TEACHERS' REFRAMING OF PRACTICE DURING A DESIGN-BASED RESEARCH PROJECT

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Abstract

This study explores how eight teachers in one-to-one environments frame, reframe and develop different aspects of their practice during a two-year long study. The data consists of 23 hours of transcribed open-ended interviews, 35 reflective log entries written by the teachers, their educational designs and the researchers' field notes. The results show: (a) how different dimensions of the teachers' pedagogical reasoning are formulated, manifested and developed during the time of the study and (b) how different aspects of their technological, pedagogical and content knowledge are included in and developed through their pedagogical reasoning.

Introduction

In Sweden, as in most other European countries, information and communication technologies (ICT) have been increasingly introduced into schools. One trend is the introduction of so-called one-to-one schools, where every student is equipped with a computer. This digitalisation of schools could be seen as a natural consequence of the digitalisation of society. Additionally, hopes have been expressed that ICT could be used to create added pedagogical values by supporting teaching and learning in new and improved ways. However, as previous research has shown, introducing ICT into classrooms does not necessarily mean the creation of added values (OECD, 2015; Wastiau et al., 2013). Vrasidas (2015) argues that for this to happen teachers would need to reframe their practices and develop what Mishra and Koehler (2006) refer to as technological, pedagogical, content knowledge (TPACK). However, due to the complex and integrated nature of teacher knowledge and teacher practice, further research is needed to better understand and support teachers' reframing of practice in digital contexts (Olofsson, Lindberg, Fransson, & Hauge, 2015; Voogt, Fisser, Pareja Roblin, Tondeur, J., & van Braak, 2013).

The research reported here is part of a longitudinal design-based research (DBR) project, where the researcher has worked with eight upper secondary teachers of English as a foreign language (EFL) in four one-to-one schools. As has been commented on in previous research, relatively few studies have examined teachers' pedagogical reasoning and the meaning of TPACK for

specific subject domains (Voogt et al., 2013). A central idea in the project has therefore been to explore ways of using ICT to create added pedagogical values in EFL, i.e., using ICT to support learning in ways that would not be possible without ICT. Shulman's model of pedagogical reasoning has been used in the process of distinguishing and analysing different dimensions of the teachers' ICT-supported practice (Shulman, 1987).

Thus, the purpose of this study is to explore teachers' pedagogical reasoning about how to integrate ICT to create added values in relation to: (a) the design of a representational repertoire (e.g., multimodal examples and demonstrations), (b) the design of learning activities, and (c) the evaluation of their educational design and assessment of students' knowledge representations. This is done by analysing how teachers' pedagogical reasoning is formulated, manifested and developed during the DBR project. The analyses focus on contrasting the discussions and educational designs constructed during the DBR project. The TPACK framework is used as a conceptual construct to analyse which aspects of teacher knowledge are included or lacking in this reasoning.

Teachers' Reframing of Practice

An important part of teachers' reframing of practice involves understanding and discovering the affordances of digital technologies (e.g., smartphones, wikis, RSS) and considering how they could be used in relation to different aspects of their practice (Holmberg, 2014; Norman, 2013). Shulman (1987) identifies different aspects of teacher practice in his seminal work on teacher practice and teacher knowledge. He refers to these aspects as *the processes of pedagogical reasoning and action*. The 'separation' of reasoning and action could be (mis) understood as a separation of *theory* and *practice*, but should actually be understood as an analytical and semantic division. Nowadays, teaching practice is characterised as complex, dynamic, relational and multidimensional (Fransson & Grannäs, 2013; Frelin, 2013). Schön refers to this process as an ongoing *reflective conversation with situations,* in which teachers reflect on their actions and their understanding in an integrated multidimensional and multifaceted process (Schön, 1987). In this paper, the term *pedagogical reasoning* is used to describe the integrated processes in which teachers *apply* and *reflect on* different aspects of their *professional knowledge* and *practice*.

Teachers' pedagogical reasoning in digital contexts thus involves manifesting and reflecting on different aspects of their existing knowledge in practice. Shulman describes the unique knowledge that for example differentiates teachers from content experts as pedagogical content knowledge (PCK) (Shulman, 1986, 1987). Mishra and Koehler (2006) argue that the increasingly important role of ICT in teachers' practices warrants a discussion about teacher knowledge using a conceptual construct that incorporates technological knowledge (TK) and its relation to pedagogical knowledge (PK), content knowledge (CK) and PCK. They have extended Shulman's categorisation of teacher knowledge and describe this "new" amalgamation as technological, pedagogical, content knowledge (or TPACK). The TPACK framework also includes technological content knowledge (TCK) and

technological pedagogical knowledge (TPK), i.e., knowledge about the reciprocal relationship between technology and content and technology and pedagogy respectively. The TPACK framework has become a commonly used conceptual framework in research on the knowledge that teachers need to use ICT to create added pedagogical values (Olofson et al., 2016). It has also proved to be an intuitive concept when communicated and discussed in collaborations between researchers and teachers (Voogt et al., 2013).

