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Article title: **Teacher Beliefs Regarding Learning, Pedagogy, and the Use of Technology in Higher Education**

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Teacher Beliefs Regarding Learning, Pedagogy, and the Use of Technology in Higher Education

This study examines university teachers' beliefs about the role of technology in achieving the pedagogical aims of learning within teaching development initiatives at a Finnish university. The initiatives targeted technology adoption in teaching and learning and were enhanced within teacher groups, with support from a university level network program. Thematic interviews were conducted with the members of 11 initiative groups, covering 18 teachers from various disciplines. The qualitative content analysis revealed diverse belief groups. Technology was perceived as a tool for: the promotion of self-paced studying without explicit learning aims; active and interactive learning; integrative learning with continuous assessment; and meaningful learning. The study highlights the need for a more systematic explication of teacher beliefs and the acknowledgment of alternative ways of thinking in teacher developmental programs.

Keywords: teacher beliefs, pedagogy, technology, and higher education.

The utilization of information and communication technology (ICT) in higher education is seen both as a pedagogical challenge and an opportunity for promoting learning. Along with digitalization, ubiquitous access to vast amounts of information may lead to multi-tasking with information resources, an increased cognitive load, and the surface-level processing of information (Carr, 2010). Challenges have also been found in relation to searching and critically assessing information sources (Kiili, 2012). Moreover, technology-enhanced environments can support individual thinking and collaborative knowledge building and, hence, play a crucial role in renewing teaching and learning practices (Häkkinen & Hämäläinen, 2012; Roschelle, 2013). Digitalization has also made it possible to measure and

monitor students' learning progress and to design interventions aimed at deepening learning (Siemens & Baker, 2012).

Meanwhile, the existing literature presents opposing views regarding the possibilities of technology as support of high-quality learning, the foci and purposes of implementing technological interventions in higher education have been regarded as problematic. Based on their literature review, Kirkwood and Price (2014) summarize that the adoption of technology within higher education has focused on replicating or supplementing existing teaching. In addition, many of the interventions have lacked the explication of educational rationale, for example, how these interventions facilitate learning (Kirkwood & Price, 2014). Thus, there is a need for research that focuses on teachers' pedagogical thinking in relation to integrating ICT into their teaching. In particular, studies should target teachers' views on teaching, learning and the use of technology in their subjects, and how these views interrelate.

ICT integration in teaching and learning has been broadly analyzed from the perspectives of teachers' competences. For example, the Technological Pedagogical Content Knowledge (TPACK) framework (Koehler & Mishra, 2009) has been applied as an analytical tool to understand the range of knowledge and skills needed in the purposeful integration of technology into education. A model for assessing the intertwined competences of pedagogy and technology has also been developed to locate the various competence levels of teachers (Lin, Wang, & Lin, 2012). Furthermore, various kinds of internal and external barriers have been found to influence teachers' ICT interventions (Ertmer, 2005a). External barriers refer to a lack of resources such as devices, time, training, and support; internal barriers are teachers' pedagogical beliefs, attitudes, personal appreciation, and values. Although teachers have extensive knowledge and external resources to adopt ICT in teaching, internal factors play a crucial role in the utilization of technology for pedagogical purposes (Ertmer, 2005a; Kim, Kim, Lee, Spector, & DeMeester, 2013; Mama & Hennessy, 2013). Consequently,

Prestidge (2012) has called for a deeper understanding of these complex intrinsic factors regarding teacher beliefs and their relation to ICT implementation, further utilizing this knowledge in supporting teachers to implement the kinds of pedagogical changes indicated in the current educational reform agenda.

Teacher Beliefs in Shaping Pedagogical-Technological Practices

The concept of teacher beliefs refers to multiple belief systems encompassing knowledge construction, learning, and teaching, or examination of these from a specific viewpoint, for example, pedagogical ideologies, values, and attitudes regarding instructional strategies (see Kim et al., 2013). The term “teacher beliefs” is also used within the broad strand of research on teachers’ conceptions of and approaches to teaching (c.f. Norton, Richardson, Hartley, Newstead, & Mayes, 2005). While beliefs regarding learning and teaching have typically been analyzed from the perspectives of teacher-centeredness and learner-centeredness (c.f. Lim & Chai, 2008; Liu, 2011), the concepts of pedagogical beliefs (e.g., Ertmer, 2005b) and educational beliefs (e.g., Northcore, 2009) have also been used. Furthermore, examining beliefs in relation to technology integration in teaching has also given rise to the use of the value beliefs concept (e.g., Mama & Hennessy, 2013; Ottenbreit-Leftwich, Glazewski, Newby, & Ertmer, 2010). Value beliefs refer to judgement regarding the importance of an approach or tool in achieving a certain goal. For example, teachers might value technology as a relevant tool in achieving certain pedagogical aims of learning (Ottenbreit-Leftwich et al., 2010).

