THE FINNISH PRODUCT DEVELOPMENT TEACHERS´ PERCEPTIONS OF THEIR PEDAGOGICAL CONTENT KNOWLEDGE IN HIGHER EDUCATION

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ABSTRACT

The paper concerns the Finnish product development teachers´ perceptions on their pedagogical content knowledge in higher education settings. The aim is to describe and analyse what kind of pedagogical content knowledge the teachers have and, therefore, to provide a better understanding of the type of knowledge unique to product development teaching. The model of pedagogical content knowledge used here includes the components of product development content knowledge, pedagogical knowledge and pedagogical content knowledge. Based on seven teacher interviews, the main content knowledge concerns the process of product development, its different phases and methods as well as the usage of different software programs. The teachers use diverse teaching methods and their attitude towards educational technology is mostly positive. Course learning outcomes and working life are acknowledged when planning teaching, but only a few teachers take curriculum into account and participate in curriculum design. Even though the teachers use different evaluation methods in teaching, new ways of evaluation are needed. This may be something that innovative educational technology tools can make possible.

Keywords: Education, Knowledge management, Research methodologies and methods, Pedagogical content knowledge, Qualitative research

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1 INTRODUCTION

Teachers are viewed as professionals in the field of learning with teacher knowledge being one of the main aspects (Antić, 2017). The essential features characterizing expert teachers include, for example, decision-making abilities, problem-solving strategies, awareness of context, challenging objectives, perception of classroom events, respect for students, and extensive pedagogical content knowledge, including deep representations of subject matter knowledge (Berliner, 2001). Earlier research in design and engineering education has focused, for example, on different pedagogical practices (Maya and Gómez, 2015) and teacher readiness (Brophy *et al.*, 2008). This paper concerns the product development teachers' perceptions of their pedagogical content knowledge in two technical universities in Finland, Tampere University of Technology (current Tampere University) and Aalto University. The paper aims to describe and analyse what kind of pedagogical content knowledge teachers possess, therefore providing a deeper understanding of the type of knowledge unique to product development teaching. On a more general level, the paper offers an overall picture of what kind of expertise and competence is needed in product development education today and in the future.

In a previous study conducted at the Tampere University of Technology, Laboratory of Mechanical Engineering and Industrial Systems, Juuti *et al.* (2017) developed the first prototype of pedagogical content knowledge in product development education. Based on Shulman's (1987) and Grossman's (1990) categorisations of teacher knowledge, Juuti *et al.* (2017) presented their findings in accordance with five sub-areas of pedagogical content knowledge, including knowledge of educational ends, purposes, and values and their philosophical and historical grounds; knowledge of student understanding, beliefs and misconceptions of the area; curricular knowledge; knowledge of instructional strategies and evaluation methods; knowledge of learners and their characteristics. Drawing on earlier studies mentioned above, the model of pedagogical content knowledge used in this paper is confined to the components of (1) product development content knowledge, (2) pedagogical knowledge with the added emphasis on educational technology perspective (see Mishra and Koehler, 2006) and (3) pedagogical content knowledge. The model is shown in Figure 1.

