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Introduction

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INTRODUCTION

Moving from theory into practice – on the informed design of educational technologies

This special issue of *Technology, Pedagogy and Education* originates from a symposium on educational technology held in 2012 at Umeå University in Sweden. Through keynote speeches, cutting-edge research knowledge was disseminated and combined with follow-up dialogues among the participants. Interesting, innovative and critical questions and concerns about the informed design of educational technologies for teaching and learning were addressed. Many insightful answers and suggestions were given; but even so, the editors of this special issue, after closing the symposium, thought that the question of how research can be designed in a sustainable and successful way, as well as implemented, integrated and used by practitioners, was not answered satisfactorily enough. Compared to other research fields, such as, for example, medicine and engineering, the link between research and practice does not yet seem, apparently, to be strong in the field of education.

According to Burkhardt and Schoenfeld (2003), for example, educational research has, over time been both questioned and challenged by practitioners such as school leaders, teachers and politicians. When practitioners experience problems, they seldom turn to research. Burkhardt and Schoenfeld (2003) even claimed that ‘education has no collective voice to counterbalance less expert commentators. Indeed, many “common sense” results that are widely accepted by the public (e.g., “retention works”) fly in the face of modern research’ (p. 9). Research results seem to have had difficulty making their way into educational settings. One might ask: why does this seem to be the case? Why is it so hard for researchers and practitioners to work together and, through mutual efforts and joint visions, improve their educational practices? How come there is such difficulty integrating research and development work? Mor (2014) for example suggested that researchers and teachers in fact can both take the role of providers of knowledge and designers of teaching and learning activities through educational technologies.

In this special issue, we attempt to go further into this complex web of problems. One way we suggest the problems can be resolved is through informed design of educational technologies. Informed is – in broad terms – here understood as the design of educational technologies that are built on solid and explicit theoretical assumptions. This implies designs that are possible for both researchers and practitioners to criticise and develop on their own assumptions and that, most importantly, have the possibility to enhance teaching and learning in digitalised educational environments (see Olofsson & Lindberg, 2012).

Next in this editorial, we provide a brief overview of already formulated critical insights and concerns within this field of research. Thereafter, the six articles included in the special issue are presented as well as their specific relation to the idea of having an informed design as a starting point for enhancing teaching and learning. With inspiration from Burkhardt and Schoenfeld (2003), this will be done

by intertwining the articles with an idea of how to improve the flow between research on design of educational technology and its integration and use in practice. Finally, with the knowledge and insights provided through the articles we will make a short comment on what we consider yet to be missing concerning the link between original and high-quality research on informed design of educational technologies and its use in practice.

Previous research within the field – a brief overview

Over the last 10 years, the potential of educational technology to, if not completely reform, at least substantially improve, education has been widely addressed (see de Koster, Kuipert, & Volman, 2011; Istance & Kools, 2013). Considerable amounts have been spent on technical equipment (Kinchin, 2012) and the body of research on educational technologies for teaching and learning in educational practices has grown rapidly. Year after year, well-reputed scientific journals contain numerous articles (Hsu et al., 2012) reporting results from research that targets various aspects of the use of educational technology, such as one-to-one computing in elementary schools, mobile and ubiquitous learning, technologies in higher education and online e-assessments. A rather massive body of research is available with the potential to be a mediating power in scaffolding and enhancing the implementation, integration and use of educational technologies in educational settings around the globe; this seems at first glance both positive and promising. There seems, though, to also be another picture present in the research literature. For example, Selwyn (2012) provided a more critical point of view, saying ‘it makes little sense to pretend that the academic research that has been conducted to date in the area of education and technology has been particularly strong’ (p. 218). Laurillard et al. (2011) also noted that there ‘is as yet no well-structured body of knowledge about how to exploit fully the use of all the different kinds of learning technologies now available’ (p. 2). Other scholars such as, for example, Säljö (2010) and McGarr (2009), argued that many of the research results reported in relation to educational technologies in schools are often unclear and that they seldom show that educational technologies contribute to changing the educational organisation in a way that facilitates teaching and learning. Such critical voices do not seem to be a new phenomenon; according to Gunn and Steel (2012), they have, rather, been articulated by researchers in the field of educational technology for more than 20 years.

