the project such as surveys. The questionnaires (with open, semi open and closed questions) were given to the students and also to potential employers (during student's internships) in the framework of the project.

The project 'Inżynieria materiałowa – inżynieria przyszłości' (Materials engineering – engineering of the future') was supported from European funds in the development of student competencies. It was financed by the European Social Fund in Poland under the Human Capital Operational Program in years 2013-2015. The main aim of the project was to encourage young people to study Materials Engineering. The background of this national program was to persuade young people to choose engineering studies as more profitable for their future. In this time, many young people chose humanities because they were perceived as easier. It caused lack of technical competencies in the Polish economy. The project was implemented at the Faculty of Mechanical Engineering of the Cracow University of Technology in the years 2012-15. The students supported by this project had an opportunity to learn the skills required on the labour market. The project was focused on developing competencies needed in the job market, collaboration with enterprises in education and creating opportunities for students to develop practical skills through internships. The project was focused on BA students. In Poland, the duration of these studies is three and half years for engineering disciplines. The students have complex support programs that include [20] the following:

- An additional subsidy for the best students (about half of students each year)
- Additional classes in mathematics, physics and chemistry on the first year
- Lectures conducted by visiting professors
- Practical classes conducted by practitioners from industry
- Study visits to foreign organizations and domestic companies
- An additional course in the field of environmental protection in the second year
- An additional course in the field of computer methods for engineers (AutoCAD)
- Workshops on research methods such as thermal analysis and scanning microscopy

- Additional course entitled Internal Auditor Environmental Management System according to ISO requirements
- Internships in companies (1 month)
- An additional course in the field of environmentally-friendly solutions for production in the third year
- Participation of the best students in conferences
- Internships in companies
- Internships at foreign universities for the bests students (Japan and Germany)
- An additional course entitled International Welding Engineer (IWE)
- A course in the field of entrepreneurship in the third year

In addition to the benefits that students have achieved enriching their portfolio, the project made it possible to prepare teaching materials and purchase equipment that was necessary to carry out the activities of modernized curricula.

One of the important elements of the complex program for students was enterprise and entrepreneurship education. It was organized as an additional class in the third year of study. This period was chosen because of the study organization. After the three and a half years the students received the title of engineer and some of them decided to start a professional career. The form of classes had an innovative character and were focused on skills based education. The course included three parts: lectures and workshops as a base to prepare a business plan step-by-step, classes with practitioners (entrepreneurs) and student work on business plans. The students were divided in groups of about 17 people. Each group had 20 hours of lectures and workshops and 10 hours of classes with practitioners. The classes ended with a competition for the best business plan and had a valuable prize. The main goal was to raise the self-motivation of the students to attend classes and work on business plans.

The results present information from three kinds of surveys. The first are those made at the beginning of each year of the three and half year study program. They were conducted on 71 students in the first year (2012/13), 54 students in the second year (2013/14), 56 students in third year (2014/15) and 20 students in the fourth year (2015/16). The surveys included closed and semi-opened questions and were modified each year depending on the project activities. Below are selected answers to the questions connected with entrepreneurial aspects. The second one are results after the class evaluation. It was made using a questionnaire with closed and semi-opened questions regarding the utility of additional course in the students' opinion. The questionnaire had 16 items.

The questionnaire were filled out by 32 of the 68 students participating in the classes, and 49 prepared business plans. Below are selected answers regarding the students' opinions about the classes. Students as well as employers participated completed questionnaires after the internships. In the project, 49 students participated in the internship program, and 47 of those had a minimum of 3 months of internships. After each internship was an evaluation. It based on questionnaires filled by student and employer. The questions were connected with the effectiveness of this kind of support and the skills required by the labour marked. The chosen opinions are presented below.

## Results

The surveys were made at the beginning of each year of study. The results show the change in attitude of the students to enterprise and entrepreneurship education and their plans for the future. The charts (Figure 1 and Figure 2) are based on questions from the surveys and the students' answers.

Figure 1 presents the results of how the students' opinion changed regarding the entrepreneurship classes. On the vertical axis there are presented year of study. On the horizontal axis there are presented amount of students that chosen the variant of answer in the questionnaire. The numbers were transferred into percentage. Since the classes were organized during the third year of study, there were no questions about the classes for the first-year students. The results have the character of a Gauss chart. Many students perceived this topic as 'quite interesting' or 'interesting' before the classes. After the entrepreneurship classes, the responses changed. The students have basic knowledge, so a small group was interested to continue the topic. It is worth saying that the classes were made during the third year and they had a positive opinion. The

students identified the appropriate adjustment of the amount of material for the classes, the appropriate form and the content, the appropriate range of material and the timeliness of the course.