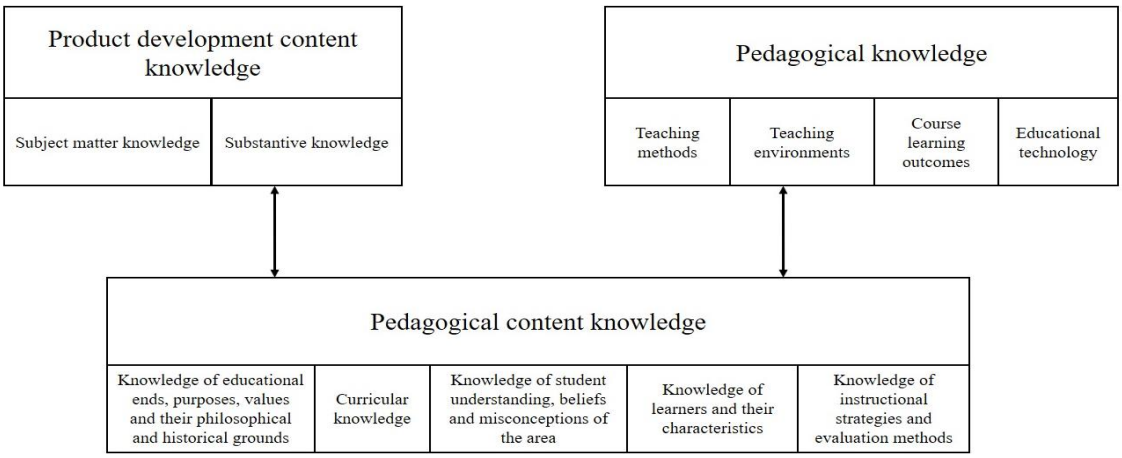

Figure 1. The model of pedagogical content knowledge in product development education

Product development content knowledge contains subject matter knowledge, or, knowledge about the discipline, as well as substantive knowledge referring to the knowledge accrued by the discipline. Pedagogical knowledge concerns teaching methods, teaching environments, course learning outcomes and the use of educational technology. Pedagogical content knowledge includes the above mentioned categorizations developed by Juuti *et al.* (2017). Importantly, the model of pedagogical content knowledge does not concern issues related to product development teachers' personal or psychological qualities, teaching skills, work ethics and the like, but it is created to describe and deliniate the knowledge base of product development teaching.

The paper is based on an ongoing research work which aims not only to describe what kind of pedagogical content knowledge product development teachers have, but it also aims at exploring what

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and how to develop pedagogical content knowledge in the context of product development education. These questions concerning development of pedagogical content knowledge are, however, left outside the scope of this paper. The product develoment teachers form a community of practice where people "share a concern, a set of problems, or a passion about the topic, and who deepen their knowledge and expertise in this area by interacting" regularly to learn together and from each other (Wenger *et al.*, 2002, p. 4). While being relevant in the formation of teachers' pegagogical content knowledge, the paper does not use the community of practice perspective here, either.

1.1 Theory base

The notion of pedagogical content knowledge originates from the work done by the American Professor Lee S. Shulman and his research teams in 1980s. In studying the knowledge base of teachers, Shulman (1986) presented three categories of content knowledge: subject matter content knowledge, pedagogical content knowledge, and curricular knowledge. In Shulman's (1987, p. 8) categorizations, pedagogical content knowledge is a specific domain of knowledge representing "the blending of content and pedagogy into an understanding of how particular topics, problems, or issues are organized, represented, and adapted to the diverse interests and abilities of learners, and presented for instruction." Following Shulman's idea of pedagogical knowledge being applicable to the teaching of a given content, Mishra and Koehler (2006, p. 1021) inferred that pedagogical content knowledge "is the manner in which subject matter is transformed for teaching. This occurs when the teacher interprets the subject matter and finds different ways to represent it and make it accessible to learners." In his 1987 publication, Shulman actually increased the categories of the knowledge base in teaching. In addition to pedagogical content knowledge, the categories included content knowledge, general pedagogical knowledge, curriculum knowledge, knowledge of learners and their characteristics, knowledge of educational contexts and knowledge of educational ends, purposes, and values, and their philosophical and historical grounds. Among these categories, Shulman's interest focused especially on pedagogical content knowledge representing a special form of professional understanding of the teachers. (Shulman, 1987.)

