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Interdisciplinarity in theory and practice

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Abstract

The text is focused on the issues of an interdisciplinary approach onto teaching and research at the Universities. It focuses on the conditions, advantages and results of the cooperation between the humanities and technical disciplines. Using empirical data, it illustrates the benefits of interdisciplinarity for a development of competences of the University graduates (in terms of improvement of their competitiveness in the labour market). Referencing to the specific projects, it can document the use of an interdisciplinary approach in scientific and research activities.

Keywords:
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Sociological research

Schlüsserwörter:
Interdisziplinarität
Kompetenzen der Universitätenabsolventen
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1 Introduction

The deepening specialization of scientific disciplines helps to develop knowledge, as well as the epistemological and methodological foundations of the sub-disciplines. However, it is also connected with a risk of limiting the possibility for understanding and cooperation between the experts with different branch backgrounds. An expanding interdisciplinary discourse presupposes a mutual respect to the theory, methodology and terminology.

The problems of the interdisciplinary approach have become the subject of interest in theory and methodology of science already in the mid-twentieth century. (Linhart, 1996, p. 443) At present, the interdisciplinary collaboration is a necessary presumption of development in the field of science and research. The interdisciplinary approach enables a deeper insight into the phenomenon studied. On the other hand, it may make it difficult to understand it. The interpretation of the studied phenomenon differ not only with regard to the anchoring branch of the author of interpretation, but also with regard to different epistemological and methodological bases within a single discipline. The problem seems to be especially the transmission of terminology system and theoretical foundations among the disciplines, which modifies the original meaning of the terms and relates them to the new ones. In this context, it is therefore better to talk about a trans-disciplinary approach, rather than interdisciplinarity. From the interdisciplinary perspective, the studied phenomenon represents the bolt among the science disciplines the inter-connection of which is otherwise difficult. (Krámský, 2008) A transdisciplinary view reflects an overlapping across the scientific disciplines. The aim of the transdisciplinary approach is to achieve a higher quality of understanding to the investigated subject, where a scientist overcomes the limits of sub-disciplines and is thoroughly studying a subject of interest and the context of its origin and existence. (Pelcová, 2000, p. 69)

The following contribution is focused on the use of the interdisciplinary collaboration both within the higher education, and in the science and research. This collaboration is shown on two projects of the VSB-Technical University of Ostrava.

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In the field of the higher education, the necessity of the interdisciplinary collaboration is illustrated by the empirical data which are reflecting the interdisciplinary nature of competencies that are expected by the employers from the university graduates.

2 Competences and interdisciplinarity

Since the first half of the nineties the employee organizations and the labor market have passed through the significant changes that greatly affected the strategies and also organizational and professional structures of the companies and the jobs. Technological changes have strengthened the importance of human potential and qualified professions with higher level of complexity of the work, which require the educational institutions to innovate the curriculum, with an emphasis on competencies that may be applicable in the context of new approaches to work and interdisciplinarity. Thus an increasing integration of the educational system with the needs of the employers is happening in the reality of the life, as the assumption for university preparation of demanded professions and competences, and for applying of these professions on the labor market. (Kowaliková, Janíková, Papřoková 2011) Here it should be mentioned that nowadays there is seen a rapid developmental trend of disciplines and interdisciplinary alternative. This is an evolution in which the professions in the information age though new technologies and the ways of working with information expand the classic "narrowly" defined field by the interaction with other knowledge.

In the post-industrial society, which is characterized by the new information technologies and the employment in services, the nature and content of the job as well as the requirements for competencies of the employees are changing. More flexible descriptions are applied in creating of the working tasks and objectives which are based on the contents of the work, qualification and motivation and which describe the changes in the nature of work and the use of potential. The work in the interdisciplinary research teams requires the people who are professionally efficient, with a wider outlook than just their professional specialization. Such a teams are foundation stones of the organizations of the future which are introducing a flexible organizational structure, focusing on the customer and building a total quality management system. The introduction of an interdisciplinary project management creates strong horizontal bonds among the departments. This is so called network model, in which the communication with the teams that are oriented to the goals is being strengthened, with a flat, multifaceted, individualized, flexible and changeable organizational structure. (Dědina, Odcházel 2007) This approach corresponds with the projects involving the relations between the individual discipline and the other disciplines which lead to new trends and applications, for example in the fields of health (medical electronics), energy business (ecological houses), social field (assistance to the victims of home violence), arts (professional folk music), etc.