Figure 2 shows the change in opinions related to the future place of work. On the vertical axis there are presented amount of students that chosen the variant of answer in the questionnaire. The numbers were transferred into percentage. On the horizontal axis there are presented possibilities of answer (multiple chose). The years of study for each variant are presented in columns (as Roman numerals in legend). The students were asked where they would like to work after the completing their studies. The results of the questionnaires show that only a small group of students is interested in conducting their own business, and that group decreased during the project. The correlation between this chart and Figure 1 is very interesting, especially the large decrease in those who would like to be entrepreneurs after the classes. The course gave the students an awareness not only about the advantages of entrepreneurship, but also about the disadvantages and barriers connected with conducting their own business. Looking at the results, the question is about the meaning of guidance enterprise and entrepreneurship education. The answers show the results of the questionnaires after internships. About 75% students claimed to lack the 'soft skills' needed in their future jobs. Participation in enterprise and entrepreneurship education gave them the opportunity to enforce it. It may be especially useful in other career types such as work in small and medium enterprise or global corporations. Student opinions confirm employer opinions that students lack 'soft competencies', including those related to enterprises.

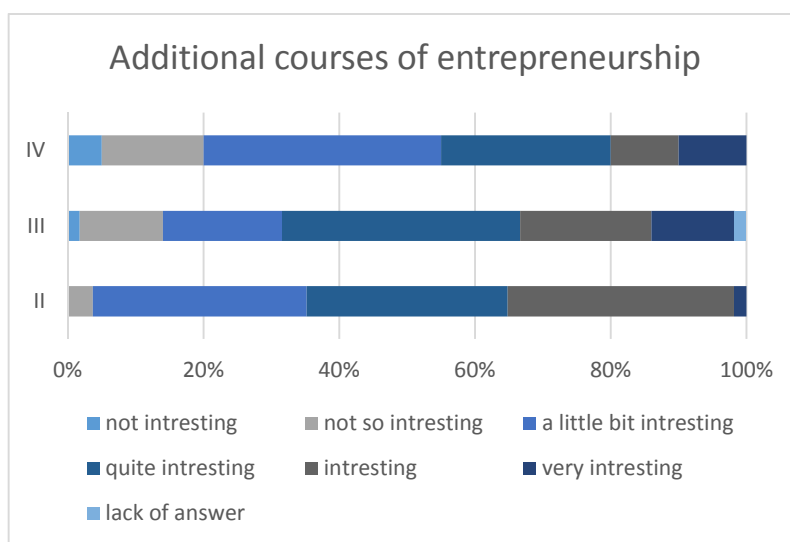


Fig. 1. The assessment of the usefulness of the entrepreneurship course developing students' skills  
Source: Author's

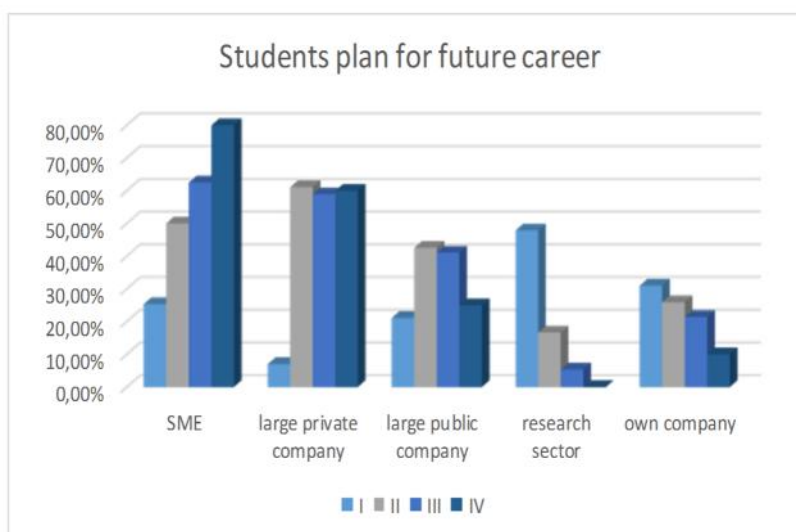


Fig. 2. The organizations where the students would like to work in the future  
Source: Author's

### Summary and conclusions

The article presents selected results connected with developing entrepreneurship competencies. The case study of the project 'Inżynieria materiałowa – inżynieria przyszłości' (Material engineering – engineering of the future'), financed by the European Social Fund in Poland shows the possibility of supporting enterprise and entrepreneurship education. The students supported by this project have a large opportunity to learn the skills that are required on the labour market. The project was focused on development competences needed in today's job market, collaboration with enterprises and creating opportunities for students to develop practical skills (internships). The students had a complex support program, including entrepreneurship competencies. The results of the questionnaires show that only a small group of students is interested in conducting their own business, and that group decreased during the project. Reasons could be the increased awareness of students regarding the difficulties linked running a company. However, the entrepreneurship classes included in engineering curricula have other advantages for the students. Participation in this kind of class may be also useful other types of careers and helps to develop other 'soft skills' that are desired by labour market.

The research results shows that the support for enterprise and entrepreneurship education is desirable. The important thing is design the modern curricula for this type of education. The curricula should be strictly connected with current market situation. In this case the European financial support for the entrepreneurial education for students is crucial. The universities, especially technical ones, concentrate on specialist knowledge missing the others area of education such as entrepreneurship. The external support gives an opportunity to enforce this area of knowledge. The results could be very promising in long term perspective. This kind of education is not only better market adaptation of the graduates, but creating the basis for modern, innovative economy based on small and medium enterprises.