In Shulman's early work, as mentioned, pedagogical content knowledge was seen as one element of teachers' knowledge base, and it has been criticised for the lack of theoretical background and determinate concepts (Kind, 2009). Since then, many researchers have analysed the components of teachers' knowledge base and developed the concept of pedagogical content knowledge further. The models of pedagogical content knowledge have typically contained four components, including content knowledge, pedagogical knowledge, pedagogical content knowledge and context knowledge (Grossman, 1990; Park and Oliver, 2008). Grossman (1990) describes content knowledge as the knowledge of syntatic structures, content and substantive structures. Pedagogical knowledge refers to the knowledge and beliefs concerning learners and learning, classroom management, and curriculum and instruction. Pedagogical content knowledge is divided into conceptions of purposes for teaching subject matter, knowledge of students' understanding, curricular knowledge and knowledge of instructional strategies. Grossman (1990) takes also knowledge of context into account, consisting of students' socio-economic backgrounds, community, district and school.

In their model of pedagogical content knowledge, Park and Oliver (2008) propose five components of teacher knowledge, including orientations to teaching the discipline; knowledge of students' understanding in the discipline; knowledge of discipline curriculum; knowledge of instructional strategies and representations for teaching the discipline; knowledge of assessment of discipline learning. Jolly *et al.* (2012) use the model of Park and Oliver (2008) to explore the complexities of teaching practice in the context of engineering education. They suggest the modification of the model to include a sixth component: teaching for practice (Jolly *et al.*, 2012).

The model of technological pedagogical content knowledge by Mishra and Koehler (2006; see also Koehler and Mishra, 2009) highlights the role of technology in teaching. Technology can either reduce or increase teachers' workload, which is why it is important to understand how different technologies influence teachers' work and how various technological solutions are used to bring added value to teaching. The knowledge about content, pedagogy and technology form the basis of good teaching with technology. Instead of treating these as separate bodies of knowledge, the model emphasises the connections and interactions between and among them. These components of teacher knowledge form the core of technology, pedagogy and content knowledge (TPACK) framework, which builds on Shulman's (1986; 1987) descriptions of pedagocical content knowledge. Teaching succesfully with technology requires that

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teachers continually create and establish a dynamic equilibrium among all components of the TPACK framework. (Mishra and Koehler, 2006; Koehler and Mishra, 2009.) For example, Magana *et al.* (2012) have studied technological pedagogocal content knowledge in engineering education.

2 RESEARCH STRATEGIES

The research strategies used in this study include qualitative research, educational research, and case study research. Snape and Spencer (2003, p. 3) describe that qualitative research aims to provide "an in-depth and interpreted understanding of the social world of research participants by learning about their social and material circumstances, their experience, perspectives and histories". The qualitative data collection methods include observations, focus groups (group discussions), and, as in this study, individual interviews. This study is also based on a qualitative approach of educational research. According to Anderson (1990, p. 6), "educational research is the systematic process of discovering how and why people in educational settings behave as they do." Educational research may focus on various aspects of education, including student behaviour, teacher training or social justice. The main purpose of the research is to improve teachers' professional practice and the systems within which they operate to support student learning. (Atkins and Wallace, 2012.) Case study research is an inquiry focusing on describing, understanding, predicting, and/or controlling the individual process, person, group, organisation, industry, or culture (Woodside, 2010). In educational research, the case study provides a means of doing a small-scale investigation of a variety of contexts and situations, ranging from the experiences of individuals to the workings of universities, and from single cases of people, classes or organisations to multiple cases (Atkins and Wallace, 2012). In this study, specifically, the case is a group of product development teachers from two technical universities in Finland. As a qualitative case study, this study seeks to understand the uniqueness and complexity of the chosen case as well as its interaction with its contexts (Stake, 1995).

2.1 Research data

Seven product development teachers from Finland participated in the research. Participants included four teachers from Tampere University of Technology and three teachers from Aalto University. The research data was collected with semi-structured interviews, which were recorded on tape. The interviews lasted approximately 30 to 90 minutes and were conducted in September and October 2018. The product development teachers participating in the research have different study and work experience backgrounds and two out of seven teachers do not do research alongside of teaching. Even though this is a case study and the aim is not to make generalisation, the data will provide a comprehensive picture of the pedagogical content knowledge of product development teachers because the subject of product development is only taught in these two universities in Finland.