Teacher beliefs are often supported by subjective experience rather than by empirical data or evidence-based knowledge (Pajares, 1992). Like any other belief, they are thought of as psychologically held understandings, premises, or propositions about the world that a person perceives to be true (Richardson, 1996). In educational settings, Haney, Czerniak, and

Lumpe (2003) define beliefs as “one’s convictions, philosophy, tenets, or opinions about teaching and learning” (p. 367). As such, teacher beliefs may include subjective theories about how students learn, what a teacher should or should not do, and which instructional strategies work effectively.

Teacher beliefs about learning and teaching have been found to shape teachers’ practices (Song & Looi, 2012), for example, the choice of priorities for teaching arrangements and the ways in which teachers want to facilitate learning (Ertmer, 2005b; Kagan, 1992). Several studies conclude that teachers with teacher-centered beliefs prefer traditional teaching methods like knowledge transmission, whereas teachers with learner-centered beliefs choose activating methods that support learners in taking responsibility for their own learning, enabling them to construct knowledge and learn together (e.g., Meirink, Meijer, Verloop, & Bergan, 2009; Norton et al., 2005). The consistency between teacher beliefs and teaching practices become obvious when technology is utilized in teaching; teachers utilize the same technological tools differently based on their beliefs about effective ways of teaching (Kim et al., 2013). Inconsistencies between reported beliefs and actual practices (Judson, 2006; Chen, 2008) or intentions (Norton et al., 2005) have been also found. These inconsistencies have been explained with contextual factors, for example, curricular requirements or social pressures (Ertmer, 2005b).

Moreover, teachers are likely to make choices concerning the pedagogical use of technology based on their appreciation of technology: positive stances toward ICT encourage teachers to adopt ICT in teaching more often than negative stances (Ertmer, Ottenbreit-Leftwich, Sadik, Sendurur, & Sendurur, 2012; Mama & Hennessy, 2013). In addition, teachers’ sense of agency regarding ICT use, together with their pedagogical beliefs, has been found to emerge in various teacher stances toward ICT integration. For example, contended traditionalists do not typically recognize the need to change the prevailing education culture

and feel extrinsically pressured to use ICT in their teaching. In contrast, creative adapters are perceived as curriculum renewers, focusing on meaningful learning; they experienced themselves as strong agents in ICT use (Donnelly, McGarr, & O'Reilly, 2011).

Even though teacher beliefs are perceived as being difficult to change (e.g., Pajares, 1992), Scott (2016) found that changes in teacher beliefs and pedagogical practices occur via dynamic processes. Critically examining one's own beliefs as well as observing and evaluating alternative beliefs in dialogue with colleagues may facilitate change (Kagan, 1992; Scott, 2013). Furthermore, Ertmer and Ottenbreit-Leftwich (2010) conclude that teacher beliefs are best changed via support through developmental programs situated within the context of teachers' own curricular needs.

The Multidisciplinary Network Program

The study was conducted within a year-long multidisciplinary network program at the University of Jyväskylä, Finland. Nationally, the university is one of the largest research institutions, comprising seven faculties, about 2,500 employees and 15,000 students. Led by the vice head, the multidisciplinary network program was established in 2011 to support teachers in their teaching development work on a focused theme. Since 2014, the theme has been eEducation meaning that the program has aimed at facilitating pedagogically meaningful and flexible ways of using ICT for learning. Thus, it has invited teacher groups annually from various subjects to join the network, share their group-specific ideas on ICT intervention with other groups of subject teachers, and support each other in carrying out their initiatives. The final participants are selected onto the network based on applications, including the preliminary plans for the initiatives on how to integrate ICT into teaching and learning.

In the program, the teachers enhance their group-specific ICT initiatives in line with the university's strategy. However, a bottom-up policy with respect to teachers' expertise and autonomy direct the entire activity. The teacher groups can thus define themselves, within the context of their own curricular needs, the developmental aims in relation to ICT-supported teaching and learning. As the teachers promote their initiatives as subject groups, they are involved in analyzing common aims and ways of proceeding from the initial stage of the initiatives. The groups are supported in their initiatives by frequent network meetings, needs-based guidance, and expert lectures on topics related to learning, teaching and ICT adoption in higher education. During the year-long participation in the network activities, the teacher groups are supposed to implement their ICT initiatives and change their teaching practices. After the network program, teaching development initiatives are expected to continue and to take root in the teachers' departments.