In relation to this special issue, it is particularly interesting to note that critiques in the research literature often include the apparent lack of use of theory. For example, Bebell, O’Dwyer, Russell, and Hoffmann (2010) claimed that, overall, there appears to be a lack of guiding theoretical principles present in studies on teaching and learning with educational technologies. Vrasidas (2014) pointed out, in a similar line of argument, that hitherto the theoretical framework for the integration of educational technology in teaching and learning is underdeveloped and in need of improvement. Anchored in their literature review study on 100 articles published between 2005 and 2010 in the *Australasian Journal of Educational Technology* and *Research in Learning Technology*, respectively, Gunn and Steel (2012) made some interesting conclusions. Among these are that theory is present only incidentally or not at all in the cases presented in the reviewed

articles, as well as that, too often, only limited references to theory or previous studies are present in the articles and that, by using unsatisfactory evidence, incorrect assumptions are made that it is possible to transfer or generalise results to other educational practices. Selwyn (2012) seemed to agree with the conclusions from the review, arguing that: ‘there are many theoretical approaches and traditions that currently are under-utilised in the educational technology literature, yet might support the building of better questions, highlight otherwise neglected issues and to act both as a point of reference and a point of correction’ (p. 217). Little or unsatisfactory attention to theory can apparently impose a risk that the design aspects in teaching and learning with educational technologies will also suffer. The designs in scientific studies are, too often, theoretically uninformed and the results are, therefore, difficult to build upon in the next phases of informed (re-)design. The lack of theory, combined with the lack of a necessary connection between theory and practice in order for educational technology-rich environments to be cultivated through informed design, seems to be both unsatisfactory and challenging for stakeholders within this area of interest.

If one examines these challenges from a European perspective, the Stellar network came up with some interesting aspects in its so-called Grand Challenges (Fischer, Wild, Sutherland, & Zirn, 2014; compare Sutherland & Fischer, 2014). They put forth that Grand Challenges can be viewed as problems related to technology whose solution can contribute to ‘breakthroughs that improve learning and educational systems and bring long-term benefits to society’ (Fischer et al., 2014, p. 1). Examples of challenges in need of attention are multi-level evaluations of TEL (technology-enhanced learning) (Olofsson, Lindberg, & Hauge, 2014), new forms of assessment for social TEL (Whitlock, 2014) and supporting an open culture of design for TEL (Mor, 2014). If one takes a more Nordic perspective on the challenges ahead, Cerratto Pargman, Järvelä, and Milrad (2012) in their turn pointed out a number of major research challenges in relationship to the rapid development of educational technologies in teaching and learning. In their opinion, challenges to be acknowledged are: ‘related to the promotion of innovative teaching practices, the need of driving technological development and design of educational tools for education, and new forms of understanding cultures of learning’ (p. 228).

Looking at these challenges as a whole, they seem to contain many aspects of teaching and learning related to the informed design of educational technologies. For example, when trying to develop a theoretical well-informed and meaningful use of educational technologies in educational practices, it is important that the relationship between such intentions be in line with local cultures and organisational goals (see also de Koster, Kuipert, & Volman, 2011). Further, to overcome some challenges, it seems important to acknowledge and include aspects of formal and informal learning with educational technologies (compare Hayashi & Baranauskas, 2013) and to support teachers (e.g., Laurillard, 2012; Laurillard et al., 2013) and students to become designers of their own teaching and learning, respectively (e.g. Kong & Song, 2013).

In the next two sections of this editorial, using some key insights from Burkhardt and Schoenfeld (2003), the articles’ contribution to the understanding of the long chain from theory to the informed use of educational technology in practice will be highlighted.

The relay

In 2003, Burkhardt and Schoenfeld argued that ‘the research-based development of tools and processes for use by practitioners, common in other applied fields, is largely missing in education’ (p. 3). If accepting the conclusion made after the symposium at Umeå University, and the main messages that appear from the brief review of research reported above, the case is, most likely, the same now as it was 11 years ago. This might be due to a variety of things; for example, it might be as Säljö (2010) suggested, that, until now, research on educational technologies is simply not good enough. Or it might be in line with, for example, McGarr (2009), who claimed that research has failed to show that educational technologies contribute to enhancing teaching and learning activities in practice. According to Burkhardt and Schoenfeld (2003), an important aspect is a more or less absence of sound theory in research combined with models that take advantage of educational research in order to shape educational practice, theories that lack the mediating power to inform the design, and models that clearly link research and practice. Burkhardt and Schoenfeld meant, for example, that ‘[T]he engineering approach to research is directly concerned with practical impact – understanding how the world works and helping it “to work better” by designing and systematically developing high-quality solutions to practical problems’ (2003, p. 5).

It is probably a difficult task to transfer engineering approaches to research on educational technologies for enhanced teaching and learning. What can, nevertheless, be learned here is the need to rearrange parts of the research conducted today in order to make it more useful to practitioners. Research that can pave the way for informed choices and designs that will improve practice; or, as Burkhardt and Schoenfeld (2003) put it, ‘[T]here must be much closer coordination of effort between research, design, development, policy, and practice’ (p. 3). One solution to this challenge that we suggest, with this special issue, is to create a kind of development activity or station between research on the informed design of educational technologies and its implementation in practice that helps transform theoretical research results into informed didactics and practical models or guidelines, as well as function as a tool for reconsidering the present activities in educational practices. This would ultimately serve as a kind of relay that creates a dialectic relationship between informed research and practice.