The purpose of this study is to understand the teachers' personal interpretations of their pedagogical content knowledge, which is the reason why interview is an effective research method for this study. The opportunity for dialogue, that an interview provides, allows the interviewer to clarify and check everything is understood in the way it was meant and to correct possible misconception (Atkins and Wallace, 2012). Semi-structured interview was chosen for this study, because it gives an opportunity to delve deeply into the teachers' interpretations about their pedagogical content knowledge. The structure of the interview consisted of three themes, which were product development content knowledge, pedagogical knowledge and pedagogical content knowledge. Semi-structured interview proceeds with the themes without structured questions and specific order. This allows the participants to freely express their interpretations and beliefs about their pedagogical content knowledge. Semi-structured interview clarified the aspects of pedagogical content knowledge and made it possible to deepen the topics with further questions depending on the participants answers (Galletta, 2013).

2.2 Research method

The research method used in this study is directed content analysis (Hsieh and Shannon, 2005), also called as directed qualitative content analysis (Assarroudi *et al.*, 2018). Directed approach to content analysis aims at validating or extending conceptually some theoretical framework or theory (Hsieh and Shannon, 2005). Existing theory and research support the development of the research question and provide predictions about the key concepts or variables as initial coding categories (Potter and Levine-Donnerstein, 1999). This has also been referred to as deductive category application (Mayring, 2000).

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The main advantage of a directed approach to content analysis is that existing theory can be supported and extended. The notion that the researchers may approach the data with an informed, but strong bias is seen as an inherent limitation of this approach. (Hsieh and Shannon, 2005.)
In the beginning of data analysis, the recorded interviews were transcribed into a text form, so that the data would be easier to handle. After the transcription, the material was read several times to examine different conceptions in each theme. In deductive content analysis, either a structured or unconstrained matrix of analysis are used, depending on the purpose of the study (Kyngäs and Vanhanen, 1999). It is usually based on previous work, including theories, models, mind maps and literature reviews (Hsieh and Shannon, 2005). In this case, after careful reading of the material, a structured matrix of analysis was created and aspects that fit the matrix of analysis were chosen from the data. An example from a categorization matrix about the pedagogical knowledge is shown in Table 1.

Table 1. Categorization matrix of pedagogical knowledge [modified from Elo and Kyngäs, (2008)]

	Teaching methods	Teaching environments	Course learning outcomes	Educational technology
What kind of pedagogical knowledge product development teachers have?	Lectures	University facilities	The base for planning teaching	Obligatory university online platforms unhandy
	Project based learning	Lecture rooms	The most important outcomes	Potential that is not exploited
	Experiential learning	Classrooms		A tool that should bring surplus value to teaching
	Flipped learning	Limited options		

3 RESULTS

The research results are presented under the main categories of pedagogical content knowledge, content knowledge, and pedagogical knowledge.

3.1 Pedagogical content knowledge

The presentation of product development teachers' perceptions about their pedagogical content knowledge is based on the categorizations provided by Juuti at al. (2017).

3.1.1 The knowledge of educational ends, purposes and values, and their philosophical and historical grounds

According to the teachers' experiences, co-operation with the industry is crucial in product development education. All of the teachers took working life and the expectations of industry into consideration when planning courses and teaching. Several teachers mentioned asking comments and suggestions from alumna and people working in industrial sector and revising their teaching and content knowledge based on the comments. Teachers wanted to use authentic working life projects, where students have to practice the skills needed in industry.

> *Our goal is that competent civil engineers graduate to industrial sector from our department and that is the starting point when planning teaching. I think it can be seen with students solving authentic working life problems. (Interviewee 2.)*

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As data analysis reveals, teaching is not as valued as researching and the teachers working in higher education are hired based on the fact if they like to do research or not. The teachers experienced that teaching development is not being executed as much as it should, because time and resources are rather put into research. On the whole the teachers saw the two roles benefiting one another, because teaching gave them new ideas to research and research gave new knowledge that can be taught to students.