The network program has similar features to a faculty learning community (FLC) (Cox, 2004). Like an FLC, teachers from different disciplines engage in lengthy, structured and collaborative working with increasing openness, reflection and an awareness of the complexity of aspects of teaching. Furthermore, the encouragement of teachers in experimental action and inspiring and empowering community building among teaching staff are intrinsic to the program. Even though the participants get theoretical knowledge on teaching and learning during the program, analysis of their beliefs are not core aspects of the activities. Program attendance offers collective support to implement new teaching initiatives and status value for the teachers as individuals and the units they represent.

Research Objectives and Questions

The present study aims to obtain knowledge about university teachers' pedagogical beliefs and value beliefs regarding ICT use in higher education. We are especially interested in the

relationship between teachers' pedagogical aims, the practices they value as important in promoting learning, and their beliefs regarding ICT use for that purpose. We also seek to capture teachers' perceptions of ICT use in higher education – manifested as, for example, their expressed prospects, enthusiasm, suspects, stipulations, or constraints – in understanding teachers' various choices in relation to ICT use in education. Furthermore, valuable knowledge gleaned from teachers' pedagogical thinking in relation to ICT will enable the further development of pedagogy at the university level. Thus, the following research questions are addressed:

1. What kinds of beliefs do university teachers have regarding the role of technology in achieving the pedagogical aims of learning within their teaching development initiatives?
 - a. What do they regard as the essential elements of student learning?
 - b. What kind of pedagogy do they perceive as important in achieving the learning goals stated in their initiatives?
 - c. What role do they perceive technology to have in achieving pedagogical aims?
 - d. How do they describe the potential use of technology in their subject/teaching?

Methodology

Participants and data Collection

The study targeted university teacher groups who participated the network program in 2014. The teachers represented various disciplines/subjects: natural sciences (e.g., biological and environmental science), social sciences (e.g., philosophy), humanities (e.g., music), education

(e.g., teacher education), economics (e.g., management and leadership), information technology (e.g., computer science), and sports and health sciences (e.g., sport pedagogy).

Thematic interviews averaging one hour in length were conducted with representatives of each teacher group (11), with the number of participants varying from one to three teachers in each interview (there were 18 teachers in total). The interviews took place in the middle of the program, following the groups' advancement of their initiatives and the concrete steps involved. The themes of the interviews were linked to the initiative enhanced by each teacher group: 1) the starting points and needs of the present initiative; 2) the central goals and elements of student learning valued by the teachers; 3) the pedagogical aims of the initiative and the reasoning behind them; 4) the role of technology, including the benefits and challenges of their planned pedagogical implementation; and 5) teachers' views on technology use in their subject teaching. The interviewees received the interview themes beforehand and were able to prepare for the interview by discussing the themes with the colleagues working on the same initiative, even though only one person could attend the interview.

Analysis

Recently, critique has been presented toward the theory-driven approach on analyzing teacher beliefs, particularly in relation to ICT integration. Ottenbreit-Leftwich et al. (2010) state that the typical categorization of teacher beliefs according to the duality of teacher-centeredness and student-centeredness may simplify or even hamper interpretations of reality.

Accordingly, the present study seeks to explore teachers' definitions in relation to learning, pedagogy, and ICT use without classifying them into pre-existing researcher-derived categorizations or preconceptions.

Qualitative content analysis (Patton, 2015) was conducted in an inductive way to the audio recorded and transcribed interview data. The data analysis can be described as an iterative and progressive process that included several rounds of reading and analysis and repeated verifications of the interpretations by comparing them to the original transcriptions. It began with a data-driven thematic analysis (cf. Braun & Clarke, 2006) of the entire dataset, attempting to capture a variety of aspects relating to the various research questions, and continued with a case-oriented strategy that considered factors relating to the various research questions at a case level within the initiative (see Miles & Huberman, 1994).

At the very first stage of the analysis, the entire text, 302 pages, was intensively read through while marking extracts regarding each research question. This marking was necessary to better manage the substantial amount of “raw” data, which also contained information on topics beyond the research questions of this study, for example, feedback for the program organizers. After marking the relevant extracts, a new reading round was executed, summarizing the marked extracts. During the summarization, notes for initial codes were generated. As a result of the summarization and note coding, we captured a variety of standpoints related to learning, pedagogy, and technology use. This round of analysis also produced various kinds of prerequisites raised by the interviewees regarding the use of technology in their subject teaching.

During the summarization, the extracts were numbered according to the interviews. Numbering helped with further analysis, illustrating links between views on learning, pedagogy, and the use of technology within the same initiative and, thus, capturing answers to the main research question. We continued the analysis by juxtaposing the views obtained regarding the various sub-questions of the research within each initiative. We aimed to understand these findings from the standpoint of the participants and within the contexts in which the teachers expressed their views.

