

DEVELOPMENT OF STUDENT'S PROFESSIONAL COMPETENCES WITHIN THE FRAMEWORK OF SCIENCE- BUSINESS COOPERATION

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Abstract: The paper concerns the issue of student's involvement in projects related to science-business cooperation, especially in the aspect of the development of their professional skills during academic training. The studies were the starting point for a reflection on students' interest in developing additional practical skills during their studies, and their knowledge of the essence of innovation and science-business cooperation. The issues concerning the role of students in science-business cooperation and the factors motivating and demotivating students to undertake such activity were also raised in the paper.

Key words: professional career, competences, academic entrepreneurship, science-business cooperation.

Introduction

Modern universities are functioning not only as centers of research and teaching, but also as institutions, whose mission is to prepare the future cadre of the economy, through professional and comprehensive process of teaching students [1]. Academic entrepreneurship, i.e. the full use of scientific knowledge in practice, depends on the creation, within universities and in the economic environment, the right conditions for utilizing the brainpower, knowledge and academical ideas [2]. This becomes possible due to the growing, despite many obstacles [11], but mutually beneficial, institutional cooperation between universities and enterprises [4]. The result of this cooperation is a release of creativity, activity, and personal potential of skilled researchers and students. Increasingly, they are engaged in projects for mutual transfer of knowledge between science and business practice [8]. The positive impact of academic entrepreneurship both on the development of scientific careers, as well as on the professional preparation of students participating in such project, should be emphasized. This is an opportunity for young people, to gain work experience while still in academic education, as well as a chance to make contact with a modern, pro-innovative companies, and for a deeper understanding of the economic environment, in which they intend to seek employment in the future. From the employers' point of view - among other cognitive and applicational qualities, relating to the science-business cooperation, the contact with young, talented and ambitious people is important from the point of view of development of human resources in enterprises. Also, if the student cooperating with the company will not be employed, his/hers activity, enthusiasm

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and optimism in his/hers activities is a valuable asset for the company, especially the companies' base staff lacks such an approach.

Despite many benefits that students can have from the science-business cooperation, especially in terms of strengthening their professional skills, and the opportunity for periodic or permanent employment, the interest in such cooperation on the part of students is still not satisfactory. The cognitive aim of this paper is to define the most interesting forms of engagement in enterprises for students within the framework of science - business projects, as well as key motivators and demotivators related to this. The application goal of the paper set out by the Author is the formulation of recommendations on optimization of mechanisms encouraging the involvement of students in science-business projects, and thus, favorably affecting their practical skills and professional competences.

In the theoretical part of the paper the Author has focused on considerations regarding desired skills and competencies that students should acquire under cooperating with companies in science-business projects; the Author has also focused on an analysis of possible forms of such cooperation. The empirical part of the paper contains a discussion of the conclusions of the studies. They are qualitative in nature and are not representative for the whole population of students, but they can be a valuable demonstrative material, for optimizing the path of development of science-business cooperation, from the point of view of the benefits for the student.

Theoretical background

The term: competences, in accordance with the Recommendations of the European Parliament and of the Council, on key competences for lifelong learning from 10.11.2005, are defined as a combination of knowledge, skills and attitudes appropriate to the situation on the labour market. As the professional competencies and qualifications, A. Keplinger treats interpersonal characteristics of a man, his dispositions (psychological characteristics and knowledge), and - disclosed in the behaviour professional abilities (skills) [9]. Competences can be seen in a wider and narrower context. In a general sense, they are defined as the ability of the employee to work for the achievement of the intended goal, but in more terms specific – the competences are generally knowledge, experience, attitudes and employee's willingness to act in given circumstances, and the ability to adapt to changing conditions [16]. Professional qualifications include knowledge and skills required to carry out specific tasks, and illustrate the potential of employee' capabilities on a specific workstation. Among the professional qualifications may be mentioned: intellectual operations (knowledge and transforming it). Qualifications are acquired through the educational system, the training or through practice [9].

