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The Cultivation of Engineering Talent

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Conference Topic: Attractiveness of Engineering Education
Keywords: Holistic Engineering Education, Reflective Competence

The paper raises the question how engineers can be educated and trained sufficiently in order to meet 21st century's needs – with its complexity, its vast technological development and its various societal needs.

Engineers play a key role in transforming ideas and inventions into innovations that create value for users [1]. But successful innovation requires a broad set of skills that is beyond a profound technological knowledge, as for example communication skills, the ability to work in a team or competences in project management. The National Academy of Sciences [2] draws an interesting scenario for future engineers in the year 2020 referring to societal, global, and professional contexts of engineering practice. The most meaningful change with a tremendous impact on today's engineering education can be identified as an accelerating global economy. The world's economy has become increasingly interlinked over the last few decades due to technological innovations which unfolds the importance of efficient collaboration in international teams. Furthermore, the steady increase in knowledge leads to a growing complexity which requires a systems perspective on engineering problems. In consequence, the collaboration of multidisciplinary teams of experts is inevitable and shows the challenges in communication and teamwork which engineers will have to face.

The academic outlook by the National Academy of Sciences summarizes in a very extensive way various perceptions concerning current developments in engineering education. Additional to a scientific point of view, challenges for today's engineering education can also be derived from industry's actual requirements. However, surveys (e.g. [3]; [4]) reveal a gap between the industry's needs and university curricula and graduates perceive similar lacks in education themselves. To successfully meet these needs a paradigm shift in engineering education that focuses on a more comprehensive approach and on the development of human potential is necessary (e.g. [5]).

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Hence, ways of implementing a holistic engineering education including approaches for sustainable career development will be discussed by using the example of MCI (Management Center Innstbruck), an Austrian engineering school. To complete the idea of supporting the individual development as professional and to increase the degree of adaptability to dynamic changes in global markets and technologies a reflective approach is introduced. Based on Weinert's understanding [6], competences are conceptualized as context-related dispositions that enable people to successfully solve problems. From an engineering educator's point of view, this draws the attention on how students can be supported in developing this sort of competence and what contribution can be made to foster this disposition and to facilitate a more holistic engineering education. Becoming a professional, in the sense of being a full member of a community of practice [7], is a lifelong process which additionally requires reflective competence in order to identify and develop one's individual potential. Thus, fostering reflective competence is supposed to be an indispensable part of engineering education. This way individual experience can be used more productively to increase engineering students' employability by actively designing their personalized curriculum and benefiting from individual talents.

Preparing graduates for a lifelong learning process also has to include the preparation for the handling of individual experience in communities of practice. The reflective competence which is required to profit from experience and to increase the possibility of transfer can already be supported in engineering schools. The increased consideration of individual experience in learning processes and in the support of a sustainable career development shows how important it is to allow for experience not only during internships in companies but also during the whole technical study program. Therefore, creating a constructivist learning environment instead of the predominant model – "talk and chalk" [8] - in engineering education is necessary although not always easy to realize. But there are some promising approaches, e.g. project-based learning, that enable experience that is close to professional reality since the biggest part of an engineer's professional practice is project related. The paper ends with pointing out tools to enlarge the sustainability of practical experience which are suitable to accompany learning processes and foster the engagement with the individual learning history. ■

REFERENCES

[1] Wnek G. E., Williamson S. (2010), Engineering Value propositions: Professional and Personal Needs, in *Holistic engineering education: Beyond technology* (Eds: D. Grasso, M. B. Burkins), Springer. New York.

[2] National Academy of Engineering (2004), The engineer of 2020: Visions of engineering in the new century, National Academies Press, Washington, D.C.

[3] Becker F. S. (2010), Why don't young people want to become engineers? Rational reasons for disappointing decisions, *European Journal of Engineering Education*, Vol. 35, No. 4, pp. 349-366.

[4] Hillmer, G., Wiedenbrüg, R., Bunz, A. (2012), Competences Required by Industry from Early-Career Engineering Graduates, in *Innovations 2012: World Innovations in Engineering Education and Research* (Eds: W. Aung). Potomac, USA in press.

[5] Grasso, D., Burkins, M. B. (Eds.) (2010),Holistic engineering education: Beyond technology, Springer, New York.

[6] Weinert, F. E. (2001), Concept of Competence: A Conceptual Clarification, in *Defining and selecting key competencies* (Eds: D. S. Rychen, L. H. Salganik), Hogrefe & Huber. Seattle.

[7] Lave, J., Wenger, E. (1991), Situated learning: Legitimate peripheral participation, 19th ed., Cambridge Univ. Press, Cambridge.

[8] J. E. Mills, D. F. Treagust (2003), Engineering Education - Is Problem-Based or Project-Based Learning the Answer?, Online: http://champs.cecs.ucf.edu/Library/Journal_Articles/pdfs/Engineering%20Education.pdf. [20.06.2012]