In the final stage of the analysis, we compared the views and found similar features among some of the initiatives with regard to the goals of development and pedagogical-technological thinking. The analysis then proceeded into a more abstract grouping. The belief groups generated at the final stage of the analysis were found after comparing the similarities and differences between the various interconnected views and condensing the typical features of each group. The analysis was conducted in close collaboration among the authors, and the summarizations and grouping were based on joint discussions.

Results

Four main belief groups were identified among the eleven initiatives. These belief groups differed from each other in terms of what was viewed as the most essential element of learning (or studying), what kind of pedagogy was perceived as supportive of learning, and how the role of technology was perceived in achieving the various kinds of pedagogical aims in the initiatives. Table 1 summarizes the main viewpoints. The belief groups were named according to the most valued pedagogical use of technology: A) a pivotal tool for self-paced studying; B) an additional tool for active and interactive learning; C) a tool designed for the integration and assessment of learning; and D) a tool for changing the learning culture. Each belief group will be further elaborated in the next chapters. One general finding across the initiatives was that the teachers who attended the interviews as pairs or groups, and thus represented the same initiative in the program, presented expectedly parallel and supportive views among one another. While describing their views, the interviewees in the individual sessions tended to use term “we” with referring to the whole subject group. In this respect, the belief groups found in this study represent more or less shared ways of thinking for the teachers inside the initiatives rather than the personal beliefs of individual teachers.

Table 1. Teacher beliefs about learning, pedagogy, and the role of technology in education

BELIEF GROUP	Beliefs about learning	Beliefs about pedagogy	Beliefs about the role of technology in education
<p>A) A pivotal tool for self-paced studying</p> <p>(three teachers) two initiatives</p>	<p>Loose or missing connection with learning aims</p> <p>Practical needs and aims in the development of teaching, for example, flexible studying, graduation</p>	<p>Giving students more responsibility for their own learning; need-based guidance during studying</p> <p>Construction of self-study courses that are flexible in terms of time and space; focus on the attractive, inspiring, and illustrative nature of the courses</p>	<p>Pivotal for enabling self-paced studying and learning via online courses</p> <p>Offers opportunities for multiple representations in the courses</p> <p>Technology enables face-to-face teaching resources for the differentiation of teaching</p>
<p>B) An additional tool for active and interactive learning</p> <p>(five teachers) three initiatives</p>	<p>Internalized knowledge; a holistic understanding of phenomena</p> <p>Intertwining of mental activities, including critical thinking and dialog with others</p>	<p>Two views:</p> <p>a) Pedagogical freedom for lecturers to define the best practices</p> <p>b) Teaching processes (including curriculum and study materials) should be systematically developed and renewed from the viewpoint of student learning.</p> <p>Primacy of face-to-face interaction</p>	<p>One tool among others when promoting active and participative learning; not at the core of pedagogy</p> <p>Course administration and coordination utilizing platforms and applications supported by the university</p>
<p>C) A tool designed for the integration and assessment of learning</p> <p>(six teachers) three initiatives</p>	<p>The development of competences:</p> <p>Understanding the interconnection between different types of knowledge (e.g., theoretical and practical)</p> <p>Acquiring skills for employing knowledge</p> <p>Consciousness of one's own learning processes</p>	<p>Temporal integration of various knowledge types</p> <p>Explication of learning processes</p> <p>Continuing and multiple assessment of learning</p>	<p>Tool for the integration of various course contents and the focused assessment of learning</p> <p>Use of platform for pedagogical purposes; flexible in terms of various pedagogical approaches</p>
<p>D) A tool for changing the learning culture</p> <p>(four teachers) three initiatives</p>	<p>Learner autonomy</p> <p>Meaningful learning experiences</p> <p>Social interaction</p> <p>Authentic, informal, and ubiquitous nature of learning</p>	<p>Radical change in teaching and learning practices, for example, new pilot spaces for teaching and learning</p> <p>Support students in constructing personal learning environments</p> <p>Inputs for active participation and becoming interested in the subject matter</p>	<p>An integral part of learning</p> <p>A tool for changing the learning culture</p> <p>Emphasis on the use of modern technology</p>

Belief Group A: A Pivotal Tool for Self-Paced Studying

In this study, Belief Group A was found to be exceptional compared to the other groups, in that, teaching development was not explicitly considered in terms of student learning. The development of teaching was primarily based on the practical need to offer students more flexible and inspiring study opportunities such as those described in the next two interviews:

It seems to be that, in practice, students' opportunities to graduate within the prescribed time limit are a problem. If you fall ill or something else happens, you easily fall by the wayside ... for the departments, it's a question of money.