3.1.2 Knowledge of student understanding, beliefs and misconceptions of the area

Earlier studies have shown that it is important for a teacher to have knowledge of students' understanding, beliefs and misunderstanding concerning the course topic (see e.g., Shulman, 1986; Grossman, 1990; Loewenberg Ball *et al.*, 2008; Park and Oliver, 2008). The interviewed teachers' knowledge of students' understanding, beliefs and misconceptions were different between the two universities. The teachers at Tampere University of Technology (hereafter, TUT) highlighted that high school prepares students very poorly for product development studies because the first-year students are used to having one correct answer to every question, so the teachers have to challenge them to think critically, give space for reflection and accustom them to uncertainty.

> *Comprehensive school and high school prepare the students very poorly for product development studies. And the reason is that students think that the world is a crossword puzzle where every question has one right answer. That kind of thinking is nonsense here. (Interviewee 7.)*

New teaching methods can feel confusing and even pressing for the new students, which is why the courses usually get some negative feedback. One teacher from TUT highlighted that the first university course is not only about creative problem-solving, but it serves also as an orientation to higher education studies, communications and interaction. Teachers from Aalto University did not express such opinions about students' suppositions or the role of high school, but mentioned that usually students are not used to uncertainty.

3.1.3 Knowledge of learners and their characteristics

In Aalto university, there are a great deal of multidisciplinary courses, where students can have various source information. This makes the designing of teaching more difficult because the teachers need to take students' different source information into account. Nevertheless, the project-based courses are very flexible and, in contrast to what the teachers from TUT said, the teachers in Aalto thought that students already have good knowledge, skills and understanding gained from, for example, summer work experience. Knowledge of learners and their characteristics helps the teacher to meet the students on their level of understanding.

> *To be fair, my teaching and conversations with bachelors, masters and people in working life don't differ that much and the more important thing is to understand why something is done. Technical tools are not that complicated and the important factor to understand is why different tools and instruments are applied. (Interviewee 1.)*

3.1.4 Curricular knowledge

Whereas all teachers took the learning outcomes of the courses into consideration, curricular knowledge differed among teachers. Out of seven interviewees, only two teachers from TUT mentioned that they take part in curriculum design and take curriculum into account when planning their teaching. They saw curriculum important, because it guides the design of the product development studies and the courses need to serve one another so that the students have the adequate knowledge from a previous course when proceeding with the studies.

> *I would like to say that I take curriculum into account but in reality… Well, depends on what you compare it to but we still have pretty much this culture that everyone takes care of their own courses. We have the documentation where the collective targets are stated but I haven't been in one meeting where we would have planned the product development studies as a whole. (Interviewee 1.)*

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Five of seven interviewed teachers mentioned that they do not consider the structure of the whole curriculum when designing teaching. They were, however, hoping that curriculum planning would be taken into account and more direction and possibilities for its development would be offered.

3.1.5 Knowledge of instructional strategies and evaluation methods

Teachers' knowledge of instructional strategies covers lecturing, problem-based learning, simulation games, practice work, flipped learning, experiential learning, and projects from the industry. The interviewed teachers utilised plenty of different evaluation methods, such as peer evaluation, mini-exams, feedback from the industry and learning logs. The teachers mentioned that using different evaluation methods makes it easier to reflect and follow the learning process, for both teachers and students. Evaluation was also partly understood as problematic among teachers.

> *If one would like to think according to the philosophy of an individual growing to his or hers own potential, the evaluation is difficult because then you can't compare one another and an individual would have one's own learning outcomes. How to evaluate if this certain student has grown into his maximum potential in this area? There is usually not enough time or perhaps tools to do this. (Interviewee 2.)*

Evaluation was also seen as challenging when evaluating group work the teachers cannot tell, how much each group member has participated in the work and how the grades should be distributed. According to one interviewed teacher evaluation should support the implementation of the course. In project-based courses, for example, evaluation should be focused on group work. This is always not the case because teachers may need individual work in addition to the group work in order to evaluate the student and give a grade.