The mentioned trend influences the educational policy of the economic organizations and their corporate culture which emphasizes the importance of the development of competencies, personal identity and learning of their employees. The employers are aware of this fact and it is taken into account in the process of personnel selection, as shown in the "Analysis of the results of the questionnaire survey on the employability of the graduates from the years 2004 to 2007 in the enterprises and organizations of the Moravian-Silesian Region", carried out in the sample consisting of 87 enterprises in total, of which 58 were large (with 250 or more employees) and 29 small and medium enterprises. (Balcar, 2008) For example, the first place among the requirements of a large organizations for the adoption of university graduates is held by the requirement "to educate a new employees according to the company needs" (17%), following by "willingness and ability to learn quickly" (14%) and "flexibility" (13%). In case of a small and medium enterprises, the order is almost identical, but more often it is required from the graduates a greater flexibility (15%).

The main factor which causes the changes in the contents of the work is a scientific and technical progress. Its assumption is the increasing of the level of education and professional competencies. The summary results of satisfaction of the employers with the professional (career) readiness of the graduates at the time of their entry into employment show a relatively successfully functioning higher education, since the employers have positively evaluated it in case of 95.3% of graduates, while negative evaluation was seen in only 3.5%. The most commonly the employers were evaluating the professional readiness of the graduates as "good" (51.5% of the cases) "sufficient" (36.0% of the cases) and "excellent" (7.8% of the cases). The evaluation of the professional readiness as "bad" or "very bad" have occurred only in 2 cases, which indicates the situation of the individual rather than a system failure. Even if the mentioned results can be understood as an indicator of the success of the universities, the frequency of evaluation with the level "sufficient" indicates a significant space for further improvement (Table 1).

EVALUATION OF PROFESSIONAL (CAREER) READINESS	FREQUENCY (OF PEOPLE)	SHARE (%)
Excellent	43	7,8
Good	283	51,5
Sufficient	198	36,0
Insufficient	17	3,1
Bad	1	0,2
Very bad	1	0,2
n.a.	7	1,3
∑	550	100

Table 1 Evaluation of professional (career) readiness of a graduate on entry to the employment

The mentioned data have been acquired from the sample of the graduates of 6 universities which were represented at least by 10 people. The share of graduates with a "good" or an "excellent" professional readiness has showed the highest score in the case of Palacky University (85,7 %), followed by Masaryk University (76,5 %), the VSB-Technical University of Ostrava (58,8 %), the University of Ostrava (56,5%), the Silesian University (50 %) and the Technical University of Brno (46,2 %).

In the postmodern era, with regard to the interdisciplinarity, the employees are requested to have a wide professional background and high degree of flexibility as well as willingness for requalification to which an open attitude to lifelong learning should contribute. In the framework of the mentioned investigation the employers have been expressing their opinions on significance of the presented fourteen selected key competences for employment of university graduates. In the list of key competences they have been asked to carry out the point evaluation on the scale from 0 to 6 (where the value 0 has been assigned to the competences which were completely insignificant for the employment of graduate, the value 6 was assigned to the competences which were the key ones for the performance of the profession). The list of the key competences, based on the surveys, has been carried out by the firm RPIC-ViP s.r.o.

The employers have highly evaluated (over 4 on the scale 0-6) the competences to independence, cooperation, lifelong learning, performance, self-reliance, active approach, problem solving and coping with stress. In the research, on the one hand the employers have identified and highly valuated the competencies to independency, to cooperation, to problems solving, to an active approach, effective communication and work with information, on the other hand the employers have attributed the least importance to the competencies to communicate in foreign languages and to the skills for entrepreneurship (see Table 2).

Competence	Average evalua-tion	Insignificant.....Key							Indicator
		0	1	2	3	4	5	6	
to effective communication	5,0	2	4	17	36	82	164	237	*frequency*
		0,4	0,7	3,1	6,5	14,9	29,8	43,1	*share (%)*
to cooperation	5,1	0	3	4	17	104	181	233	*frequency*
		0,0	0,5	0,7	3,1	18,9	32,9	42,4	*share (%)*
to entrepreneurship (entrepreneurship spirit)	2,9	40	112	72	80	149	63	25	*frequency*
		7,3	20,4	13,1	14,5	27,1	11,5	4,5	*share (%)*
to flexibility	4,6	6	9	8	57	164	152	146	*frequency*
		1,1	1,6	1,5	10,4	29,8	27,6	26,5	*share (%)*
to satisfaction of the customer needs	4,3	18	22	39	82	85	133	162	*frequency*
		3,3	4,0	7,1	14,9	15,5	24,2	29,5	*share (%)*
to performance	5,1	0	9	7	16	92	209	209	*frequency*