And, "We have tried to diversify teaching. However, in the lecture hall, there are limited opportunities for magic tricks." Practical needs regarding development were related primarily to the department's aim of fostering efficiency. In this regard, the teachers mentioned, for example, the need for the department to ensure the graduation of students, foster the reputation of the department as flexible, and draw students toward studying in the field.

Despite the loose or missing connection between the development and learning aims, the teachers presented general pedagogical views that they perceived as valuable. One such view was that students should take greater responsibility for their own learning; however, guidance should be offered to students upon request. This kind of thinking was based on the idea that a substantial number of students can study at their own pace when they are offered high-quality and inspiring study materials and technological tools or applications suitable for the subject studies. In order to enhance this kind of pedagogy, the teachers believed in the development of self-paced online courses that include multiple representations with illustrative, animating, and diverse course materials, for example, music videos, interviews, and visualizations. A

series of traditional face-to-face lectures could be replaced with another kind of teaching, for example, short video clips.

For the representatives of Group A, technology played an essential role, particularly in enabling self-paced studying and learning and offering tools with which the teachers could diversify the study material. The following extract reveals that opportunities in the use of technology for educational purposes have increased: “Before, the systems were not appropriate for our subject teaching. That is why we stuck to traditional teaching. In other words, there were no pedagogically meaningful technological tools. Now, we have them.” However, while the teachers in Group A considered the use of technology from the point of view of their own work, two reasons for choosing the use or non-use of technology were presented. On one hand, technology was seen as a means to being released from the challenges of teaching mass courses and allocating the proper teaching resources to the differentiation of teaching. As one teacher said, “Face-to-face teaching is difficult to implement successfully because of the heterogeneity of the students. Increasing the use of online courses provides better resources for small-group teaching.” On the other hand, because of the meaningfulness of the work, some teachers would not have wanted to abandon traditional lecturing. For example, one participant mentioned the human need for face-to-face interaction, saying “I don’t believe that online courses replace lectures entirely. Every so often, you must also get together with people.” Another recalled the large workload involved in organizing courses, stating that “The administration of online courses is multiphase and laborious. Beginners don’t often know that.”

Belief Group B: An Additional Tool for Active and Interactive Learning

In Belief Group B, the teachers emphasized the construction of internalized knowledge and a holistic understanding of phenomena as essential learning aims. In order to achieve these

aims, students' mental efforts, such as active reading, working on tasks, critical thinking, and interaction with others, were seen as central elements of learning. Within this belief group, however, the views of learning were presented in two contexts that seemed to coincide with the teachers' views on pedagogy. Within the first initiative, the aims and elements of learning were seen as fundamental starting points for all teaching in the discipline. According to one interviewee:

Learning trivia is not the point. Rather, students should be developing the skills they need to understand the world. The tradition of the discipline is the development of critical thinking, which is learned in dialogue, that is, through discussion and participation. Things can be learned only by processing them within one's own mind. Knowing [understanding] presumes critical thinking, which includes considering the various interests behind knowledge.

Conversely, within the other two initiatives, the emphasis on holistic understanding and internalized knowledge in learning arose specifically from concerns regarding present higher education practices, which were perceived as overly fragmented and passive for students. For example, one teacher characterized the aims and prerequisites for learning in her study program as follows:

It's important that students understand the content unities instead of details and... at the same time, construct a personal relationship with the contents. The problem with our program is that we may each offer separate courses with the same types of content... The aim is that a student would obtain a more holistic conception of our [field-specific] competences in these various courses.

Within the first initiative presented above, the central elements of learning were argued to be based on the nature of the discipline and its method of producing knowledge. Accordingly, pedagogy was not seen in the context of commonly defined practices; rather, the pedagogical freedom of teachers to choose the ways in which to facilitate students' learning in a given context was emphasized. As the interviewee observed, "Learning must be seriously considered as a process of the mind... that requires stimulus through dialogue. However, each teacher must define him-/herself and his/her own pedagogical thinking about how students' thinking skills are best developed." Within the other two initiatives, the teachers believed that broader curricular development across separate courses at the program level was needed. This included the re-consideration of all teaching practices from the point of view of student learning, for example, working on maintaining coherent content across courses, utilizing the knowledge gained from the students' pre-tasks among teachers of various courses, developing study materials while taking account of the students' various starting levels, and increasing multi-fold interactions in teaching.