3.2 Content knowledge

The content knowledge the teachers in the two universities possess varies because they teach different courses. For example, one teacher's main content knowledge on the course was to teach the use and application of some specific software program while the other teacher's main content knowledge was the whole product development process with its various phases. Two teachers whose courses dealt with specific software programs, such as 3D-modeling, understood content knowledge exclusively as technical skills, whereas the other interviewed teachers comprehended content knowledge as a wide totality.

> *We always have interdisciplinary project-based courses where every team has a little bit different needs and goals. The content knowledge is always bound to the context and the user-centered product development process and its phases stay constant. (Interviewee 1.)*

The different courses caused differences in teachers' understanding of content knowledge but there are also similarities in teachers' understanding of it. Teachers who taught courses that dealt with wider topics than some specific software program, saw the user-centric product development process, its methods and phases being the core of product development content knowledge. The teachers saw that the vital factors in the process of product development are knowledge of different engineering design methods, ideation methods, elimination methods, and decision-making methods. The important thing to understand in the process is why the specific product is developed and what are the methods and tools that can be applied in the process. The teachers in Aalto highlighted that in their interdisciplinary courses it is important to connect the process of product development to other branches of science so that the content knowledge taught in the course is relevant to all of the students coming from different faculties.

3.3 Pedagogical knowledge

According to data analysis, teachers utilised different teaching methods, such as project based learning and flipped learning. Each of the interviewed teachers used lecturing as a teaching method because they had experienced that students need an introduction to a certain topic before it is approached through practical exercises. If the teaching started straight away with a problem-solving exercise, the teachers felt that the students become confused and had negative attitudes towards the teaching methods being used.

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We do a lot of interactive lectures, of course you have to go through the topic and then we do exercises but sometimes also in reverse. First we practice and then the students bump into a problem and we go through the theory both inductive and deductive way. (Interviewee 6.)

Nevertheless, some teachers wanted to exploit the use of experiential and problem-based learning because the students are likely to face corresponding tasks in working life. The connecting factor behind the teaching methods being used was experiential learning which was executed with different projects and practical work. The teachers understood practical approach and learning-by-doing vital and wanted to give the students tools for creative product development and critical thinking. Based on teachers' experience, the reasons behind the used methods were active and directional interaction, working life orientation and knowledge and feedback of teaching. Several teachers wanted to make the face to face situation inspiring for the students and carry out discussion and use different methods to keep the level of energy high. All of the teachers mentioned working life and industry being an important factor when planning teaching and projects. In addition, the knowledge gained from research and through student feedback had an impact on teachers' understanding because it offered new ideas to teaching and a way to take notice of the methods that did not promote learning.

Teaching environments were mainly limited to university facilities, so traditional lecturing and classrooms were still the most popular teaching environments. The options being limited, the teachers picked out the most suitable environment for teaching a certain topic and made an effort to make the teaching situation meaningful and inspiring, even though the environment would not be most suitable for innovative product development teaching.

All of the interviewed teachers thought that the design of teaching starts with planning the learning outcomes of the courses. The teachers create the learning outcomes for their courses, which defines the ways in which course contents are taught. Teachers decide what are the goals in the course and the best ways to achieve these goals.

Exploiting educational technology is a necessity in a changing higher education because it can offer new ways of effective learning. It also provides means for both students and teachers to develop one's professionalism. For the most part, the interviewed teachers had a positive attitude towards technology and understood it as a tool among others. One of the teachers mentioned, that technology is a current topic to which you can easily get development funding because there are a lot of excitement and ideas around it. All of the teachers had negative experiences about the university's obligatory online platforms, for example Moodle and WebCourses. They gave criticism about the online platforms being clumsy and difficult to use, which is why their usage is insignificant.

Technology should reduce the work load and make things easier - and if you think about the time when I have been using overhead projectors, technology hasn't reduced the work. (Interviewee 7.)