		0,0	1,6	1,3	2,9	16,7	38,0	38,0	*share (%)*
to independence	5,1	0	8	0	13	95	195	231	*frequency*
		0,0	1,5	0,0	2,4	17,3	35,5	42,0	*share (%)*
to problem solving	5,1	0	5	6	16	78	220	217	*frequency*
		0,0	0,9	1,1	2,9	14,2	40,0	39,5	*share (%)*
to planning and organization of the work	4,6	11	2	17	50	135	191	135	*frequency*
		2,0	0,4	3,1	9,1	24,5	34,7	24,5	*share (%)*
to lifelong learning	4,7	0	5	20	24	167	177	149	*frequency*
		0,0	0,9	3,6	4,4	30,4	32,2	27,1	*share (%)*
to active approach	5,0	0	5	6	25	90	216	200	*frequency*
		0,0	0,9	1,1	4,5	16,4	39,3	36,4	*share (%)*
to coping with stress	4,8	2	5	14	48	135	159	179	*frequency*
		0,4	0,9	2,5	8,7	24,5	28,9	32,5	*share (%)*
to discovering and orientation in information	5,0	0	5	9	22	100	223	183	*frequency*
		0,0	0,9	1,6	4,0	18,2	40,5	33,3	*share (%)*
to communication in foreign languages	3,8	32	54	60	73	77	126	118	*frequency*
		5,8	9,8	10,9	13,3	14,0	22,9	21,5	*share (%)*

Table 2 The evaluation of importance of the competences for performance of the employment by the graduate, done by the employers. Note: The average evaluation has been classified as a weighted arithmetic average of the available responses, where the response frequency was used as a weight.

It can be assumed that the scope and the level of competencies necessary for the performance of the job will be very different as in the case of individual jobs, so in the case of individual economic branches.

The same questions, which were responded by the employers, have been answered also by 550 present and former employees of the mentioned 87 companies (which participated in the questionnaire survey) who have successfully completed university studies in 2004 and the following years. The sample consisted of 62,7 % of graduates of VSB-Technical University of Ostrava, 8,7 % of graduates of the University of Ostravě, 5,1 % of the Silesian University graduates and 0,5 % of graduates of the College of Business. Of the total group of 550 graduates who are or were employed at the 87 largest companies in the Moravian-Silesian region, there was 424 persons, i.e. 77,0 %, who were the graduates of local universities.

The graduates have considered as the most important competencies those to solve problems, to independence and lifelong learning, which was indicated as an excellent by every fourth respondent (26%). The results of other surveys have confirmed similar tendencies in the evaluation of the employers and the graduates. (Kalousková, 2007 etc.) Education is a significant lifelong instrument both for realization of changes in the character and the contents of the work, the development of the professions and organizational changes, and also for building the interdisciplinary teams, as well as the condition for finding a job on the labor market.

3 Interdisciplinarity cooperation in teaching students of the VSB – Technical University of Ostrava

As it is apparent from the mentioned results of the empirical survey, the professional specialization is one, but not the only presumption for the employability of graduates on the labor market. It is supposed that the graduate will have not only the professional knowledge and the skills, but also so called soft skills which will enable him to participate effectively in the organizational life. These are especially the communication skills (including the ability to communicate in a foreign language, which has become a necessity in a globalized world), the ability of teamwork, the organizational skills, the knowledge of time management etc.

While in case of the humanities-oriented disciplines the development of these skills is often a part of the curriculum of the disciplines, within the framework of the natural sciences or technical disciplines such a psychosocial skills are still considered to be secondary and unnecessary. Therefore, the development of these skills was the aim of the project of the students of VSB – the Technical University of Ostrava: "Corporate culture as an integrating element of the humanitarian subjects' curriculum at VSB-TU Ostrava." (reg.no. CZ.1.07/2.2.00/15.0128). The members of the Department of Social Sciences who are engaged in sociology, psychology and personnel management have conveyed to the students the information which both can increase their employability on the labor market and also to help them in adapting to the working environment. The project has been monitoring the link between the competitiveness and the professional development of the graduates and their ability to adapt to the the working environment, respectively the corporate culture, to contribute to its creation and to use it to the career growth and increasing of the prosperity of the organization.

Through the educational modules the students were acquainted with the concept of the corporate culture, which was represented as an organizational environment in which both the employees and the management must work together to achieve the organizational goals. The students have acquired the knowledge concerning the issue of identification and internalization of the basic rules, values and standards of the company, as well as the principles of behavior and communication within the organization. The educational modules were focused on the sociological interpretation of culture as a framework for understanding the organization, to diagnosing the corporate culture, to the social and the personnel audit, the process audit and the management of the changes in the corporate culture, the leadership and the mobilization of human resources in the company and on the ethics and the etiquette in the culture of the company.

