University Teachers' Conceptions of Their Role as Developers of Technology-Rich Learning Environments

Kirsi Heinonen[1], Päivikki Jääskelä[2] and Hannakaisa Isomäki[3]
[1]*Faculty of Education and Psychology, University of Jyväskylä, PL 35, FI-40014, Jyväskylä, Finland*
[2]*Finnish Institute for Educational Research, University of Jyväskylä, Jyväskylä, Finland*
[3]*Faculty of Information Technology, University of Jyväskylä, Jyväskylä, Finland*

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Abstract: This phenomenographic study examines how a diverse group of university teachers conceptualised their role as developers of technology-rich learning environments at one university in Finland. The research findings illustrate a variety of conceptions. Five qualitatively different ways of understanding teachers' roles regarding the development of technology-rich learning environments were found: 1) innovator, 2) early adopter, 3) adaptive, 4) sceptic and 5) late adopter. In order to connect the whole set of interconnected roles to a theory of change, Everett Rogers' innovation diffusion theory was exploited in the last phase of analysis. Finally, hierarchically structured categories were created along with five evolutionary themes of expanding intensity. These findings can be used as an assessment tool among teachers to identify their role in educational reform.

1 INTRODUCTION

The rapid digitalisation of society has raised expectations regarding the use of modern information and communication technologies (ICT) in universities. Higher education policy calls for flexible possibilities for studying that do not require a student to be in a particular place at a given time and that are available throughout the whole year. In response to this call, new kinds of learning environments utilising ICT have been developed. In addition, researchers have introduced pedagogical arguments regarding the promotion of student learning (Kirschner et al., 2009). Various problems related to students' cognitive construction of knowledge, motivation to study and collaborative work have been pointed out by studies examining ICT-based learning environments (Häkkinen et al., 2010). Thus, there is demand for innovations relating to ICT use in higher education teaching and learning that support students' flexible studying as well as their competence development.

During the past 20 years, much research has focused on the use of ICT in teaching environments (e.g. Means et al., 1995; Kozma, 2003; Garrison and Kanuka, 2004; Häkkinen et al., 2017). Numerous pilot studies aiming to renew traditional teaching practices and construct technology-supported learning environments have been conducted (e.g. Cavus and Ibrahim, 2009; Hämäläinen et al., 2006; Chu et al., 2010). However, efforts concerning the adoption of technology in learning and teaching environments have not been sufficient (Beetham and Sharpe, 2013). One comparative study on the use of ICT in school education (Survey of schools 2013) reviewed the differences between countries, finding that some countries, such as Finland, lagged behind others in the EU. In addition, technology-enhanced learning experiments in higher education have not innovatively transformed the learning environments or pedagogy (Kirkwood and Price, 2006).

The successful use of digital technology depends not only on teachers' technical skills but also their perceptions, beliefs and attitudes related to ICT use in teaching and learning. These attributes lay the foundation for development of technology-rich learning environments and reflect the practical implications of teachers' work (Mama and Hennessy, 2013; Prestidge, 2012). Thus, it is important to gain knowledge about teachers' thoughts and conceptions regarding the use of technology in an educational context and their own work as well as the adoption and effective integration of technology in their teaching.

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The effects of university teachers' thoughts, beliefs and perceptions of their approaches to teaching in higher education contexts have received considerable attention (see e.g. Bowden and Marton, 2004, Hativa et al., 2001; Prosser et al., 1994; Prosser and Trigwell, 1997; Samuelowicz and Bain, 1992; Åkerlind 2004). Further research has extended the knowledge related to this phenomenon and reported findings on technology-rich learning environments by investigating the conceptions of the e-teaching among university teachers (González, 2012), teachers' perceptions of blended learning and teaching (Ellis et al., 2006) and approaches to teaching using virtual learning environments (Lameras et al., 2008). However, research has tended to focus on academic teachers' beliefs and conceptions of teaching or e-teaching rather than the conceptions of their own role as developers of higher education.

Thus, the following two research questions were defined:

1) How do university teachers perceive their role as developers of technology-rich learning environments?
2) What are university teachers' beliefs regarding the advantages and disadvantages of technology in higher education?