However, Voogt et al. (2013) conclude in their review of the TPACK literature that defining teacher knowledge is "not enough" and that studies of teachers' pedagogical reasoning (i.e., teachers' use and development of knowledge in practice) are needed to better understand teachers' decision making about technology (p. 119). It is in the pedagogical reasoning that teachers' knowledge, skills, judgements, analyses, decision-making processes and so on are manifested and possible to study. The process of reasoning also includes aspects of making sense of past, present and future situations and understandings (Biesta, 2013; Weick, 1995). This way, reasoning facilitates sense-making and the construction and re-construction of understandings and influences present and future decision-making. Thus, the process of pedagogical reasoning may facilitate a reframing of the teachers' understanding of teaching, teaching practices, possibilities with ICT, etc.

In research, there is empirical evidence to suggest that teachers' reframing of practice to one that makes use of ICT to create added pedagogical values is helped by, for example, collaborative design work (Baran & Uygun, 2016; Koh & Chai, 2016). Researchers and teachers who collaboratively apply their respective understandings and skills *in pedagogical reasoning* and in authentic educational contexts are also at the heart of DBR. DBR is increasingly considered as a viable research approach in studies of teachers' ICT-supported educational design processes (McKenney & Reeves, 2012; Plomp & Nieveen, 2013).

Methodology

This study is conducted as part of a DBR project where the on-site researcher collaborated with eight upper secondary school teachers of EFL in four different one-to-one schools in Sweden over a period of two years. The on-site researcher met with the participating teachers at their schools at different intervals, depending on the current nature of the collaboration. In between the physical meetings, Skype meetings with screen sharing were held.

The data was collected over a period of two years and consists of: (a) 23 hours of transcribed open ended interviews with the teachers in relation to their design intentions, (b) the teachers' practical enactments of these intentions (i.e., their educational designs), (c) 35 written reflective log entries that the teachers then shared with the researcher and (d) the researcher's field notes.

The data was coded and analysed using qualitative content analysis (Schreier, 2012) with the aid of the NVivo software. The TPACK framework (Koehler, Mishra, Kereluik, Shin, & Graham, 2014) is used as a conceptual construct in both the analysis and the presentation of the results.

At the beginning of the DBR the on-site researcher's primary role was to explore the teachers' intentions for and de facto use of ICT and to gain a basic understanding of their pedagogical reasoning. The teachers' pedagogical reasoning was stimulated by the researcher's questions and was used as a 'think-aloud' methodology when designing and discussing plans and different ICT tools. The teachers' own questions to the researcher were recognised as a 'sort of' pedagogical reasoning and stimuli for their own pedagogical reasoning. The teachers' design questions and design ideas were interpreted by the researcher and discussed with the teachers in relation to theories of learning and available technologies. Thus, during the project the on-site researcher and the individual teachers participated in an ongoing reflective conversation with and about their design situations. In this reflective dialogue, both parties suggested ways of using ICT to create added values, although the teachers themselves took the final decision about implementation. If a teacher expressed the need for hands-on "technical assistance," the researcher provided this as far as possible and acted as a tutor until the teacher felt comfortable in his/her own use of the technology.

Results

In this section the results from the study are presented under three separate headings referring to the teachers' pedagogical reasoning about the use of ICT for added pedagogical value in EFL with regard to:

- the design of a representational repertoire
- the design of learning activities
- the evaluation of educational designs and the assessments of students' knowledge representations.

The major themes that emerged in the analysis are presented under the three headings. Thus, under each heading the results are presented in relation to: (a) the most common uses of ICT and the perceived added values of these uses, (b) the development of the teachers' pedagogical reasoning during the DBR project, (c) teachers' intentions for vs. their actual use of ICT and (d) reasons for any discrepancies between the intentions for and use of ICT with regard to TPACK.