Despite the varying pedagogical beliefs between the teachers from the various initiatives, the value beliefs concerning the role of technology in education were similar in Belief Group B. Technology was perceived as an optional tool for use in promoting active and participative learning. As one teacher stated, "It's one tool among others." According to this group, technology does not have a primary role in pedagogy. Technology was intended for use in administering, coordinating, and orchestrating the courses offered. The teachers described how they would, for example, deliver various kinds of material to students, implement group discussions, provide feedback about learning tasks, and gather course feedback from students by utilizing the online environments used at the university.

The following four extracts show that even though the modernization of teaching was seen as an explicit aim of teaching development, the teachers' perceptions toward technology

use in education were cautious or even skeptical in Belief Group B. In the first extract, the interviewee highlighted content-driven development and perceived the role of technology as conditional.

Having study material online inevitably changes the amount and quality of teaching. It forces the student to take more responsibility for his/her own learning and increases study motivation. However, first, we consider the content. After that, we consider the possibilities for using technology to support learning content.

In the following two extracts, the interviewees brought out more clearly the limited possibilities for using technology to support learning. They both emphasized the primacy of face-to face interaction in teaching and learning. “Digital skills are important to students too. They should be prepared to use ICT. However, you can’t learn thinking skills from the Internet. Discussion skills must first be learned face to face.” Moreover:

The implementation of technology should not proceed at the expense of students’ conceptual thinking. The problem involved in the use of technology is that you can’t necessarily catch students’ misunderstandings, nor are the students able to realize the core of the matter... Face-to-face meetings are the starting point of group work; discussion skills must be learned first. After that, you can use technology in group work...We see technology as a man hired to be utilized.

Furthermore, some teachers also explained the non-use of technology via teachers’ and/or students’ lack of skill in utilizing technology: “The students’ insufficient information acquisition and processing skills constrain the use of technology in teaching. We, as teachers,

will also use technological tools with which we have experience. We are open to new ideas about utilizing technology.”

Belief Group C: A Tool Designed for the Integration and Assessment of Learning

The teachers in Belief Group C typically mentioned the need to develop students’ competences by integrating theoretical and practical knowledge and employing content knowledge. For example, one teacher highlighted the intertwining of content knowledge and generic skills:

A student may have good content knowledge and be clever when arguing... and be capable in all sorts of situations, but if he/she has a contemptuous attitude toward the study group, his/her skills and competences will be of little value. The interactional competence required of our students includes broad varieties of knowledge as well as ethics, skills, attitudes, motivations, and many rules. However, somehow, we should ... get together to construct an idea about what the future expertise in this field should be and what roles various kinds of knowledge play... such as discipline-specific content knowledge, group-work skills, interaction, and language.

From the point of view of contextual learning, the representatives of this belief group emphasized an understanding of the connection between different types of knowledge (e.g., theoretical and practical) and of the challenges involved in employing content knowledge as important learning aims. They also perceived that becoming conscious of one’s own learning process, particularly the problematic nature of learning, was necessary to deepen learning. Thus, the following three pedagogical means, in which technology was perceived as playing a central role, can be commonly found among the initiatives. First, the teachers believed that

theoretical knowledge and practical exercises must be temporally integrated. With regard to the use of technology in this integration, one teacher stated that “Technology is just a tool to help in integrating teaching materials and practical tasks so that both theory and practice are considered at the same time. This will help students to connect things.” Second, the teachers felt that learning processes must be made explicit for both the learner and the teacher. This is a way of identifying the challenges involved in learning and becoming conscious of the quality of learning. Regarding technology, the teachers perceived that with the help of applications, students’ deeper working processes can be better analyzed and assessed by both the teacher and the students. The third pedagogical view shared among the representatives of Group C concerned assessment, which the teachers viewed as a determinant of learning. Consequently, one interviewee stated:

Assessment is always easily passed over...however, assessment directs action. If we assess, we can’t assess only the outcomes. We must also assess what we see while the student is working... during the process, what they learn, what they discuss while working... I wish that we could document these things and the learning processes that we don’t see in face-to-face lecturing situations or in the final study attainments.

All interviewees in this group felt that assessment ought to be continuously developed in the learning process. Especially in terms of developing the forms of assessment, the teachers highlighted the advantages of technology – that it was believed to offer multiple tools for teacher-, peer-, and self-assessment.

A distinctive feature of this group compared to the other belief groups was that technologies were considered to be tools that can be modified or designed for specific pedagogical uses based on pre-considered pedagogical ideas. According to one interviewee:

The entire design must be considered twice so that it will be constructed based on our pedagogical ideas. If we found suitable platforms for the various study stages of the course, for example, the stage of preparing a presentation, which starts with writing an abstract, we would need to find a platform on which one can structure a written production and obtain feedback. In the presentation stage, the presentations would be videotaped, and we should find a suitable platform for that purpose. We would then find a place to reflect. This could be a third platform. The point is finding these platforms and developing study processes around them.