2 METHOD

The research method merges with the principles of phenomenography (Marton, 1981; Bowden, 1994; Marton and Booth, 1997; cf. Åkerlind, 2011). The central principles are second-order perspective, contextuality, intentionality, and the inspection of the essence of phenomena as collective habits of conceptualization (Isomäki 2002, pp. 58-60). In phenomenography, the second-order perspective defines the object of research: the investigation is oriented towards humans' thoughts or conceptions of the surrounding world, not the world itself. A conception forms the relation between an individual and the surrounding world.

In phenomenography, people's conceptions are not detachable, either from their context or from the task at hand (Marton, 1981). Intentionality of conceptions is seen with respect to two intertwined aspects, which signify the qualitative differences among conceptions and render conceptions contextual: the what- and how-aspects that reveal the meaning of a conception. The what aspect indicates the object of thought whereas the how aspect refers to the mental quality of the mental act (Marton and Booth 1997, 84).

In order to understand the whole mental act, we have to examine both the what and how aspects of a conception. The inspection of the essence of phenomena as collective habits of conceptualization mean that, on the one hand, conceptions include socially constructed features, and on the other hand, phenomenography aims at relating individual conceptions to a collective way of seeing phenomena (Engeström, 1986). By building this relation between individual and collective conceptions phenomenography discloses the essence of phenomena through the variation of the informants' different ways of seeing phenomena.

2.1 Context of the Study

The data were collected within the context of a multidisciplinary network project at the University of Jyväskylä, which is one of the largest research universities in Finland. The university has seven faculties, approximately 2,500 employees and approximately 15,000 students. This annual project brings together university teachers from various disciplines who are interested in developing focused teaching methods. The aim of the network is to develop pedagogically high-quality and technology-rich teaching and learning environments. The university teachers participating in this network project are required to design a pilot course and implement technology that is applicable to their teaching.

During 2016 nine pilot courses were executed throughout the University of Jyväskylä. A one-year project offered collective support for teachers to create shared developmental tasks. In addition, teachers are supported in their developmental work by, for example, expert lectures, technological and pedagogical guidance and research on the experiences of teachers and students during developmental interventions. After the project, the teachers are expected to disseminate the developed novel practices both in their own departments and the university as a whole.

The integration of technology in teaching and learning is an aim of the university. The teachers themselves define the final aims, technological tools and methods of this pedagogical development. Thus, the network project is based on a 'bottom-up' policy that values the teachers' expertise and autonomy.

2.2 Data Collection and Participants

The data were collected from reflective writings

from 14 university teachers who participated in the network project during 2016. Writing tasks were voluntary. The teachers represented four disciplines: the natural sciences, humanities, sport and health sciences and educational sciences. Four of the participants were male, and ten were female. The participants' age ranged from 26 and 58 years (missing data for two participants), and they had between 2 and 35 years of experience as university teachers (missing data for one participants).

The teachers worked on their writings when they first joined the network, when they still had not developed concrete steps to implement their initiatives. They were asked to reflect on their own attitudes regarding change in higher education as well as their role in teaching reform, especially related to the integration of ICT in teaching and learning.

2.3 Analysis

In phenomenographic research, common characteristics of different conceptions are defined during data analysis and are used to identify to an outcome space (Marton, 1986; 1994). The unit of our analysis was meaning, and thus, our interpretative framework was the structure of meaning (Marton and Booth, 1997). This means that in our iterative analysis (Åkerlind, 2003) we identified both what and how aspects of teachers' conceptions.

We first explored the data by reading the whole data several times in order to familiarise ourselves with it and compose an overview of all respondents' conceptions. During repeatedly reading, the similarities and differences in meanings were identified across data by comparing for what and how the respondents described their own role and their relation to technology in higher education. The purpose of this initial data analysis was to draft range of categories for the collective understanding (Åkerlind, 2012).

In the second phase of analysis, we considered the features of each category and ensured that all meanings in the data relevant to research questions could be identified and classified into the appropriate categories. At this stage, the features of the categories were compared to each other, and the variation of common themes concerning university teachers' ways of perceiving their roles in the development of technology-rich learning environments were recognised (Marton and Booth, 1997). These critical attributes of variation were utilised for developing a hierarchical structure in terms of the logical connections between the categories. Further, while reconsidering the categories identified by the data-driven iterative analysis in a more conceptual way, Everett Rogers' (2003) innovation diffusion theory was exploited by mirroring the logic of the categories to the theoretical view of technological diffusion. In this way hierarchically structured categories and five evolutionary themes of logically expanding intensity were created.