After completing the modules, the students are able to identify the key elements of the organizational culture (the values, the standards, the artifacts), to adapt to the culture of the organization (to participate effectively in the team activities, to lead the team), to act and communicate within a given type of the corporate culture. Those who are the future managers have been acquainted with the information related to the diagnostics of the corporate culture and identification of the desirable changes, concerning the common creating of the culture with respect to the nature of the organization (what industry, a size of organization, the area for action) and its future development, and information about an effective presentation of the culture to the members of the organization. The learning modules were applied to more than two thousand students from all faculties of the VSB-Technical University of Ostrava within two years.

We are interested to strengthen the trend of connection of knowledge from the humanistic disciplines with the specific field specialization of the students of technical disciplines in the future. That is why we have welcomed a positive feedback from the students which we have acquired through the research survey among the graduates of the educational modules. The evaluation questionnaires, which were focused on the evaluation of both the content, a logical structure and the benefits of the educational module for use in organizational practice, and also for example the lectors´ competencies of the teachers, were filled by 878 students. The feedback from the students has shown that the concept of the corporate culture can overcome the dichotomy of theory and practice, as well as to integrate and enrich each other the social sciences concepts and the curriculum of technical disciplines which seemed to be apparently distant (Kowaliková, Papřoková, 2014).

The second example of interdisciplinary collaboration of technical disciplines with the humanistic disciplines, this time in the field of science and research, is shown on the planned project of the VSB-Technical University of Ostrava.

4 The social-psychological aspects of the use of unmanned systems in the urban agglomerations

The post-industrial society is characterized by a number of potential risks which are connected among others with the development of the new technologies (Beck, 1992; Bauman, 2000; Lipovetsky, 2005 etc.). These are especially the unintended consequences of modernization principles and practices which are adoring the role of science, technology and industry (deterioration of the environment, the threat of nuclear weapons, etc.). The spacetime compression, caused mainly by the development of information and communication technologies and the development of transport, reduced the world and heightened the interdependence of its parts. The mentioned changes were manifested as the instability and changeability of the social contexts,

loosening of the bonds. The permanent presentation of risks and the continuous efforts to reduce them has undermined significantly the feeling of safety.

This thesis is reflected by the planned project entitled "The adaptation and the possibilities of the use of the new technologies – the unmanned aviation systems in the urban agglomerations", on which the Institute of Transport of the VSB collaborates with the Department of Social Sciences. The aim of the project is the adaptation of the new aviation technologies into the densely built-up agglomerations, through the way of the analysis of the possibility of using the unmanned aviation systems and the proposal for the movement possibilities of the unmanned aviation systems in the urban agglomerations. The project includes, in addition to the development of the models of motion and the draft of the legislative measures for the movement of the unmanned aviation systems in the built-up areas, also the socio-psychological analysis of the process of introducing of the unmanned aviation systems into the densely populated areas.

The epistemological framework of socio-psychological analysis is Giddens concept of the adaptation mechanisms, respectively the responses to the threats associated with the life in the post-industrial society. Many authors are concerned with the impact of the awareness of those risks on an individual sense of ontological security. How is it possible to live in the world which is completely out of control. Giddens distinguishes four types of adaptation responses. A pragmatic acceptance of the risks focuses on individual problems of everyday life without necessity to think through a potential threat. Permanent optimism indicates the response which is relying on the science and common sense that are taken as the guarantees to ensure the safety. A cynical pessimism uses humor, cynicism and sarcasm as ego-defense mechanisms. A radical commitment motivates the individuals to become active, to be engaged in the public life in order to reduce the sources of danger. (Giddens, 1991, pp. 131-137)

Giddens, as well as other authors (Beck, 1992; Bauman, 2000; Lipovetsky, 2005 etc.), notes that compared with the modernistic assumptions, the scientific progress and the growth of knowledge does not bring a more rational, predictable and stable society. On the contrary, he points out that dynamic changes in social life and their unintended consequences are connected with the increase of knowledge that changes the nature of social reality. Dynamics is greater in an anonymous and heterogeneous urban space. Thus it can be therefore expected that within the built-up agglomerations the feeling of safety will be even more threatened. (Sennett, 1992)

The first phase of socio-psychological analysis in the framework of the mentioned project is therefore connected with the empirical survey aimed at the respondents' attitudes towards everyday use of the latest technologies in the urban space. Specifically we will focus just on the change of the character of a sense of ontological security in relation to the use of the unmanned aviation systems in the immediate vicinity of the respondents. We suppose the realization of a representative survey among the residents of Ostrava. We would like to focus on the feeling of safety/ threat also in relation to the selected socio-demographic characteristics (gender, age, education).

The mentioned project is still in the preparation phase. Nevertheless, its research questions and the goals illustrate the necessary character of the interdisciplinary collaboration in the scientific research as well as the practical application of the research findings.

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