However, depending on the teacher's pedagogical thinking, technological tools could be based on a structured way of working, with the guidance of expert knowledge as Extract A reveals, or on self-directed and student-centered learning, with support for interaction among students or between students and teachers, as in Extract B. "Pedagogy constructed with technological tools will guide the students to recognize the problematics of learning. It can also be used for assessment, including self-assessment" (Extract A). "It will primarily be used for independent and self-paced learning and for explicating this process. However, it also renders opportunities to follow students' work and offer real-time, needs-based support." (Extract B).

In addition, in Belief Group C, the teachers clearly emphasized the need to work on becoming conscious of pedagogical purposes when choosing, valuing, or using technology in education. This was manifested in the following extract:

I think that technology is so strongly present in our lives that we must analyze what kinds of tools are best suited to specific purposes and stages of the process... this need exists from the point of view of both teachers and students.

Belief Group D: A Tool for Changing the Learning Culture

In Belief Group D, the aims of learning were typically related to professional learning or learning various skills such as musical or motoric skills. In all three initiatives assigned to this group, the following aspects were pointed out as essential for learning: 1) learners' autonomy in taking control of and managing their own learning; 2) meaningful learning experiences through action; 3) social interaction; and 4) authenticity in observing the informal and ubiquitous nature of learning. The teachers also highlighted the importance of recognizing learners' personal needs and interests as this was perceived as creating the prerequisites for the purposeful learning described above. For example, one teacher described the situation as follows: "The reasons why someone engages or does not engage are personal. Our task as teachers is to find ways to support the students' interests... and to consider what makes the students switch on." Another teacher said, "Everything starts from the learner's own needs and stage of development. After that, the learner him-/herself has a chance to influence how his/her competence will be developed."

Pedagogy includes ideas about radically changing existing teaching and study practices in which technology plays a central role. This means, for example, that new spaces for teaching and learning will be piloted with the aim of breaking down the boundaries between formal and informal learning; various inputs for active participation and becoming interested in the subject matter will be offered; students will be supported in constructing their own personal learning environments with meaningful learning processes; and flexible digital tools for interactive guidance will be used. For example, one teacher described the pedagogical ideas of her group's initiatives as follows:

This means that above all... everyone collects, in accordance with his/her own needs, [discipline-specific content] knowledge and skills in a personal learning environment... the implementation of the PLE idea offers a chance for everyone to have his/her own technological learning environment on a personal device... The idea is that we offer professional online tools in which the content is included in tools themselves.

The representatives of Group D perceived technology in a positive way and as inseparable from living and learning. It was simultaneously viewed as a context and a tool for learning. As one teacher described, "There are no options or choices. It [technology] is everywhere and a natural part of living. It opens up, for example, through gamification, totally new possibilities for learning." Modern technologies, for example, iPads and smartphones, were seen as tools for use in changing the learning culture into one that embraces authentic and ubiquitous learning. The teachers in this group were also willing to renew the present teaching and learning culture in universities by challenging the present methods of using technology in education. As one teacher described the aims of the initiative:

We try to find new ways of learning... and environments with the help of which it will be possible to change the cultural activities of educational institutes. The biggest challenge is to consider the additional value of technology when studying. It is not just a substitute for pen and paper. It should be the next step forward.

Discussion

Key Findings

This study contributes to improving the quality of teaching, and the findings are worth considering especially in the further development of ICT-integrated pedagogy at the

university level. First, the study showed that university teachers involved in active pedagogical development are not a homogenous group in terms of pedagogical thinking, even though they are supported in their initiatives by pedagogical support and network activities. The teachers considered pedagogical and technological development in view of the needs emerging as the most pressing in their subject areas. In some cases, the most pressing drivers for development were external – increasing efficiency and confirming the survival of subject teaching in the area. In other cases, the needs arose from concerns about students' learning or lack of learning aspects within the curriculum. In particular, the former drivers described above are disconcerting from the point of view of pedagogical development in higher education. If a teacher has experienced working under the external pressure of developmental circumstances, he or she may not be capable of long-term thinking about the purposes of education, and the expected change in pedagogy may not always occur (Ertmer, 2005b; Ertmer & Ottenbreit-Leftwich, 2010; Biesta, Priestley, & Robinson 2015).

In this study, we found diverse belief groups in terms of learning and pedagogical preferences in the development of teaching and how the role of technology was perceived in these initiatives. The development of teaching focused on promoting: a) self-paced studying without explicit learning aims; b) active and interactive learning; c) integrative learning with continuous assessment; and d) meaningful learning through authenticity and informality, including a deeper change in the learning culture. From these foci, the first one represents the practical view of the development in responding to the wider structural change, recognized as the massification of universities, and the need to find new modes of provision and delivery (see Tomlinson, 2015). The latter three foci represent varieties in terms of the theoretical principles of learning science (Bransford et al., 2006).