3 RESULTS

Five qualitatively different conceptions of teachers' role in the development of technology-rich learning environments were identified in this study: *innovator*, *early adopter*, *adaptive*, *sceptic* and *late adopter* (Table 1). Each category is described in detail below with a brief overview and relevant fragments of the written responses to show the essential aspects of each category. However, no single quotation can wholly represent a category. In the outcome space, the categories compose hierarchical structure of the roles in which the first category includes teachers with the strongest desire to participate in educational reform to integrate ICT into teaching and learning. These categories were compared in terms of five critical attributes of variation: *ICT use in digitalisation of teaching*, *relative advantage of learning technology*, *compatibility of learning technology*, *complexity of learning technology* and *observability of learning technology.*

3.1 Category A: Innovator

The university teachers in this category realised their role as innovators in the use of ICT for the digitalisation of university teaching. These university teachers are very attracted by digital tools, eager to try new technologies and characterise themselves as 'technofreaks'. For example:

> The learning technology was originally one of the biggest reasons why I became enthusiastic about teaching, and I'm still eager to reform learning technologies.

Innovator teachers understand the relative advantage of learning technology and believe that digital technologies are very compatible with university education. Teachers in this category are excited for new technologies and don't perceive digital technologies as complicated. They also believe that

Table 1: University Teachers' Conceptions of Their Role to Develop Technology-Rich Learning Environments.

ATTRIBUTES OF VARIATION	CATEGORIES: ROLES IN THE DEVELOPMENT OF TECHNOLOGY-RICH LEARNING ENVIRONMENTS				
	Category A: Innovator	Category B: Early adopter	Category C: Adaptive	Category D: Sceptic	Category E: Late adopter
ICT use in digitalisation of teaching	Technofreak	Visionary	Pragmatist	Conservative	Technophobic
Relative advantage of learning-technology	Very useful	Considerable	Adaptable	Necessary evil	Not useful
Compatibility of learning-technology	Very compatible	Enabling	Appropriate	Suspicious	Not compatible
Complexity of learning-technology	Excited	Curious to test	Cyclical	Desire for simple solutions	Avoid learning
Observability of learning-technology	Inspire others	Catalyst	Collectivist	Individualistic	Criticise users of learning-technology

learning technologies have a high level of observability. Inspiring other teachers to try new digital technologies is seen as an essential element of their role as innovators. For example:

> I have always been the one who try to encourage the others to explore, test and to become enthusiastic.

3.2 Category B: Early Adopter

This category includes teachers who are early adopters of ICT in learning environments. Teachers in this category understand their role as visionaries in educational reform aiming to create digitalised learning environments. For example:

> I'm pretty daring to pilot new. For example, I am happy rejoice about my decision to put the learning environment into operation in our project although it is still in its infancy.

Within this category, it is assumed that university teachers gain a considerable advantage from digital technologies. Learning technologies are seen as enabling elements in the learning process since they offer new and flexible approaches to delivering information. For example:

> I see that instructional technology works best when, for example, it can be used to plan learning assignments, which are difficult or impossible to implement without technology.

These teachers believe that the observability of learning technology inspired them to be catalysts for educational reform of digital learning environments. For example:

> I do not like to boast about my doings, but if the reforms I developed achieved good results, I'll gladly accept my role as a promoter of the reforms.

3.3 Category C: Adaptive

The role of an adapter involves the pragmatic development of technology-based learning environments. Such development is meant to support rational and practical technology-enhanced learning solutions. Teachers within this category are circumspect developers who have an adaptive understanding of the relative advantage of learning-technologies. They determine the compatibility of learning technologies based on their appropriateness for teaching. For example:

> I'm not a technofreak, but new platforms and tools inspired me based on what they enable me to do and how they will benefit my pedagogical thinking at that moment.

In this category, teachers admit to the complexity of educational technology and understand the development of technology-enhanced learning environments to be a cyclic process. In addition, they believe that technology is difficult to control and favour simple technical solutions. For example:

> I have been involved to the promotion of learning technologies for years, or rather for decades, but I'm not willing to get involved in the cycle of reform emphasizing technology. But I consider closely the additional value of different media for learning and know-how point of view.

Teachers within this category consider the observability of educational technologies from a social point of view. They mentioned that collegiality played a highly significant role in the integration of technology into their teaching. For example:

> I definitely want to hold on to the current collaborative/collegial planning and implementation of the teaching, and consider students as human beings in learning situations, not as a spinning credit top or item of expenditure.