The relay traced in the included articles

In this special issue, we learn about examples of such a relay from the perspective suggested by Holmberg. In this conceptual piece, he discusses the still-present influence from Simon in design methodology and how this might account for a disconnection between educational theory and practice. Holmberg argues that the rich affordances of digital technologies and teachers’ and students’ situated designs with such technologies in complex and changing educational contexts make viewing design as rational problem-solving scenarios, in accordance with Simon, problematic. Instead, he suggests that adopting Schön’s view of design as a reflective conversation with the situation in design-based research (DBR) approaches has the potential of informing both research on the use of digital educational technologies and teachers’ situated use of such technologies. Through the use of a reflective DBR approach, Holmberg strives to include the reflective conversations teachers

have with situations in the design process; thereby, he articulates a theoretical position for the idea of informed design as a relay between research and practice.

In the next article, written by Hauge, the author demonstrates the need for taking a design perspective on teaching and learning in the study of the complex processes of uptake and use of information and communication technology (ICT) in education. He argues for the identification and scrutinising of designs for teaching and learning at the institutional level to overcome the contradictions that often arise in the uptake and use of ICT. The design approach Hauge proposes is dialectic in nature and aligned to Simon's perspective of technical rationality and the design process as reflection-in-action proposed by Schön. Hauge illustrates how design is conceived and changed by teachers using technologies in institutional practices of teaching and learning. Through the use of two empirical case studies, he makes these contradictions visible; and, thereby, also possible to understand in their design and functions as a relay between research and practice.

Price and Kirkwood draw upon findings from a recent investigation of practitioners' use of evidence in the design and deployment of technology for teaching and learning in higher education. In the analysis, the authors build on a re-examination of a literature review in which they consider the theoretical models and assumptions that underpin them. They use this to examine the assumptions made about learning (whether explicitly or implicitly) and to model how this informs the learning design and the subsequent evaluation of its success. The review shows that there is both an under-specification of theoretical models as well as evidence from relevant research and evaluation studies to inform the design of educational technology interventions in higher education. The informed design suggested by Price and Kirkwood grounds interventions in a better conceptualisation of what constitutes and shapes learning rather than focusing on technology as agent of change. In this sense, informed design becomes a relay between research and practice.

Popov, Biemans, Kuznetsov, and Mulder present an exploratory study of the effectiveness of an interculturally enriched collaboration script for working in culturally diverse groups within a computer-supported collaborative learning environment. The informed design of the collaboration script was a tool that proved valuable in addressing questions regarding culturally related differences in student behaviour, learning and experiences. The groups using the script showed a higher frequency of so-called contributing behaviour but a lower frequency of planning behaviour, seeking input and social interaction than groups using more general scripts. The study suggests that the informed design of educational technology has impact in practice, working as a relay not only from research to practice but also for student learning.

Collazos, Padilla-Zea, Pozzi, Guerrero, and Gutierrez focus, in their article on the issue of designing for learning processes; and, more specifically, on a model for cooperative learning processes. The authors claim that something more than forming and assigning students a common goal is needed for cooperation to occur. Collazos and colleagues demonstrate how a software tool designed according to the model proposed can be conceived. In the software, some design guidelines have been implemented in order to support cooperative learning activities and allow the cooperative process to be monitored. The preliminary results presented in the article show that the participants who have interacted with this software tool have obtained good cooperation scores and cooperative abilities have been fostered, such as participation, engagement and communication during learning activities. This implies,

as in the case of Popov and colleagues' article, that informed design that results in increased student learning also becomes a relay for the use of educational technology as such.

Increasingly, Dennen and Hao argue, the education world finds itself working in an environment that is full of mobile devices and tools. Students, the authors claim, are likely to own smartphones and tablets, which leaves instructors facing the challenge of integrating mobile devices into their course activities, whether as a full delivery medium, an enhancement or an optional tool. Situations such as this are likely to arise concerning other kinds of technologies as well, and the need for an informed design of the use of novel technologies is apparent. The authors present the M-COPE framework as a tool that can be used in the instructional design process to inform the design of educational technology. The M-COPE framework is specifically argued to be a tool for them that prompts them to consider five critical areas related to mobile learning: mobile affordances, conditions, outcomes, pedagogy and ethics. This framework, they claim, can be them with any instructional design process to help instructors engage in the informed design of mobile learning activities. In this sense, the use of a framework that relates the issues of informed design to upcoming practices provides a relay for research to influence practice.

A final word

We will end this editorial by summarising our main argument. It is possible that research on the informed design of educational technologies that builds on both solid and explicit theoretical assumptions and that addresses real problems may also inform educational practices in more general ways. A kind of research that is according to the literature both asked for and needed in this field of interest. This special issue contains six such research articles that, in different ways, provide valuable knowledge and insights regarding the important link between research and practice related to the informed design of educational technologies in teaching and learning. It is our hope that this special issue of *Technology, Pedagogy and Education* will provide value on how to establish and maintain a highly important and strong link between theory and practice, between researchers and practitioners.

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