R&E-SOURCE http://journal.ph-noe.ac.at
Open Online Journal for Research and Education
Special Issue #4, December 2015, ISSN: 2313-1640

Engineering Pedagogy and its role in quality assurance in higher education

Roman Hrmo, Lucia Krištofiaková*

Abstract

Professional training of engineers who teach at secondary schools and universities of technical orientation was initially focused only on technical training. Experience has shown that the success of such training depends also on whether they acquire the necessary pedagogical erudition. We consider it important that university teachers acquire the theoretical and practical pedagogical-psychological training aimed at tertiary teaching. By this, one element of quality assurance in higher education within the internal quality system is complied. In our paper, we describe the importance of teacher training of university teachers, the importance of engineering education, we point out the importance and place of IGIP (Internationale Gesellschaft für Inginieurpädagogik / International Society for Engineering Pedagogy) in this process and finally, we focus on pedagogical training of university teachers as part of quality assurance in higher education within the internal quality system at Dubnica Institute of Technology in Dubnica nad Váhom, Slovakia.

Keywords:
Engineering Pedagogy
Higher Education
University Teachers
Quality Assurance

1 Introduction

In the past, technical subjects were taught by engineers who entered the university workplace following completion of their university studies or after several years of work experience in a company, without any pedagogical training.
Since no one before taught them how to teach, they barely managed to guide their students to learn. Increasingly, this situation manifested the need to pay attention to this issue. The need for the development of Engineering Pedagogy appeared (Driensky, 2007).

2 Engineering Pedagogy

The teacher is a decisive factor in educational process, as eloquently expressed Ushinskiy (1948, p. 62): "... no organizational rules and curricula, no artificial mechanism, even the best developed, can replace the personality in education. ...Without personal immediate impact of educator on his student, a real education that would have penetrated the student's character is not possible. Only personality can affect the development and determination of personality, only the character can shape the character "(Turek, 2010). If teachers have to carry out their task effectively - to educate, bring up and develop the personality of students, they must carefully master their professional fields, have a good pedagogical preparation and high general culture. They should have a quality professional, pedagogical, but also general education (Turek, 2010).

* Dubnica Institute of Technology in Dubnica nad Váhom, Ul. Sládkovičova 533/20, 018 41 Dubnica nad Váhom, Slovakia. *E-mail: hrmo@dti.sk, kristofiakova@dti.sk*

Pedagogical training of teachers-engineers at secondary schools was involved in supplementary pedagogical studies for longer period. However, the curriculum of this field of studies included only limited selection of educational, psychological and related sciences. Only later, it was extended to the didactics of technical studies and teaching practice. There was missing the subject, which should transform the knowledge of social sciences into the content of technical sciences. Over the time, it has appeared that Engineering Pedagogy will become such a subject (Driensky, 2007).
Engineering Pedagogy is interdisciplinary field that transforms the knowledge of educational and psychological theory in technical sciences in order to increase the effectiveness of didactic education of engineers.
The subject of Engineering Pedagogy is the knowledge needed for rational training of teachers of technical subjects, that educate future engineers. Education is yet understood in a broad sense, because it deals not only with didactic questions, but at the same time to the upbringing. Content of Engineering Pedagogy is focused mainly on the following topics:

- Historical development of Engineering Pedagogy,
- Introduction to the methodology of technical sciences,
- Engineer and his/her function in society,
- Characteristics of master and engineering studies,
- Engineering Education and Technology,
- Status and role of didactics in technical studies (Driensky, 2007).

One of our activities carried out at our institution is the pedagogical training for university teachers, that means, university pedagogy, that is accepted by IGIP standards. By these pedagogical studies, teachers acquire teaching skills and competences to teach technical subjects at universities (Hrmo, Krištofiaková, 2013).