### Acknowledgements

This research was part of the project 'Inżynieria materiałowa – inżynieria przyszłości' (Materials engineering – engineering of the future'), financed by the National Centre for Research and European Development under the Social Fund in Poland 2007-2013.

### References

- [1] M. Abdulwahed, 'Technology Innovation and Engineering' Education and Entrepreneurship (TIEE) in Engineering Schools: Novel Model for Elevating National Knowledge Based Economy and Socio-Economic Sustainable Development, *Sustainability* 9, 171 (2017) 1-21.
- [2] M. Borrego, J. Bernhard, The emergence of engineering education research as an internationally connected field of inquiry, *J. Eng. Educ.* 100 (2011) 14-47.
- [3] J.G. Gutiérrez, J.E.G. Baquero, New cross-proposal entrepreneurship and innovation in educational programs in third level (tertiary) education, *Contaduría y Administración* 62 (2017) 239-261.
- [4] H. El-Gohary, H.M. Selim, R. Eid, Entrepreneurship Education and Employability of Arab HE Business Students: An Attempt for a Primary Investigation, *International Journal of Business and Social Science* 7, 2 (2016) 52-72.
- [5] A. Patil, G. Codner, Accreditation of engineering education: Review, observations and proposal for global Accreditation, *Eur. J. Eng. Educ.* 32 (2007) 639-651.
- [6] M. Abdulwahed, W. Balid, M.O. Hasna, S.A. Pokharel, Skills of engineers in knowledge based economies: A comprehensive literature review, and model development, in *Proceedings of the 2013 IEEE International Conference on Teaching, Assessment and Learning for Engineering (TALE)*, Kuta, Indonesia, 26-29 August 2013, 759-765.
- [7] J.A. Hamad, M. Hasanain, M. Abdulwahed, R. Al-Ammari, Ethics in engineering education: A literature review, in *Proceedings of the 2013 IEEE Frontiers in Education Conference (FIE)*, Oklahoma City, OK, USA, 23-26 October 2013, 1554-1560.

- [8] T. Rachwał, K. Wach, Badanie intencji przedsiębiorczych młodego pokolenia: wyniki ankietyzacji wśród studentów kierunków nieekonomicznych, *Przedsiębiorczość – Edukacja* 12 (2016) 405–415.
- [9] A. Andrzejczyk, *Przedsiębiorczość studentów województwa podlaskiego*, *Optimum. Studia Ekonomiczne* 6 (84) (2016) 142-170.
- [10] T. Kusio, Podnoszenie kompetencji przedsiębiorczych przed wejściem na rynek pracy, *Nierówności Społeczne a Wzrost Gospodarczy* 50 (2/2017) (2017) 403-412.
- [11] S. Ojaghi, B. Rezaee, N. Naderi, H. Jafari, Conceptual – Analytical Model Challenges of Entrepreneurship Education in Higher Education Institutions (Case Study: Universities in the Kermanshah City), *Pal. Jour.* 16 (2017) 95-104.
- [12] S. Karimi, H.J.A. Biemans, T. Lans, M. Aazami, M. Mulder, Fostering students' competence in identifying business opportunities in entrepreneurship education, *Innovations in Education and Teaching International* 5, 2 (2016) 215–229.
- [13] R. Cachia, A. Ferrari, K. Ala-Mutka, Y. Punie, Creative Learning and Innovative Teaching. Final Report on the Study on Creativity and Innovation in Education in the EU Member States, Luxembourg: Publications Office of the European Union, 2010.
- [14] T. Garvan, B. Ocinneide, Entrepreneurship Education and Training Programmes: A Review and Valution, *Journal of European Industrial Training* 18, 11 (1994) 13-21.
- [15] S. Robinson, H. A. Stubberud, Elements of entrepreneurial orientation and their relationship to entrepreneurial intent, *Journal of Entrepreneurial Education* 17, 2, (2014) 1–11.
- [16] K. Wach, Edukacja na rzecz przedsiębiorczości wobec współczesnych wyzwań cywilizacyjno-gospodarczych, *Przedsiębiorczość – Edukacja* 9 (2013) 246 – 257.
- [17] A. Mohanty, D. Dash, Engineering Education in India: Preparation of Professional Engineering Educators, *Journal of Human Resource and Sustainability Studies*, 4 (2016) 92-101.
- [18] A. Chatterji, E. Glaeser, W. Kerr, Clusters of Entrepreneurship and Innovation, *Innovation Policy and the Economy* 14 (2014) 129-166.
- [19] N. Onuma, Entrepreneurship Education in Nigerian Tertiary Institutions: A Remedy to Graduates Unemployment, *British Journal of Education* 4, 5 (2016) 16-28.
- [20] K. Korniejenko, J. Mikula, Development of Polytechnic Education by Using the Projects Funding from External Sources, proceedings of the International scientific conference 'Modern technologies and the development of polytechnic education', Far Eastern Federal University, Vladivostok, 14-18 September 2015, 772 – 776.