

The characteristics of pedagogical development in the fields of science and technology

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Particularly in STEM disciplines, targeted teacher training is often neglected. [Maria Clavert](#) argues why pedagogical development in technical fields should emphasise the academic dual identity of a teacher-researcher. Furthermore, her findings suggest training was most effective with academics who were already open to alternative pedagogical concepts and looking for ways to change their teaching practices. Teaching should become everybody's business and the disciplinary pedagogical traditions should be exposed to critical evaluation.



*The educational scientists had a very different world view than us. For example, questions like are all human beings *laughs* equally capable of learning things. Their book says they are, and we think that they are not.*

The above quote highlights the frustration of an engineering educator after participating in a pedagogical training programme. Every year, most technical universities encourage their faculty members to participate in pedagogical training courses targeted for a general group of 'teachers'. The programmes have been criticized for neglecting the academic research-orientation and failing to provide continuous changes in practice. Struggling between connecting pedagogical theories with academic practices is something I deal with on a daily basis when working as a pedagogical Development Expert among engineering educators at Aalto University Design Factory. It seems that not all technical academics consider themselves primarily as teachers when participating to pedagogical training.

In the fields of science and technology, it is typically assumed that expertise in teaching is an inevitable side product of disciplinary research expertise. Teaching is seen as a private, autonomous activity guided by the implicit pedagogical traditions of the department. It is something that has to be done alongside the primary research activity. In the beginning of their teaching careers, the academics possess a doctoral education preparing them for acting as researchers in their own field of expertise, but most of them have no pedagogical education or previous teaching experience. As the technical disciplines differ fundamentally from educational sciences in how knowledge is produced and taught to others, most academics see the two disciplines as contradictory. They might even consider the unfamiliar pedagogical ideas and contradicting values as a threat to their disciplinary researcher identity. The university funding and quality assurance policies as well as academic reward systems are mainly based on research-based activities. Research merits, such as the number of publications, are easy to identify, measure, and communicate in the tenure track system. In contrast, the effects of pedagogical development efforts manifest themselves in the future activities of the students. Thus it seems that allocating working hours for long-term pedagogical development activities is very difficult to justify within the resource-intensive higher education context.



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Despite the emphasis of research orientation, developing oneself in teaching the discipline is an essential part of making a social impact as an academic. Unlike the development as a researcher, pedagogical development is dependent on the establishment of a teacher identity: becoming aware of one's assumptions regarding teaching and willingness to critically reflect on them in order to enhance student learning. In our [recently published study](#), we interviewed Finnish academics from the fields of science and technology in order to explore the experiences that influenced their pedagogical development process. Instead of talking about a linear process starting from the first official teaching experience, the academics described facing difficulties in teaching, being exposed to contradicting pedagogical thoughts, attending pedagogical trainings, conducting pedagogical experimentations, and collaborating with colleagues. These triggering experiences resulted in identifying oneself as a teacher, understanding the need for pedagogical development, and gaining motivation for conducting the necessary changes in one's teaching. Pedagogical training was most effective with those academics who were already open to alternative pedagogical concepts and looking for ways to change their teaching practices. To summarize, the teacher development process in the fields of science and technology was described as an experience of becoming a teacher. All the triggering experiences mentioned in the interviews are presented in Table 1.

Table 1. The triggering experiences related to becoming a teacher (Drawn from [Clavert et al. 2014](#))

Pedagogical actions	Participating in pedagogical training Teaching Developing teaching Acquiring official teaching duties Studying
Social experiences	Teacher models Contact with the students The attitude of the students towards teaching Collaboration with other teachers
Emotional experiences	Satisfaction and increasing enthusiasm of developing one's teaching successfully Resentment and declining enthusiasm of not being able to develop one's teaching Courage of developing teaching Thrill of teaching in front of a large audience
Cognitive experiences	Understanding the need for pedagogical development Increasing understanding of one's own teaching Understanding one's own willingness to teach
Contextual experiences	The attitude of the work community towards pedagogical development

The findings imply that pedagogical development should be considered beyond the official training programmes as a possibility of becoming a teacher. Seeking out for the triggering pedagogical experiences would require breaking out from the homogeneous departmental silos and embracing the disciplinary diversity in an open dialogue. Consequently it would require abandoning the traditional view of teaching as a private, autonomous activity. Teaching should become everybody's business and the disciplinary pedagogical traditions should be exposed to critical evaluation. Becoming aware of the potential conflicts between the shared disciplinary assumptions and the actual needs of the students should be supported with pedagogical mentoring and well-timed training that is participant-oriented, context-aware, and dispersed in time and place. Including clearly defined pedagogical merits into the university funding policies, quality assurance processes, academic reward criteria, and tenure track systems is a prerequisite for establishing new academic cultures supportive of both teaching and research activities. The resulting mutually reinforcing teacher-researcher identity provides a fruitful basis for further professional development within the academia.

Further reading: Clavert, M., Björklund, T., & Nevgi, A. (2014). [Developing as a Teacher in the Fields of Science and Technology. Teaching in Higher Education](#), DOI: 10.1080/13562517.2014.901957.

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