3 International Society for Engineering Pedagogy IGIP

International Society for Engineering Pedagogy IGIP was founded in 1972 in Klagenfurt, Austria. IGIP supports scientific research in the field of engineering pedagogy - defines the education and training involving activities in engineering and technology, from skilled staff to certified engineers, coordinates and supports the international efforts of engineering education in the future. The aim is optimizing the teaching methods of vocational subjects, creating the curricula of technical programs in accordance with the requirements of practice while respecting the rights and needs of students, the use of modern media in education of engineers, integration of humanities in the education of future engineers, support of managerial training of engineers, development of responsibility of engineers to the environment and the development of engineering education in developing countries.
IGIP accredits training centres for "International Engineering Educators", the teaching matter of which conforms to IGIP's curriculum for engineering pedagogy. These centres have to be reaccredited every five years.
The ING.PAED.IGIP is for all technical teachers who are

- engineers according to IGIP principles and
- have studied according to the IGIP curriculum studies at accredited institutes
- plus have one year of teaching experiences.

This is a minimum qualification profile for teachers and trainers in engineering education.
IGIP curriculum is a modular system which consists of

- Core modules (7 Credit Points)
- Theory modules (5 CP)
- Practice modules (5 CP)
- Elective modules (3 CP)

The Core Modules include

- Engineering Education in Theory (2 CP)
- Engineering Education in Practice (3 CP)
- Laboratory Didactics (2 CP)

The Theory Modules include

- Psychology (2 CP)

- Sociology (1 CP)
- Engineering ethics (1 CP)
- intercultural competencies (1 CP)

The Practice Modules consist of

- Presentation and Communication Skills (2 CP)
- Scientific Writing (1 CP)
- Working with Projects (1 CP)
- ICT in Engineering Education (1 CP)

The Elective Modules consist of

- Evaluation of student performance (1 CP)
- Quality Management (1 CP)
- Portfolio Assessment (1 CP)
- Creative Thinking (1 CP)
- Coaching and Mentoring in Education (1 CP)
- Collaborative work (1 CP)

Both the Register and the title ING.PAED.IGIP will generally improve the position, role and responsibility of engineering educators in society (http://www.igip.org/igip/ing-paed-igip).

4 Quality assurance of university teachers at Dubnica Institute of Technology in Dubnica nad Váhom

The issue of importance of quality development and its assurance is very topical also at our university. Dubnica Institute of Technology in Dubnica nad Váhom (DTI) has established a fully functional system of quality management according to ISO 9001:2008 in the field of: Education in all degrees of university studies and the related scientific, research and publication activities.

The certification audit has proved that management system fulfills requirements the above-mentioned standards and the Dubnica Institute of Technology in Dubnica nad Váhom was given a certificate by the company QSCert, that confirms the implementation and the use of quality management system according to ISO 9000:2008 in the mentioned field.

Dubnica Institute of Technology in Dubnica nad Váhom, in accordance with the standards of the Internal quality assurance of university education according to the § 87a of Act No. 131/2002 of Law Code on Higher Education as amended, in accordance with The European Standards and Guidelines for Quality Assurance in the European Higher Education Area (ESG) and requirements of ISO 9001:2008, defines the integrated Internal Quality Assurance System and Internal Quality Managements System, its strategy, objectives of quality and procedures through the Reference Manual of Quality and Related Organizational Standards. The Reference Manual of Quality and Related Organizational Standards in its individual chapters and the related documentation sets out the responsibilities and procedures in the creation, documenting, implementing and maintaining of the processes of internal the quality management system in the DTI, and responsibilities and procedures for continuous improvement of the education provided.