Acquired competencies, skills and experience are an important pillar of a career [15]. Among the factors influencing professional attractiveness of candidates for employment, uniqueness and quality of competences and

professional qualifications, can be found on one of the key places. The development of professional competencies and qualifications is a complex and multi-step process [13]. As a rule, only at the appropriate stage of employee's career, that is about 30-50 years of age, the specialization in a particular field and a clear increase in the competences and qualifications are taking place [15]. The advantages of university graduates' job seekers, are personal talents and skills, as well as the uniqueness, and the program and degree of completed studies. In general, young candidates for employment can only demonstrate a willingness to work, and to a much lesser extent, specific competencies. Instead, their advantage may be the willingness to learn fast, interpersonal skills and the ability to work in a group. Definitely however, they lack in everything what is the effect of gaining practical experience, training and exercises. It should be noted, however, that most knowledge of young people is more modern, while the competences of older people have a more general nature [15].

With the development of innovation in the economy and increased demand for knowledge in enterprises, companies have intensified contacts with scientific institutions, mainly universities. In more and more companies, so called, knowledge workers are valued, who can be briefly defined as people earning a living by thinking [6]. This group includes senior representatives of companies, as well as some experts, specialists and scientists. Knowledge workers are distinguished by specific competences and skills, they possess both theoretical as well as the applicable knowledge, and are open to a change, to share their knowledge and learn from others, and above all – they are able to use their knowledge in practice [5]. These and a number of other competencies are desired strengths of employees who apply for employment with the most innovative companies. Despite the aspirations of many of these young people for a fast career advancement, currently, in most cases they can offer potential employers mainly enthusiasm, optimism, willingness to learn, and commitment to work. One of the biggest drawbacks is the lack of professional experience and applicable knowledge, which are expected by employers. The shortage of practical skills, in the opinion of employers, occupies the first place on the list of graduates' deficiencies [12]. At the same time employers emphasize that specific skills related to the profession are the element of education which is most useful at work [12]. Among the competencies and skills sought by employers among the graduates entering the labour market, most frequently are [10]:

- personal skills: ethics and loyalty; responsibility, commitment; self-reliance; openness to learning and continuous development; the ability to work under pressure of time; correct self-esteem; flexibility and the ability to adapt; empathy.
- interpersonal skills: effective communication; teamwork and the ability to work in a multicultural environment; negotiation skills.

- intellectual abilities: logical thinking; creativity; the ability to think independently; the ability to formulate and solve problems; the ability to define and justify priorities.
- numerical skills: knowledge of foreign languages; the ability to organize work and efficient time management; project management; the ability to use informatics tools; general and vocational knowledge; industry-specific knowledge and directional expertise appropriate to the current requirements of enterprises.
- analytical skills: work experience, entrepreneurship, diplomas, certificates, certificates on completion of studies, programs, possession of specific skills.

Referring to the scope of numerical skills described above, there is even the term: an enterprising student in the literature, that is a student who is easier to find work for himself, or to organize it for himself [14]. Fundamental questions about the following, arise at this point:

- the degree of awareness of students about the importance of professional qualifications in their future careers,
- methods for the development of professional competences proposed by the universities/preferred by the students during their academic education,
- motivators and demotivators influencing students' attitude towards engaging in various forms of cooperation with the business within the university.

The Author was trying to get an answer to these questions, by focusing on the analysis of opportunities to engage students in projects implemented on the edge of science and business practice. Most of them, are projects aimed at mutual transfer of knowledge between research centres and companies, which engage academic staff and employees of the companies, and still, too rarely students take part in them. Contemporary models of knowledge transfer also take into account a wide range of cooperation between academia and businesses, such as supplying companies in human capital of high quality [7]. The problem is, that often both the university, as well as enterprises, lack a genuine interest to join together to solve the problems of economic practice and the practical training of students. Among many strategies of co-operation between academic entities with enterprises mentioned in the literature, as those which may contribute to a greatest extent to foster the professional competences of students, one can indicate [3]:

1. Patrons and sponsorship strategy – a strategy which is focused primarily on shaping the image of the patron (the company) in the minds of students (future employees), among others, through joint organization of conferences and research and business events.
2. Basic strategy of cooperation – non-contractual and contractual exchange of services; temporary employment of academic staff and/or students in projects, internships, or practice, usually financed by public funds. This strategy also includes the establishment of companies created by students or faculty (e.g. within Academic Incubators of Entrepreneurship), or offering the university research infrastructure to the companies.

3. Promotional services strategy – it is based on the integration of the university into the program of studies, an information on specific companies, including their offer of products, services, technology. It also covers providing the university with demonstration equipment, that is used in the context of teaching, as an infrastructure strengthening practical training.