In terms of value beliefs concerning the role of technology in teaching and learning, all the teachers perceived technology as meaningful in their intended pedagogical

implementations. As the data were collected in the context of a developmental teaching program aimed at facilitating ICT in education, this result was not unexpected. However, the study found a variety of nuances in terms of teachers' value beliefs and perceptions toward ICT integration in education. The value of technology was defined both in relation to the intended pedagogy and to the teachers' own work. Despite the fact that all the teachers' aims involved some kind of modernization of teaching through technology, some of the teachers expressed quite cautious and conventional beliefs about ICT use in education, stating that it could replicate or supplement their existing teaching practices (see Kirkwood & Price, 2013). Other teachers' beliefs can be characterized as daring and transformative. In contrast to Kirkwood and Price's (2013) findings relating to the poor identification of educational needs in ICT interventions, our study revealed that beliefs about ICT use were most often related to various aims of learning. However, especially in Belief Groups A and B, the teachers expressed concerns over changes in the nature of their work and increasing workload as well as critical perceptions toward either the applicability of technological tools to their subject teaching or their own/their students' digital competences. Whereas in Belief Groups C and D the teachers perceived ICT integration in teaching as positive in nature, they also reflected active and strong agency to the use of ICT for educational purposes. These findings approach the contented traditionalist and creative adapter types identified by Donnelly, McGarr, and O'Reilly (2011).

Limitations and Suggestions for Future Research

The generalization of the results regarding the teachers' pedagogical thinking must be read with caution. The teachers reported their views on learning, pedagogy, and ICT integration in a certain context, one closely related to ongoing developmental work for their courses shared with the other subject teachers. As members of a development group, the teachers typically

expressed their views using plural, such as “we offer...” or “we must also assess...”, even in the individual interviews. Thus, the interviews may be more representative of collective views than individual views. Individual teachers may also have alternative beliefs that do not fit neatly into the belief groups found in this study. Beliefs may depend on the kinds of courses and contents one teaches and the kinds of opportunities and resources one perceives as available for the development of various courses. One weakness of this study is that we did not ask interviewees about the potential conflicts that teachers perceive inside the subject group regarding their pedagogical thinking.

Further, when considering the transferability of the results to other contexts, it is noteworthy that the target group of the present study represents a selected group of university teachers whose attitudes toward teaching development, including ICT integration in education, are fundamentally affirmative, despite the fact that some critical perceptions toward technology were found. The teachers voluntarily applied for the university’s multidisciplinary network program and expressed an interest in teaching development.

The present study contributes to the research on teachers’ pedagogical beliefs and their beliefs regarding ICT integration in education. As teachers are key actors in teaching development, there is a need for further study to obtain evidence regarding the influence of teacher beliefs on their use of technology in pedagogical practices. Follow-up data should be collected from the participating teachers by interviewing them and observing the pedagogical implementations in the courses they have developed. Further studies on teacher beliefs within a larger group of teachers in various departments will provide important information about social factors (ref. Ertmer, 2005b) that support or hinder the pedagogical development of study programs.

Implications for Practice

The results of the present study can be utilized for teacher development programs as a stimulus for reflection in terms of increasing awareness of the variety of beliefs among university teachers and in helping individual teachers analyze their own beliefs, perceive alternative ways of thinking, and direct the development of their teaching. By making core pedagogical ideas visible and sharing good practices, various groups will benefit from learning from each other. For example, it can be assumed that active pedagogy, continuous assessment, and meaningful learning experiences are strongly intertwined in an ideal learning environment. Some teachers would also benefit from more systematic pedagogic guidance toward arriving at developmental aims from a learning perspective. Training about the opportunities of ICT integration and support services in the adoption of ICT may empower those teachers who perceive their ICT skills as weak.

Along with the reflection on teacher beliefs and the sharing of ideas with other teachers in the developmental groups, there appears to be a need for a dialogue forum, such as learning café, in a university community. This kind of forum could offer both theoretical knowledge of learning and teaching, and possibilities to work on one's own pedagogical thinking against the theoretical knowledge.

This study points to a need for more open discussion on the long-term aims of university pedagogy. We need transparent definitions and reflection on the quality of learning and pedagogy in contemporary university teaching through the use of ICT. The particular aim is to think about the kind of learning we want to facilitate and with what kinds of pedagogical arrangements. Furthermore, the added value of integrating ICT in supporting learning needs to be considered.

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