One of the areas where procedures of quality assurance are being applied is the quality assurance of university teachers. DTI has developed a system (rules and requirements) for quality assurance of university teachers, including their qualification procedure and assessing the level of competence of all new teachers in accordance with the Process tab 13 Quality assurance of the staff. DTI provides its teaching staff with opportunities for further development and improvement of their teaching skills through the Course of Pedagogical Competences for University Teachers. The current offer is made public through the WIKI portal. The Institute has developed a mechanism for exploitation of the results of evaluation of teachers by students and other teaching staff through student feedback tools (The survey of quality of study programs in the system MAIS), the tool "Attending Classes/Observation Lesson" and through the Programme of Adaptation of the New Teacher. The results are a part of the regular evaluation of teaching staff. System of quality assurance of university teachers provides procedures from admission, through adaptation, development and education, up to the evaluation of the quality of teachers and researchers. Procedures for ensuring the quality of university teachers at the DTI are shown in Figure 1.

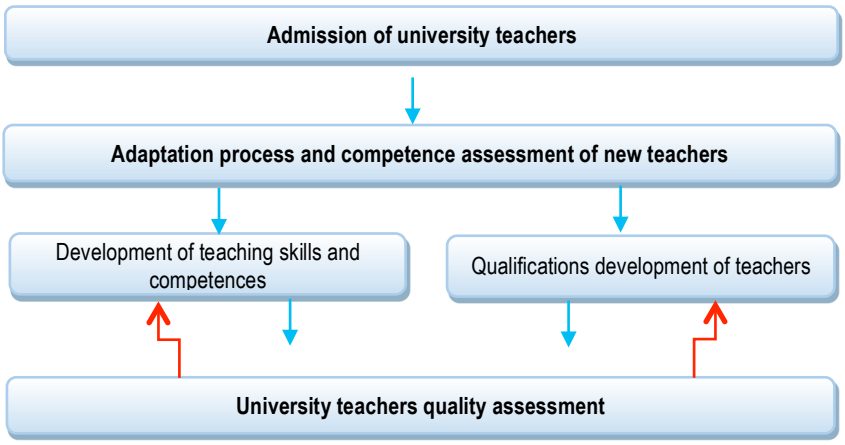

Fig. 1: Procedures for the university teachers' quality assurance at the DTI

5 Conclusion

The teachers, who were and still remain the most important factor in educational and instructional process can complete their important role only if they are able to lead their students effectively to not only professional, but at the same time also to social competence. It is therefore essential to have adequate professional as well as pedagogical erudition (Driensky, 2007). We consider it important that university teachers acquire the theoretical and practical pedagogical-psychological training aimed at tertiary teaching. By this, one element of quality assurance in higher education within the internal quality system is complied.

Acknowledgement: The authors gratefully acknowledge the contribution of the KEGA Grant Agency of the Slovak Republic under the KEGA Project 010UCM-4/2015.

References

Bilčík, A. (2010). Zlepšovanie kvality v podmienkach vzdelávacej organizácie. - 1. vyd. - Trnava : AlumniPress, 2010. - 84 s. - e-monografia. - ISBN 978-80-8096-132-9 (http://www.mtf.stuba.sk).

Depešová, J. (2015). Odborné technické vzdelávanie v podmienkach výrobnej praxe. In : Edukacja - Technika - Informatyka : wybrane problemy edukacji technicznej i zawodowej. - ISSN 2080-9069, Roč. 6, č. 1 (2015), s. 82-87.

Driensky, D. (2007). Inžinierska pedagogika. Bratislava : STU, 2007. 185 p. ISBN 978-80-8096-040-7.

Frankovský, M., Lajčin, D. (2012). Zvládanie náročných situácií v manažérskej práci. - 1. vyd. - Praha : Radix, spol. s.r.o, 2012. 107 p. ISBN 978-80-87573-02-0.

Hagara, V., Ružinská, E., Jakúbek, P., Paľun, M. (2015). Creativity and positive image in educational institutions. Brno : Tribun EU, 2015. 202 s., ISBN 978-80-263-0968-0.

Hlásna, S. (2013). Socio-Educational training as an Innovative Form of the Lifelong Education of Teachers at Secondary Vocational Schools – Project KEGA no. 005DTI-4/2013. In : Acta Technilogica Dubnicae, 2013, vol. 3, issue 1, s. 94-96. ISSN 1338-3965 22.