In addition to these strategies, one can indicate at least a few potential opportunities for cooperation between science and business, favourable from the point of view of the development of students' professional competences. These include:

- implementation of engineering, master's, doctoral thesis, based on the real problems of economic practice, with the empirical part implemented in enterprises;
- the involvement of business in developing programs of studies, including internships, strictly dedicated to specific industries or even companies;
- joint fundraising to finance additional internships in enterprises,
- funding scholarships for gifted students by the companies, with the option of parallel co-operation with the company during the period of study and after its completion,
- assigning auxiliary tasks to students in on-going R & D projects.

Methodology and results of study

The research problem of the paper was to recognize the essential – from the point of view of the attractiveness on the labour market – competences of graduates, the assessment of student awareness of the importance of practical competences in their future careers, and students' motivation to acquire these competencies through participation in various forms of science-business cooperation. In this paper the Author puts forward four research questions:

1. Are the students interested in developing additional practical skills during their studies?
2. How shapes the knowledge of students about the nature of science-business cooperation and development of innovative companies in partnership with universities?
3. What role students can play in science-business cooperation?
4. what motivators and demotivators affect students' interest in participating in projects on science-business cooperation?

To achieve research goals of the paper, desk research and empirical studies were used – qualitative, exploratory, supported by figures, obtained from 30 randomly selected students of engineering studies in Academy of Business in Dąbrowa Górnicza. Due to the number of responses (30), conducted the study treated only as qualitative research support, as due to the size of the sample and lack of its representativeness, it was not possible to statistically process them. Despite the qualitative nature of obtained results, and the lack of generalizability, the results of the study are important cognitive, *inter alia*, for universities interested in the integration of students in the projects on science-business cooperation.

Quantitative data were obtained based on an electronic questionnaire, completed by students in the Google Forms system in March 2014. The questionnaire included 15 questions - one or multiple choice ones.

The first issue in the survey was students' interest in developing additional practical skills during their studies. Students were asked about the desire to acquire practical skills useful in their future careers. On this question, 24 people replied affirmative, 1 - negative, and 5 people had no opinion on the matter. Then the students were asked to clarify what forms of development of practical skills would they be interested in (it was possible to indicate more than one response). The results are presented in Table 1.

Among surveyed, the largest popular are internships and participation in various projects, e.g. on the cooperation between universities and companies. A significant proportion of respondents also points to the constant professional work, in parallel with studies. The number of responses, despite the possibility of multiple-choice, is not too high in any of the variants. This means that the majority of respondents limited their choices to a small number of variants.

Table 1. Preferred forms of the development of practical skills during the studies

No.	Preferred forms of development of practical skills	No. of responses
1.	internships	15
2.	participation in projects, for example on the cooperation between universities and companies	15
3.	volunteering	1
4.	Work&Travel programs	6
5.	looking for employment by themselves, outside the academia	6
6.	professional work in parallel with studies	9
7.	self employment	4
8.	do not have an opinion on the matter	1

The second part of the survey referred to students' knowledge about the nature of science-business cooperation and development of innovative companies in partnership with universities. Half of the respondents declared that they are aware of the areas of cooperation between universities and companies, such knowledge did not have 9 people, and 6 had no opinion on the matter. At the same time, most respondents confirmed that during academic activities issues concerning innovation and the transfer of knowledge were discussed. Only 12 people were able to give examples of projects on cooperation between universities and companies, and 18 people had no knowledge on the subject. Only half of the respondents could point specific examples of companies and universities working together. The range of science-business cooperation expected by the respondents is presented in Table 2.

Table 2. Preferred range of cooperation between a university and a company

No.	Preferred range of cooperation	No. of responses
1.	the acquisition of practical skills by the students during internships	22
2.	research carried out in companies or for their benefit	9
3.	selling or gratuitously sharing with companies the knowledge such as patents, or utility patterns, gathered at the university	8
4.	participation of employees in training / conferences organized by universities	7
5.	internships for students interested in working in the industry of the company after graduation	16
6.	performing theses by students on topics relevant to companies cooperating with the university	10
7.	solving problems in companies with the help of faculty, students and university laboratory base	6
8.	cooperation between companies and academic offices of career in the recruitment of students and graduates	11

The most popular among the students are internships, as well as the cooperation between companies and academic offices of career in the recruitment of students and graduates, as well as the ability to prepare graduate theses in accordance with the needs of businesses.

