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HIGHER EDUCATION OF TEACHERS-ENGINEERS IN THE CZECH REPUBLIC

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This text deals with the issues of engineering pedagogy, pedagogic-psychological training of teachers of technical subjects. It analyses the specifics of this education in the Czech Republic and compares it with the experiences from abroad. It emphasizes the necessity of a multidimensional approach to the Technical Sciences, Humanities, and Social Sciences. Effective education is in a number of spheres based on a high-quality training of pedagogical workers. This process is associated with the necessary development of the pedagogy as a science and also with enhancement and quality improvement of its teaching at all levels of technical schools, and in particular at technical universities and colleges.

Keywords: engineering pedagogy, information technology, history of education, teaching at technical schools, Social Sciences, education of teachers-engineers, higher education.

Multidisciplinary approach to the Technical Sciences, Humanities and Social Sciences

Problems and risks caused by the contemporary social, economic and technical development have a many-sided and complex character. Experts, who deal with them, are on the contrary usually specialized, that is one-sided professionally orientated. Therefore, for the last few decades educators have been discussing the necessary interdisciplinary education and mutual dialogue between the technical, humanistic and social disciplines. A close interconnection of social, technical and humanistic sciences is markedly reflected in the conception of the technical subject didactics.

The requirement for tertiary education is at present preferred not only in our country but also abroad [1]. "The present stage of industrialization of the society, the rapid development of engineering and information technologies and also intensification of the automated production, results in a radical decrease of the number of people in industry and agriculture. The attention therefore inevitably moves to the tertiary sphere that will probably "set the tone" in creation of the lifestyle and human being care. In other words – at a certain level of industrialization it will be necessary to move from the quantitative indicators to the care about the quality of human life as the whole future social development will depend on it" [2].

The demands on one´s own responsibility for choice of the professional career are nowadays increasing. The transition to the "information society" in the contemporary globalized world entails in many countries the increased need for an unspecified and extensively based education that creates prerequisites for variable forms of work with information of various kinds. This process relates to the development of a number of new professions and vacancies for which the young people are "prepared in the framework of a tertiary education, i. e. in the context of the International Classification of Education (ISCED): partly by non university tertiary education – by higher technical colleges and partly by higher or university tertiary education – 3 to 6 years studies, bachelor magisterial and doctoral" [3].

The intensive development of natural and technical sciences induces at present an unprecedented pressure on all systems of education. The inconsistency between the number of findings and information, that a man must manage, is growing with the limited time available for its processing and adoption. In this sense, we should primarily emphasize such a conceptual orientation that will take into account both the adaptation and anticipatory institutional goals. With regard to these facts it is necessary to answer the

principal question, what kind of educational contents (together with formative – educational means and application of educational methods) will help us in training of future graduates, with the aim to prepare them for conditions of the changing requirements of the job market, ability to adapt themselves to the new challenges, technological innovations and conditions of the society in the 21st century. And how the school system reflects this problem, that relates to a rapid development of a number of branches, digitalization of a number of activities and development of ICT? In most cases it reacts conservatively, slowly and with caution [4]. Innovative approaches place increased demands on further education and self-education of pedagogues. Moreover, it is necessary to outline and realize the alternative models also for a broader general education of engineers-technicians. The mentioned special branch tendencies concern also the institutionalization of training of teachers – technicians and engineers [5].

Engineering pedagogy – history, the present times and perspectives

How can the social successfulness of a pedagogue, teacher, educator, parent, student be viewed? What conditions the fact that we are accepted and respected by the people and held in high regard by them? Professional qualities. Not only personal characters, results of our work but also the overall external neatness and appearance are without doubt important prerequisites of a social successfulness. Without well-developed communication skills, managing of efficient assertive tactics and strategies of conduct in interpersonal relations, a person can socially fail even if he/she is respected for his/her encyclopaedic education, if he/she is not be socially competent. Social qualification forms an important part of the professional competence both for all pedagogues and also for engineers-teachers, who lecture principally technical subjects at secondary technical schools or universities. A great importance is, therefore, attached to the development of the science discipline "Teaching theory of technical subjects – engineering pedagogy", not only in our country but also in international context.