Pedagogical Reasoning in Designs of Representational Repertoires

In Shulman's model for pedagogical reasoning and action he discusses the need for teachers to find ways to transform their understanding of the content, to "scrutinise" the teaching material to decide whether it is "fit to be taught" and if it is not, to decide how it could be "made more suitable for teaching" (Shulman 1987, p. 16). He refers to this process as *transformation*. Today, the amount of teaching material available e.g., on the Internet is practically unlimited. In this study, none of the eight teachers made use of a course textbook or any other kind of pre-ordered course material. Instead, they used ICT to find web-based content and create their own teaching materials. The teaching materials mainly consisted of:

- Authentic multimodal content in the form of written texts, videos and podcasts freely available on the Internet. These were mainly used as examples to model the intended learning outcomes.

- Explanatory and 'already transformed' multimodal content. This content was sometimes produced by:
    - 'official' educational stakeholders like the BBC
    - EFL or ESL (English as a second language) teachers from around the world
    - native English speakers
- Explanatory texts (sometimes scanned from books) or multimedia presentations (mainly PowerPoint) that the teachers had either received from colleagues or created themselves. At two of the schools, teachers teaching the same subject had used their learning management system (LMS) to create folders in which they shared different kinds of teaching materials.

The teachers admitted that finding and creating the teaching material took time, but that this was necessary because it allowed them to use and create material that was *authentic*, *up-to-date* and considered *relevant* by the students. The teachers also found it important to be able to work with topics and explanatory examples they themselves found interesting.

It could be argued that the teachers' decisions to sometimes use teaching materials created by others meant that they accepted other people's interpretations and transformations. Not using a textbook also meant the lack of a publisher 'guaranteeing' the quality of the teaching material. In general, the participating teachers showed signs of a highly developed CK and PCK. Their oral and written English was excellent and they understood which aspects of the learning content were problematic for learners (e.g., certain grammatical constructions, nuances in oral speech, etc.). However, if this is not the case, the wealth of online teaching materials of varying quality could be considered a potential problem if teachers simply 'accept' someone else's transformations.

The teachers considered that authentic educational material was easy to find, but expressed that they often wished they knew how to: "choose certain parts (of this content)," "comment on it," "build on it" and "save it for use in other contexts." Moreover, they also found it difficult to include external material in the school's LMS in a "logical way" without having to resort to less satisfactory solutions, such as word documents with long lists of links. It can be thus said that the teachers had the necessary curricular knowledge and CK to identify teaching materials with explanatory value and/or value as models for the intended learning outcomes. It could also be argued that, in theory, they had the *theoretical* TCK to envision the value of this functionality of ICT. However, at the beginning of the project they lacked the TK to curate, edit and annotate, i.e., digitally transform, this material to suit their own and their students' needs. In the design conversations towards the end of the DBR project, learning this in collaboration with the on-site researcher was mentioned as one of the benefits of being involved in the project.

The fact that the teachers did not know about or had not used annotation tools such as screencasting services and formulating this as 'a lack of TK' could be interpreted as the teachers not being "technologically competent." However,

based on the on-site researcher's experience and their own statements, they could all be considered somewhat more ICT competent than the average colleague at their schools. Three of the teachers even had special roles as someone to whom their colleagues could turn for help with ICT-related issues. Moreover, when the on-site researcher introduced the teachers to the web-based screencasting service, Screencast-O-Matic, they immediately saw the potential of this as a teaching tool. Shortly thereafter, six of the eight teachers wrote about or showed the on-site researcher how they had learned to use Screencast-O-Matic for annotation or lecturing purposes. This illustrates that TK, as "knowledge about traditional and new technologies that can be integrated into curriculum" (Koehler et al., 2014, p. 102), is a rather blunt theoretical concept. In this study, the six teachers who quickly learned to create screencasts proved that they had the necessary knowledge and skills to use the required technology once they had been introduced to the idea of annotating and explaining by recording their screens using a web-based service. Another way of expressing this is that their *general* TK allowed them to understand the benefits of a certain digital tool and to quickly develop the necessary *specific* TK to use this tool to add pedagogical value to their representational repertoire.