The next question concerned the participation of students in projects on science-business cooperation. More than half of respondents believe that the transfer of knowledge from science to business should also involve students. At the same time the question of whether the university tries to include students in the cooperation with companies was responded affirmatively by nearly half of the respondents. The same number of students believe that participation in projects on cooperation between universities and companies should be mandatory for students. Preferred forms of participation by students in projects on science-business cooperation are presented in Table 3.

Table 3. Preferred forms of participation by students in projects on cooperation between business and university

No.	Preferred range of cooperation	No. of affirmative responses
1.	free participation in research and development service provided by the university for businesses	8
2.	payable participation in research and development service provided by the university for businesses	18
3.	participation in study visits to innovative companies	19
4.	preparing dissertations on a specific topic for interested companies	11
5.	the use of paid scholarships funded by business for students taking a job there after graduation	14
6.	Individual internships during the academic year	14
7.	summer internships in innovative companies	16

By far the trips for study visits to companies and the possibility of paid participation in research assignments carried out by the academia for the benefit of companies enjoyed the largest interest of the students. A significant number of respondents also declared a desire to benefit from scholarships and paid internships at private companies.

The final focus of the study was the issue of the assessment of incentives motivating and demotivating students to participate in projects on science-business cooperation. The answers given in this regard by the respondents are shown in Tables 4 and 5.

As shown in Table 4, all indicated motivators enjoyed a relatively high interest of the students, however, the most support gained factors directly related to the possibility of financial gain, professional, i.e. remuneration for participation in science-business cooperation and the prospect of employment in the cooperating company. Also, the following had enjoyed the attention of respondents: the opportunity to gain new experience and references. On the side of the most demotivating factors lack of proposals from the lecturers and lack of time for such activities were pointed out. Some of the respondents also recognizes the sense of lack of qualifications for such work as a problem.

Table 4. Factors motivating students to engage in collaborative science-business projects

No.	Name of the factor	No. of affirmative responses
1.	higher degree in the subject	12
2.	references for future employers from the participation in the current project	15
3.	chance to work for the company after graduation	20
4.	financial gratification	17
5.	opportunity for self-promotion among the companies	14
6.	chance to gain new experiences in relationships with entrepreneurs, prospective employers	16

Table 5. Factors demotivating students to engage in collaborative science-business projects

No.	Name of the factor	No. of affirmative responses
1.	no time for such activities	12
2.	lack of proposals from the lecturers	13
3.	distance between lecturers and students	5
4.	distance between entrepreneurs and students	5
5.	lack of interest in work related to innovation after graduation	0
6.	a sense of lack of qualifications for such work	9
7.	desire to focus on other matters	1

Summary

The study confirms that students are generally interested in the development of additional practical skills during their academic education, but certainly, the level of activity in this area is decreasing, if we ask for a specific, preferred forms of engagement. Most of the students have indicated internships and participation in projects. Combining these results with the answers provided in Tables 3 and 4 – it should be noted, however, that the most interesting for the students are paid forms of improving competences. Financial expectations of students, however, in many situations will encounter a resistance from employers, claiming that the company should obtain gratification for the practical training of students. Therefore the difficult problem how to reconcile the financial aspirations of students with the attitudes of employers remains to be solved. Although the answer to the above research question 1 is positive, this does not mean that the university will automatically create conditions for the development of practical skills to all interested students. It depends, inter alia, on the following factors:

1. the quality of student's theoretical knowledge as a starting point to explore opportunities to develop their practical skills in cooperation with companies,
2. authentic readiness for greater education effort on the part of the student and motivation to engage in additional forms of practical training,
3. organizational efficiency of the university in preparation of practical classes and other forms of participation in science-business cooperation such as internships, study visits, for interested students,
4. interesting of companies in taking students on practical training in various forms.

The second research question was about assessing the level of students' knowledge on innovation and science -business cooperation. As a rule, students have a basic knowledge of this field, that comes above all from academic activities, and some of the respondents encountered even with actual examples of this type of cooperation. Responses presented in Table 2 indicate that the students associate the science-business cooperation primarily with the development of their practical competences (and not, for example, with research for the companies), and expect that it will take just such a shape at college. From the point of view of the needs of students, the expectations are correct, although effective science-business cooperation should not be understood only in those terms. According to the Author, academic education should put more emphasis on the dissemination of benefits from such forms of cooperation, among academic staff and students, such as:

- addressing the problems of economic practice by the academic staff and students,
- research carried out in companies or on their behalf.