Engineering pedagogy as an independent science discipline is already a number of years developed on an institutional basis both in our country and also abroad. An important trend for the engineering pedagogy seems to be an increasing incorporation of humanistic and social components into the technical education. Engineering pedagogy – IGIP (Internationale Gesellschaft für Ingenierpädagogik) deals with all sides of the technical studies, particularly with its conception, goals, contents, methods and material resources. It solves the current issues of a rapid growth of scientific and technical findings and their transformation into the timely limited study programmes (aimed at a complementary pedagogical education of engineers – technicians teaching the technical subjects and education of future engineers – technicians generally), proportions of the basic and specialized technical studies, the way of management and control of the independent work of students, the use of new technical means, including computers and internet in teaching at technical schools and in independent studies of students. Engineering pedagogy creates didactic systems based on the technical sciences, pedagogy, psychology, sociology, philosophy and ethics, cybernetics, information theory and school management. The development of the mentioned branch can follow not only the previous development in our country but also abroad, where the engineering pedagogy is studied at a number of prestige universities.

By engineering pedagogy are, therefore, understood activities aimed in a broader sense at improvement of the teaching technique including the goals, content and forms of this teaching. For a more detailed explanation of the origin of the term "engineering pedagogy" a short inside into the past can be used.

Engineers – teachers of technical subjects are mostly graduates of the magisterial studies at the technical universities who have no exact pedagogical education. Just this deficiency should be solved by the engineering pedagogy, the substance of which forms the mutual interaction of technical sciences and pedagogy. Ministry of Education introduced the complementary pedagogical studies for teachers of technical subjects at least from 1963. Special departments for realization of these studies were then established at certain universities as for example ČVUT in Prague, VUT in Brno, VŠST in Liberec. Masarykův ústav vyšších studií (MÚVŠ) came into existence in 1992 and assumed the tasks of the pedagogical education of engineers-teachers, that were in the past presented as complementary (or supplementary) pedagogical studies of engineers-teachers [6].

These studies were in the course of the years presented as studies of engineering pedagogy due to the influence of the International Society for

Engineering Pedagogy - IGIP (Internationale Gesellschaft für Ingenierpädagogik), established in 1972 in Klagenfurt – Austria, and its founder professor Ing. Adolf Melezinka. The activity of IGIP comprises annual international symposiums devoted to the engineering pedagogy, as well as other conferences, seminars and workshops, organized at the national and international level, summer schools and commissions, dealing with the respective themes of engineering pedagogy. IGIP has also elaborated international criteria, comprising minimal requirements for education of engineers-teachers and has founded the international professional register of engineers-teachers authorized by IGIP. The engineer-teacher who has finished his pedagogical studies that meet the criteria of IGIP and whose engineering education and professional praxis meets the criteria of IGIP, can be stated in the mentioned professional register as an International engineer-pedagogue with a title ING.PAED.IGIP. Applications for the title ING.PAED.IGIP are initially considered by the National Monitoring Committees (NMC) in individual countries and after this consideration and recommendation they are submitted to the International Monitoring Committee (IMC) for the final consideration and approval. Applicants for the title, whose applications were approved, are conferred a degree and awarded the respective certificate [7].

Teaching of Engineering Pedagogy, as a field of study in the Czech Republic, is realized either concurrently with the engineering studies or as a component of the subsequent training of teachers-technicians. As centres of engineering-pedagogical studies in the framework of IGIP in our country accredited six institutions – ČVUT in Prague, Masarykův ústav vyšších studií (MÚVS); Technická univerzita (Technical University) in Liberec; Vysoká škola báňská – Technická univerzita (University of Mining and Technology – Technical university) in Ostrava; Vysoké učení technické (Technical university) in Brno; Vysoká škola chemicko-technologická (University of chemistry and Technology) in Prague and Centrum pro studium vysokého školství (Centre for the university studies) in Prague. These centres are responsible guarantors of engineering pedagogy teaching, in accordance with the professional model of IGIP. To the subjects of the IGIP standard humanistic subjects belong that were not a part of professional training of engineers at the universities (in particular engineering pedagogy; engineering-pedagogical practical classes; didactic and laboratory technique; creation of curricula; rhetoric; communication; selected chapters from the psychology, sociology, philosophy and ethics; writing of a comprehensible text; biological basics of an individual´s evolution; school of law and legislation; management and other things). Getting through the complementary pedagogical studies or studies of the engineering pedagogy is currently compulsory for all teachers of technical subjects [8].