Pedagogical Reasoning in the Design of Learning Activities

Teachers' work of designing a representational repertoire to help students' learning is intimately connected to ideas about how students could use these representations in different learning activities. For example, at the beginning of the DBR project, one teacher used two speeches made by Angelina Jolie and Leonardo DiCaprio that were available on YouTube as examples of powerful speeches, and as an illustration of argumentation and speaking techniques. This was done in the classroom by the teacher fast- forwarding; pausing and commenting "live." After being introduced to tools for editing and annotation by the on-site researcher, the teacher used a web-based service (www.tubechop.com) to select illustrative parts of these speeches and make a screencast to record and comment on the specific qualities of the speeches, and the techniques used by Jolie and DiCaprio. The screencast was made accessible to the students as a link in the LMS so that they could watch it whenever and wherever they wanted. Thus, these tools helped the teacher to add value to his/her representational repertoire. However, the teacher also realised that finding, selecting and commenting on other good (or bad) argumentative speeches was a good way for students to understand the qualities of speeches and the techniques used to deliver them. The teacher therefore designed a learning activity in which the students were asked to find argumentative speeches and to choose and comment on their illustrative parts. They then exchanged examples with a peer and used these to illustrate their understanding of what characterised a good argumentative speech and what needed to be learned to deliver an argumentative speech. In other words, the students used ICT to *transform* and convey their understanding of the content in a similar way to teachers.

During the initial design conversations with the individual teachers, most of them, albeit to varying degrees, said that they thought that ICT could be used to create added values that would help them to support collaborative learning

to a greater extent. However, they also expressed that for various reasons they had not explored these potentials (Holmberg, 2016)). One of the reasons for this was that the teachers lacked functionality to support collaborative learning in the LMS shared by three of the schools: "I can see their texts, and that's good, but the mass of knowledge that they (the students) have is seldom shared between them."

Another reason was that they did not know the answers to a number of technology related questions: "Well it's just…how do you record, practically speaking? Could everyone use their phone or iPad? How would they… how do you share it so that I can see it, and a number of students, but not everyone?" Some of the teachers also felt that they had to be able to support students if they asked them to use their own hardware to videotape themselves or each other. Here, it could be argued that in this regard the teachers did not have sufficient TK to realise their intentions for increased collaborative teaching and learning.

However, in dialogue with the on-site researcher, several free web-based services with built in social and collaborative functionality were introduced, explained and gradually adopted by the teachers and students (e.g., Wikispaces, Evernote, Blogger, Padlet, YouTube, and Diigo). Thus, students' use of ICT to create knowledge representations and share these for peer modelling and peer discussion became an increasingly common type of learning activity in the teachers' educational designs during the research project.

These digital knowledge representations were also increasingly created for *authentic audiences*, for example other students in the school, parents, or the entire world. The possibility of using ICT to make learning activities as authentic as possible was mentioned as an important added motivational value by all the teachers. Two major reasons for this became evident in the research material. First, creating and presenting for an audience outside the classroom was seen as a way to "force the students to get their act together." The knowledge that a 'real' deadline and/or a 'real' audience was going to listen to the podcast or see the video created an incentive for the students to perform well. Second, the teachers also expressed that the creation of digital artefacts for use in 'the real world' also meant that the actual learning process became more authentic, because the students used digital tools and a language that was not 'adapted' for classroom use: "…because then you don't get the…'do I have to write a complete sentence or does it have to be'…there is a context that can provide answers to those questions."

These insights relate to TCK, i.e., an understanding that Swedish school English and native English differ and that the use of ICT could illustrate this. However, these insights also relate to TPK, i.e., how ICT could be used as a pedagogical tool to motivate students by allowing them to participate in authentic contexts. The teachers' creation of educational designs that incorporated both these added values could be described as signs of TPACK.

Students' own digital multimodal knowledge representations were also used to support their reflections on their learning outcomes and learning strategies. Four of the teachers incorporated this as a regular part of their educational designs, where students used blogs or the LMS's log book functionality to reflect on their own recorded practices and the thinking and studying that had led to them. Students were also asked to compare the lessons learned from their reflections with their peers and to use the knowledge representations as practical examples in these discussions. Thus, ICT was used to support individual and collaborative metacognitive reflection in relation to the learning goals, the study process and the knowledge representations produced.

Pedagogical Reasoning in Evaluation of Educational Design and Assessment of Students' Knowledge Representations

Shulman (1987) discusses teachers' constant checking of students' understanding as an important and integrated part of teachers' pedagogical reasoning. However, during the initial design conversations with the teachers, they all, albeit to varying degrees, expressed that they spent more time than they wanted on administering tests. One teacher even went so far as to say, "We don't teach anymore, we just collect products for assessment." In relation to this, a number of the teachers mentioned the use of ICT for automated feedback as a potential added value. Some of the teachers used web-based services to create flashcards and word tests with automated feedback. However, they recognised that the potential added value of this use was limited to students' learning of factual knowledge, e.g., words and spelling.