These forms were not indicated by the students as often as others, probably because they cannot properly assess their cognitive and application significance, both for academia, as well as for companies. It would also be useful to demonstrate on specific examples, the extent to which students can turn in this type of actions, and the benefit they can get.

The third research question concerned the role of students in science-business cooperation. Students claim that they should be involved in this type of work, and also that the university is trying to involve them in such activities. According to some respondents, this kind of activity should even be mandatory. The Author does not agree with these opinions, as observations indicate that both in the companies, as well as universities, there are people that feel very well in this type of activity, as well as those that do not have predispositions to that. Definitely the access to shared scientific and practical projects should be open to students, such as open recruitment for study tours, internships, and the use of company-funded scholarships. But mainly students who meet certain criteria, should benefit of these the most lucrative forms of cooperation. This is important just in respect to paid forms, where the company provides the student with financial gratification, but also has the right to demand from the student. Such undertakings should therefore be dedicated primarily to the brightest students, equipped with appropriate knowledge and the most motivated to undertake such activity. The university, which organizes student's participation in collaborative science-business projects, should strictly define the criteria to be met by students applying for such a possibility.

The last research question concerned the issue of student's motivation for participation in projects on science-business cooperation. Professional issues come to the fore here, as students combine such activities with the chance for a good presentation to prospective employers. This is, of course, a correct way of thinking, but the opportunity to gain employment through contacts with the company during the studies should be the result rather than the precondition to take such cooperation. For many students certainly an important argument in favour of engaging in cooperation with the companies will be payment, the more, that devoting their time for a participation in science-business projects, they restrict the ability of other paid employment during their studies. Financial gratification should be used as an important, measurable contribution to students engagement in science-business cooperation. As it turns out of Table 5 – the biggest barrier to student participation in such projects is the lack of time and lack of proposals for such cooperation. Taking the time to acquire practical skills should of course be treated in terms of austerity, that will certainly pay off in the future, but only part of the students will be able to accept the fact.

The University may support them in this area by improving the organization of their activities, such as establishing certain days off from classes during the week. Nevertheless, the student who focuses on strengthening his position in the labour market, certainly has a stake in cooperation with companies, while sacrificing many other leisure activities. As mentioned above, the university's task, should be to support students who seek opportunities to strengthen their practical competences in contact with companies, either by directing the information that such opportunities arise to them, as well as by pointing them the individual path of cooperation with companies out, recognizing earlier students' pre-qualifications to take such actions. According to

the Author the best academic intermediaries in integrating students into science-business cooperation should be centres for technology transfer or careers offices. The Author intends to devote further research on science -business cooperation to this issue.

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ROZWÓJ KOMPETENCJI ZAWODOWYCH STUDENTÓW W RAMACH WSPÓŁPRACY NAUKA-BIZNES

Streszczenie: Artykuł dotyczy kwestii zaangażowania studenta w projekty związane ze współpracą nauka-biznes, w szczególności w aspekcie rozwoju ich umiejętności zawodowych w trakcie kształcenia akademickiego. Badania były punktem wyjścia do refleksji na temat zainteresowania studentów w rozwijaniu dodatkowych umiejętności praktycznych w trakcie studiów oraz ich znajomości istoty innowacji i współpracy nauka-biznes. W artykule zostały również poruszone kwestie dotyczące roli studentów we współpracy nauka-biznes oraz czynniki motywujące i demotywuujące ich do podjęcia takiej działalności.

Słowa kluczowe: kariera zawodowa, kompetencje, przedsiębiorczość akademicka, współpraca nauka-biznes.

科学与商业合作的框架内学生的专业能力的发展

摘要: 纸的问题在有关科学与商业合作,特别是在学术训练期间他们的专业技能的发展方面的项目中的学生的参与。研究了学生的兴趣在学习期间发展更多的实用技能和他们的知识创新和科学业务合作的本质的思考的起点。关于学生在科学与商业合作和因素的作用问题激励和丧气学生进行这种活动也提出了在文件中。

关键词: 职业生涯、职权范围、学术的创业精神、科学与商业合作。。