Institutional training of teachers – technicians and its specifics at MÚVS attached to ČVUT in Prague

Constitution of the pedagogical institution at ČVUT in Prague dates back to 1961 when the Ministry of Education and Culture established a special department at the Engineering faculty of ČVUT in Prague as an Institution for the Studies of Workers. The existence of this department did not last long and dates from 1st of July 1961 to 31st of March 1962. The department was then transformed into the Institution for the Studies of Workers (ÚSP), effective from the 1st April, 1962. The ÚSP was later on transformed into the Institution for Studies at the Technical Universities (ÚST), based on the decision of the Ministry of Education and Culture, effective from 10th of February 1965. The Research Institute of Engineering Studies (VÚIS) was established by consolidation of the existing Institution for Studies at the Technical Universities and the Research Institution of the Sound Technology and Films, based on the decision of the Ministry of Education, Youth and Sports (MŠMT) dated 30 August 1974. This Institution acted later at ČVUT in Prague at the Electrical engineering faculty from 1947, according to the decision of MŠMT No. A-259241/46 – V/2 dated 31 December 1946. The principal activities of the above mentioned institutions consisted from the outset in research of contents, methodological and organizational issues of engineering studies in the former Czechoslovakia, in development and processing of new didactic means and in pedagogical activity, in complementary pedagogical education of students and engineers.

Masarykův ústav vyšších studií (MÚVS) was constituted in 1992 as an education institution in the position of a university establishment. The engineering pedagogy is here represented in the department of engineering pedagogy and in a bachelor study programme “Specialization in pedagogy”. The accredited bachelor studies are based on the effective laws and standards that

specify the prerequisites and requirements for discharge of activity of the pedagogical workers and the career advancement in the school system. It concerns particularly the respective provisions of the Law No. 561/2004 Coll., on the pre-school, elementary school, higher technical college and other education (the education law), Law No. 563/2004 Coll., on pedagogical workers and the respective change of several laws, further the respective provisions of the Regulation No. 317/2005 Coll., on further education of pedagogical workers, accreditation commission and the career system of pedagogical workers and the related regulations.

The present conception of the pre-gradual training of technical subject teachers at secondary schools is realized in a three year bachelor study programme "Specialization in pedagogy", divided in two study fields "Teacher of technical subjects" and "Teacher of practical schooling and technical training".

The study field "Teacher of technical subjects" is determined for students of master´s degree study programmes at ČVUT in Prague, respectively for graduates of magisterial studies of the technical study fields at the technical universities and colleges, in full-time or combined forms. The object of this study is to acquire the prescribed qualification requirements for the discharge of activity of pedagogical workers and the career advancement in the school system.

The bachelor study field "Teacher of practical schooling and technical training" is determined for graduates of the higher technical education or completed secondary technical education with a school-leaving examination (machine engineering, electro engineering, civil engineering and other related technical study fields), who carry out or possibly consider a qualified fulfilment in the discharge of function of a pedagogical worker-teacher of practical schooling or teacher of technical training. The graduates will acquire professional qualification for the immediate pedagogic activity.

The aim of the studies is to provide theoretical findings in pedagogy, psychology, didactics of technical subjects and in other disciplines related to the teaching of technical subjects at secondary technical schools and higher technical colleges, with regard to the development of the psycho-didactic and psycho-social competence.

With regard to certain differences in the level of the preceding training for the studies, the propaedeutical side of the approach to studies was intensified, particularly for students of the study field "Teacher of practical schooling and technical training". The specifics of both target groups of students are respected in the contents specialization. A higher degree of preparedness for the theoretic side of the studies can be respected at the study field "Teacher of technical subjects". At the study field "Teacher of practical schooling and technical training" it is necessary to respect the involvement in the formative-educational praxis at positions, where the activities of practical teaching and technical training prevail in the first place. Study plans of individual specializations are outlined and realized with regard to the respective target groups.