3.4 Category D: Sceptic

In this category, the developer role of technology-based teaching is seen as an activity that represents sceptical and critical meanings towards digital learning-technologies. For example:

> My attitude towards technology is slightly contradictory. I'm slightly sceptical on that score; is e-learning promoted only for cost reasons, or do we really want to develop flexible learning solutions?

The role is understood by university teachers to be conservative in terms of its approach to teaching and learning. They do not recognise the relative advantage of learning technologies, and view the use of digital technologies for teaching purposes as something unpleasant that nevertheless must be accepted. Teachers within this category are suspicious about the compatibility of technology with teaching and learning methods and favour simple solutions. For example:

> However, flexibility should not drift into a situation in which teaching is tailored for every student according to his or her individual schedules and needs. In some circumstances, it now comes to my mind that individualism has become synonymous with selfishness when a student determines what dates are suitable for his or her shifts and hobbies.

In addition, these people's developmental focus is individualistic and they concentrate in their own work. For example:

> Currently I'm doing development work in my sphere of responsibility.

3.5 Category E: Late Adopter

This category includes late adopters who are technophobic and believe that there are barriers to the integration of ICT in teaching and learning. For example:

> If technology is seen exclusively as a tool for intensification of studying and an enabler of 'the flow-through', it isn't too easy to look on it positively.

These teachers recognise very few relative advantages and many negative effects of learning technologies. They engaged in passive resistance to the compatibility of digital technology for teaching and learning. For example:

> Development of more flexible university studies, for example, by means of technical solutions, may not ease that contradiction since students will pick even more to study as the quality of their learning falls.

> Technology-enhanced e-learning offers a frightening opportunity to make students more passive than before. Technology creates opportunities to move work that is unavoidable and required for learning.

They perceive technology as complicated to use and express a desire to avoid learning how to use modern learning technologies. The university teachers within this category criticise their colleagues' rash usage of learning technologies. For example:

> Therefore, I should myself learn to rustle up these videos and to edit them, but I don't have enthusiasm or enough time to do that. So, I welcome reforms of education, but the requirements of the digital leap don't appeal to me. There are many digital applications that are cumbersome, slow to learn, not motivational or out of date when they implement them.

4 CONCLUDING DISCUSSION

This study aimed to identify university teachers' conceptions of their role as developers of technology-rich learning environments and how they value the integration of technology in higher education. The study was performed during a multidisciplinary network project that gathered teachers who are willing to pilot new teaching methods that apply technology. The results revealed that the teachers fulfill very different roles in the development of technology-based learning environments. We identified five distinct roles: innovator, early adopter, adaptive, sceptic and late

adopter. In addition, the teachers' attitudes regarding the integration of technology in higher education were widely varied. When the study's context is taken into account, the results of this study are rather surprising: not all the teachers who developed pilot courses utilising ICT during the network project are active supporters of ICT in teaching.

In this study, Everett Rogers' innovation diffusion theory (2003) was utilised to reflect the logic of data-driven categories in a more conceptual way. In line with this theory, we identified a dominant characteristic of each of the five different roles within the social context. If the aim of educational development in higher education is wider diffusion of innovations concerning the digitisation of teaching in an evolving university community, these different roles in the integration of learning technologies need to be identified and exploited.

The findings of this study can be used by teachers to assess their role in educational reform and categorise their perceptions of ICT. However, deeper knowledge about the various roles, including the beliefs behind the conceptions, is needed. Also, ways to support university teachers' transition between the different stages of innovation (in Rogers' diffusion model) should be developed. We propose that these kinds of tools offer opportunities to support and speed up the diffusion of modern learning technologies in educational organisations.

A limitation of this study is that our analysis of teachers' conceptions is based on a rather small amount of data (n=14). Sandberg (2000) suggests that around 20 informants would be a sufficient amount in order to reach the saturation in phenomenographical studies. Additionally, the data in this study were collected from reflective writings, which may not have reached all the potential respondents. Further research should thematically interview all the teachers that participated in the multidisciplinary project to develop digital learning environments. This will offer an opportunity for these teachers to identify and evaluate their conceptions and thus obtain deeper knowledge about them. In addition, it is important to further study possible changes in teachers' conceptions during the network project and the effect of various network activities on their attitudes regarding ICT.

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