Hrmo, R. (2014). Príručka kvality Dubnického technologického inštitútu v Dubnici nad Váhom (Vnútorný predpis vysokej školy upravujúci vnútorný systém kvality). 2014.

Hrmo, R. - Krištofiaková, L. (2013). Vzdelávacie a vedecko-výskumné projekty v oblasti inžinierskej pedagogiky na Slovensku. In: Interdisciplinární vztahy mezi technickými, humanitními a společenskými vědami. Praha : České vysoké učení technické v Praze, 2013. ISBN 978-80-01-05287-7.

IGIP (2015). [online]. [cit. 2015-10-26]. Available on internet: <http://www.igip.org/igip/ing-paed-igip>.
Hrmo, R., Krpálková Krelová, K. (2007). Pedagogické vzdelávanie vysokoškolských učiteľov podľa štandardov Medzinárodnej spoločnosti pre inžiniersku pedagogiku (IGIP) na Materiálovotechnologickej fakulte Slovenskej technickej univerzity so sídlom v Trnave (MTF STU). In: Vzdelávanie dospelých. - ISSN 1335-2350. - Roč. 12, č. 3 (2007), p. 79-86.
Chromý, J., Sobek, M., Krpálková Krelová, K., Krpálek, P. (2013). Determining Aspects of Electronic Systems for Teaching Support. In : Recent Advances in Educational Methods: Proceedings of the 10 th International Conference on Engineering Education (EDUCATION ´13), Proceedings of the 1st International Conference on Early Childhood Education (ECED ´13). Cambridge, UK, February 20-22, 2013. pp. 62-67. ISSN: 2227-4618. ISBN: 978-1-61804-163-0.
Kentoš, M., Sláviková, G. (2013). Zvládanie stresu manažérmi. - vyd. - Praha : Radix, spol. s r. o., 2013. 72 p. ISBN 978-80-87573-08-2.
Makýš, P., Šlúch, M. ISO 9001:2008 a jeho interné audity podľa normy ISO 19011:2011. Žilina : M KREO s.r.o. 76 p., ISBN 978-80-971299-0-3.
Kučerka, D., Rusnáková, S., Husár, Š., Kučerková, M., Hrmo, R. (2013). Research in engineering pedagogy, in: Proc. 16th International Conferance on Interactive Collaborative Learning, Kazaň; CTI Villach, Kazan, National Research Technological University, 2013, pp. 30-35.
Oberuč, J., Lajčin, D., Porubčanová, D. (2014). Stress management in the Workplace. In : Journal on Law, Economy & Management. - London : Eastern european developement agency n. o., 2014. - ISSN 2048-4186. - Roč. 4, č. 2, (2014), pp. 47-51.
Podařil, M., Hrmo, R. (2013). Vplyv informačno-komunikačných technológií na autoritu učiteľa. In: Trendy ve vzdělávání. Informační technologie a technické vzdělávání. ISSN 1805-8949, Roč. 6, č. 1 (2013). pp. 680-687.
Szőköl, I.- Horváth, K. (2013). Kvalita vzdelávania z hľadiska rozvoja informačných a komunikačných kompetencií učiteľa. In Neubauer, J. – Hájoková, E. (eds.): XXXI. International Coloquium the Management of Educational Process. Brno : Univerzita obrany, Fakulta ekonomiky a managementu, 2013, 241-245 s. ISBN 978-80-7231–924–4.
Tamášová, V., Barnová, S. (2011). School climate as the determinant of the relationschip between the level of students resilience and school satisfaction. In : ACTA- technologica Dubnicae. - ISSN 1338-3965. - No. 1 (2011), s. 19-37.
Turek, I. (2010). Didaktika. Bratislava : Iura Edition, 2010. 598 s., ISBN 978-80-8078-322-8.
Zákon č. 131/2002 Z.z. o vysokých školách.