The teachers thought that technology itself should not be a target, but a tool to serve learning, produce surplus value and reduce the workload of teachers. The technology has a lot of potential, which is not exploited because the teachers do not have the time or resources to develop and take a closer look at the technological possibilities.

4 CONCLUSIONS AND DISCUSSION

This paper aimed at exploring the product development teachers' perceptions of their pedagogical content knowledge in two Finnish technical universities. The results are summarized here according to the planning, implementation, and evaluation activities of teaching. The interviewed teachers had different opinions about the wanted learning outcomes which affected the planning of their teaching. All of the teachers took course learning outcomes and working life into consideration and stated that they were the starting point for planning. What is striking here is that only two teachers took curricular knowledge into account at the time of planning. Accordingly, merely two out of seven interviewed teachers participated in curriculum design which had an effect on their teaching and guided their knowledge of important learning outcomes.

In the execution of teaching, teaching methods and environments were chosen based on the fact of how well they supported the course learning outcomes and course content knowledge. The teachers had different perceptions on content knowledge based on the topics of their courses. Main content

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knowledge included the process of product development with its different phases and methods, as well as different software programs, such as 3D-modeling and the use of CAD-tool. Teachers must not only be capable of defining for their students the accepted truths in a domain, but also to explain why a certain matter is worth knowing and how it relates to other propositions, both within and without the discipline (Shulman, 1986). Despite the fact that different ideas about the content knowledge can cause differences in teachers' views about teaching, they can also give the students versatile skills and knowledge to use in professional settings.

All of the teachers used diverse teaching methods. They wanted to carry out active and conversational teaching and to give students authentic projects from the industry, which served the idea of experiential and project-based learning. Teachers wanted to make the learning situation inspiring with various teaching methods, because the teaching environments were not always ideal as they were mostly limited to traditional university lecture rooms and classrooms. Teachers' knowledge of students and their understandings and beliefs had an impact on the implementation of teaching. The teachers at TUT stated that the first-year students have poor skills when starting the product development studies whereas the teachers from Aalto University understood that even the first-year students already have decent skills and some experience. The students' different beliefs and possible misunderstandings emerged during the courses, which is why the teachers had to spontaneously revise their teaching. Development of educational technology could offer new teaching methods and online learning environments that can be exploited in product development teaching.

Teachers used different evaluation and assessment methods in evaluating the students. Teachers saw the problematic nature of evaluation and were hoping to be able to assess the student as an individual learner. New ways of evaluation are needed for the teachers to be able to evaluate the learning process of individual students. This may be something that innovative educational technology tools can make possible. Student feedback and comments from alumna and industry gave the teachers the opportunity to assess their teaching and an opportunity to improve their pedagogical content knowledge.

In focusing on the components of pedagogical content knowledge of product development teachers, this paper offers only one, but significant approach to the discussion related to professional expertise and professionalism in higher education settings. In their conference presentation, Juuti and Rättyä (2015) highlight that the higher education teachers themselves need to have the skills and knowledge of the researcher, project manager, facilitator and academic writer in order to teach those skills to their students. For example, the researcher role requires that the teacher has an expertise and experience in terms of research methods, theories, concepts, research ethics, database searches, etc., like most of the product development teachers participating in this study have. An ongoing survey research conducted at the Laboratory of Mechanical Engineering and Industrial Systems focuses on exploring the knowledge, skills, attitudes and future competence needs of World Class Design Practitioners (WCDP) from industrial point of view. Once the results are available, it would be interesting to analyse further how the skills and competencies defined by the industry could be included in the curriculum and how they could be taught to students.

The processes of globalization and global competition have been reshaping the higher education sector over the past few decades. Whether deliberately or not, higher education institutions are becoming increasingly linked across borders in a various ways, which in turn produces competition within the global higher education landscape. (Bagley and Portnoi, 2016.) We think that an adequate and up-to-date pedagogical content knowledge of higher education teachers is an important asset in the competitive higher education environment. In order to survive in the face of intense competition, the teachers' knowledge base must be under continous processes of reflection and improvement.

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