041
Using Models to Promote Scholarly Development in Engineering Education

T. Olsson[1]
Senior lecturer/Academic developer
Lund University, Faculty of Engineering
Lund, Sweden
thomas.olsson@genombrottet.lth.se

T. Roxå
Lecturer/Academic developer
Lund University, Faculty of Engineering
Lund, Sweden
torgny.roxa@genombrottet.lth.se

Conference Topic: Engineering Education Research
Keywords: cognitive dissonance, critical reflection, double-loop learning, engineering education

Theoretical approaches within teaching and student learning are often based on aspects of social sciences that are unfamiliar to most teachers in engineering. The development of engineering education is facilitated by a basic understanding of pedagogical theories, but also by the recognition of, and connections to, more recognizable engineering traditions. The use of illustrative models to explain and simplify complex pedagogical processes is an example of how a scientific tradition familiar to engineering teachers could help them increase their understanding of teaching and learning, and serve as a driver for the development of engineering education.

In this conceptual paper we present and analyse a model for pedagogical competence, integrating theory and practice in engineering education [1]. The model involves four essential parts – *pedagogical practice* or actual teaching activities related to student learning; *observation* of teaching and student learning; *theory* or theoretical knowledge of teaching and student learning; and *planning* as a means for improved pedagogical practice.

The pedagogical practice involves a variety of teaching activities and it is within the pedagogical practice that student learning is actively supported through interactions between teachers and students. We identify the qualitative level of the pedagogical practice as *teaching skills*.

[1] T Olsson, thomas.olsson@genombrottet.lth.se

Pedagogical competence is a broader concept than teaching skills. A professional teacher should continuously observe and reflect on the teaching practice and its effect on student learning. Based on theoretical knowledge, and own observations of teaching and learning, the teacher analyses his or her teaching practice in relation to students' learning and draw rational conclusions and make plans for continued development.

Our arguments are related to the theory of *cognitive dissonance* developed by Festinger [2]. In the case of teaching and learning an important dissonance may be between a teacher's knowledge about teaching and learning and the actual teaching practice and its outcomes. Festinger argues that the tension between conflicting cognitions, the dissonance, is a driving force for change since people want to reduce or eliminate dissonance and achieve consonance, and we argue for teachers' own observations to be the single most important factor to disclose dissonance.

Reflection is an essential characteristic of scholarly teaching and integrated in all parts of our model. Mezirow [3] discusses increasingly complex ways of reflection: *content* reflection, *process* reflection and *premise* reflection. Process and premise reflection increase the possibilities for teachers to transform their conceptual structures to become more complex. We argue that to reflect beyond content reflection it is necessary to go outside the pedagogical practice and include observation, theory and planning.

We also build on Argyris and Schön [4]. A very important feature in double-loop learning is the ability to draw conclusions from data, something consistent with the use of observations as exposed in our model. Teachers that teach without observing teaching and student learning, and without reflecting with the use of pedagogical theory, are likely to learn only through single-loop learning. Teachers that demonstrate pedagogical competence are much more likely to produce double-loop learning.

The Faculty of Engineering at Lund University has an extensive and integrated program for academic development. In addition to this program, a formal research subject, *engineering education*, was introduced in 2011. The core activities of the academic development program comprise pedagogical courses at university level; consulting services; evaluations; applied research related to engineering education, dissemination of knowledge and arenas for scholarly conversations; and, a system for rewarding excellent teaching. The model of pedagogical competence is used in analyses of our ideas about academic development and we will discuss some practical results and implications at our presentation of the paper.

REFERENCES

[1] Olsson, T, Mårtensson K and Roxå T, (2010), Pedagogical Competence – a development perspective from Lund University. In Å. Ryegård, K. Apelgren, & T. Olsson (Eds), *A Swedish Perspective on Pedagogical Competence* (pp. 121-132), Uppsala University, Division for Development of Teaching and Learning.

[2] Festinger, L, (1957), *A Theory of Cognitive Dissonance*, Stanford CA: Stanford University Press.

[3] Mezirow, J, (1991), *Transformative dimensions of adult learning*, San Francisco: Jossey Bass.

[4] Argyris, C and Schön, D, (1974), *Theory in practice: Increasing professional effectiveness*, San Francisco: Jossey Bass.