The studies develop the ability of the graduate to process and present on one´s own the contents of the technical disciplines curriculum for adoption to students of the secondary schools and higher technical colleges, actualize it continuously, select the right teaching methods and techniques, develop and cultivate the personality of students. It prepares the graduate for the possibility to carry out pedagogical activity at the similar secondary schools abroad, particularly in EU countries, among others in relation to the international accreditation of IGIP.

The structure of study subjects reflects in itself the development of the scientific knowledge in the sphere of Humanitis and Technical Sciences. The structure of study subjects and their content specialization, thus, respects the specifics of the individual spheres of training in particular for the teachers of secondary technical schools, higher technical colleges, respectively. It particularly respects the basic development strategy of the formative educational system both in the Czech republic and also in the advanced countries, primarily in European Union. Innovations of the study programme "Specialization in pedagogy" are executed in connection with the grant and development projects that are realized directly at the Masarykův ústav vyšších studií [9].

The practical training of future teachers is unthinkable without the possibility of a direct contact with the real school terrain. Realization of the goals in pedagogical praxis is supported by the gradual actualization of contracts and intensification of the cooperation with the secondary technical schools and their qualified and experienced teaching staff. The student, by the way of inspections, sitting in classes, will be in the course of the pedagogical praxis thoroughly acquainted, with the school as a whole, with its atmosphere,

social relations, school and teaching climate, the way of control, with the role of students and teachers and their mutual interaction and communication. The cooperation with the high-quality secondary technical schools constitutes a guarantee of the improved quality of conduction of students applying for the pedagogical profession of a teacher in the system of technical schools. The time subsidy for the pedagogical praxis has been improved, the stage of preparations for the proper realization of the pedagogical praxis at schools has been well worked-out in the framework of the field study of didactics and propaedeutics of the pedagogical praxis. Students can carry out analyses of classes at the individual pace and practice the conduction of the inspection documentation with the use of a teaching support. They intensify at the same time their own theoretical and methodical training for the discharge of the pedagogical activity.

Conclusion

Fragmentation of the contemporary world is a very complicated phenomenon that has many aspects. The issues of the interdisciplinary relation and searching of a dialogue between the technical, humanistic and social disciplines constitutes in this framework only one of the key themes. It concerns at the same time issues that have their general theoretical aspects and also serious contexts with the realization of the concrete pedagogical process at technical universities and colleges.

This article should contribute to the theoretical discussion on interconnection of the pedagogy and technical sciences and also analyse and specify the characteristic features of these disciplines, important from the point of view of the didactics of the technical subjects. Indisputable common characteristics and relations of both scientific spheres result in conclusion that concerns the possibility of using analogical approaches in solution of the teaching issues in both spheres.

Effective education in a number of spheres is based on a good-quality training of pedagogical workers. This relates not only to the necessity of developing the pedagogy as a science but also to the extension and quality improvement of its teaching at all types and levels of technical schools, particularly at the technical universities and colleges. Constitution of the "information society" and "society of knowledge" requires a higher intervention of pedagogical knowledge and activities and also a more dynamic development of the pedagogy itself in the technical, humanistic and social sphere.

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ПОДГОТОВКА ПРЕПОДАВАТЕЛЕЙ ТЕХНИЧЕСКИХ ДИСЦИПЛИН В ЧЕШСКОЙ РЕСПУБЛИКЕ

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Освещены вопросы инженерской педагогики и психолого-педагогического образования преподавателей технических дисциплин. Анализируются специфические условия их образования в Чешской Республике, и проводится сравнение с осуществлением образования в зарубежных странах. Обоснована необходимость междисциплинарного подхода к техническим, гуманитарным и социальным наукам. Показано, что эффективность образования в некоторых сферах существенно зависит от уровня подготовки педагогов. Это обусловливает целесообразность развития педагогики как науки, рост внимания и улучшение качества ее преподавания на всех уровнях технических школ, и в частности, в технических университетах и колледжах.

Ключевые слова: инженерная педагогика, информационные технологии, история образования, обучение в технических школах, социальные науки, образование педагогов технических дисциплин, высшее образование.

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