Prior to the national tests of English that Swedish students take as part of their English studies, one of the teachers asked the on-site researcher for help in creating a standalone material that could be used to practise reading and listening skills and to provide automated feedback or material for self-correction. This teacher knew that s/he would have to work individually with some students to help them prepare for the test, but wanted the rest of the class to be able to prepare on their own. In dialogue with the teacher, a web-based service called Blendspace was used by the on-site researcher to curate and aggregate freely available resources with varying levels of difficulty from the web to build two *Blendspaces,* where students could practise their reading or listening skills. These resources were shared with three other teachers in the project whose classes would be also taking the national tests that term. When questioned about the potential value of these Blendspaces, the teachers were very positive (also on behalf of their students). The statistics available in Blendspace show that each Blendspace had approximately 350 views before the national tests by the student group consisting of approximately 100 students (four classes). The teachers used two lessons for voluntary work with the Blendspaces, which were only available to students who had access to their unique links. However, despite the perceived usefulness of such ICT use, only one of the teachers incorporated Blendspace as a recurring part of his/her practice. The reasons why the other teachers did not start or continue to use Blendspace included a perceived lack of time and/or technological knowledge to create a Blendspace, as well as *a sense of losing control of the assessment process* because they could not see the students' answers or results.

In relation to the assessment of students' knowledge representations, the use of ICT to support self-assessment (as part of the self-reflection described above) and peer assessment was increasingly mentioned as an added value during the time of the project. The teachers also used their newly developed knowledge of screencasting to formatively assess students' knowledge representations. The ability to do this in direct relation to a student's knowledge representation and to use their voice to convey nuances in this process were mentioned as important added values of ICT.

Discussion

Previous research claims that teachers use ICT to a lesser extent than could be *expected* and in ways that do not take advantage of the *potential* of ICT (Vrasidas, 2015; Wastiau et al., 2013). Vrasidas (2015) refers to previous research and argues that teachers use digital tools in the same ways as analogue tools and that a reframing of teacher practice is needed. Behind such a claim there must be, at least subconsciously, some idea about the *expected* ways of using ICT and their *potential*, what a reframing of practice would mean and how teachers' reframing efforts could be supported. However, if we recognise the uniqueness of every educational context and view teaching as professional conversations with situations in context, the added pedagogical value of ICT in a given context will most likely be discovered and created by a teacher through the pedagogical reasoning process. This in turn could lead to a reframing of practice that is attuned to the teaching context in question. According to this line of reasoning, the teachers themselves need to discover the added values of ICT and thus create incentives for the reframing of practice.

As has been shown in this study, the process of discovering, taking advantage of and/or creating these added values is intrinsically linked to the development and reframing of teachers' TPACK. Previous research indicates that TPACK can be successfully developed in authentic teaching situations and through collaborative design work (Baran & Uygun, 2016; Koh & Chai, 2016). These findings are supported by this DBR study, where the teachers worked *in context* and *in collaboration with* the on-site researcher to develop the necessary knowledge *and skills* to realise their pedagogical intentions in relation to ICT.

The results show how the teachers' reframing of practice is both enacted and elaborated through their pedagogical reasoning in which they apply and reflect on different aspects of their professional knowledge and practice. For example, during the study the teachers learned how to edit, annotate and record authentic material and to share this with their students, thus adding to its potential as teaching material in line with their expressed intentions. However, as their now extended TK allowed them to create designs in line with their intentions, they sometimes also discovered that expected added pedagogical values had to be reconsidered, for instance, in the example of ICT, for automated feedback. Thus, an extension of their TK sometimes led to a reframing of their TCK and/or TPK. Their newly developed knowledge and skills also inspired and made possible the design of new types of learning activities. For example, when the teachers' experiences of recording

themselves led them to design assignments where their students recorded their own argumentative speeches as multimodal knowledge artefacts for peer modelling and meta-cognitive reflection. Moreover, the teachers increasingly used ICT to support learning in authentic contexts (i.e., on the web with people and tasks from 'outside' the classroom) and with collaborative technologies like wikis and blogs. The teachers also began using digital tools to annotate the students' recorded knowledge representations (for example, argumentative speeches) as part of their formative assessment practices.

Over the course of the project, the teachers thus developed a practice in which ICT-supported collaborative learning became a more salient feature in their teaching. This reframing of practice is also reflected in the design conversations between the on-site researcher and the teachers. The development described above illustrates that the development of the teachers' TK did not only have consequences for how they chose and transformed the teaching content (i.e., as part of their TCK), but also meant that they found new ways of designing for collaborative learning and formative assessment (i.e., as part of their TPK). By integrating this knowledge with their existing knowledge of how to teach certain aspects of EFL in a particular context (PCK), their pedagogical reasoning could increasingly be described as characterised by TPACK.

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