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RESEARCH ARTICLE
Understanding the Theoretical Framework of Technological Pedagogical Content Knowledge: A collaborative self-study to understand teaching practice and aspects of knowledge
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This paper describes a self-study research project that focused on our experiences when planning, teaching, and evaluating a course in initial teacher education. The theoretical framework of technological pedagogical content knowledge (TPACK) was used as a conceptual structure for the self-study. Our understanding of the framework in relation to our teaching practice was in focus. The principal educational goal of the course was to develop the pedagogical use of web 2.0 resources to support learning in the preschool/school context. As a result, the focus, content, form of distribution, teaching, and assessment of the course went beyond what is common in initial teacher training in Sweden. The potential of the different digital tools was explored by situated use in the design and teaching of the course. Analysis highlights the challenges and opportunities that teacher educators and student teachers may encounter while working with, and learning about, information and communication technologies to support learning. Some of the findings discussed are related to the identified challenges and opportunities for both teachers and students to integrate content knowledge, pedagogical knowledge, and technological knowledge into a TPACK. Taken-for-granted organizational and institutional assumptions about teaching, learning, and assessment in teacher education were identified in the study.

Keywords: information and communication technologies; self-study; teacher education; technological pedagogical content knowledge; theory

Interest in the professionalization of teacher educators has accelerated in recent decades and self-study has been a way for teacher educators to raise their pedagogical awareness (Bullock & Ritter, 2011; Hamilton, Loughran, & Marcondes, 2009; Loughran, 2007; Zeichner, 2007). These self-studies have largely focused on various dimensions of the professional development of roles. However, two phenomena in particular have received little attention, namely, the understanding of theories and information and communication technologies (ICT)-rich teaching practices. In the self-study reported here, these two issues are in focus.

Teachers have an important role to play in helping students to acquire the necessary skills to become digitally literate and digitally competent in today’s society. Consequently, teacher education and teacher educators have a strategic role to play in helping student teachers to develop these competencies so that they are in a better position
to help their students develop similar skills (Archambault & Crippen, 2009; Collins & Halverson, 2010; Starkey, 2010). However, previous research indicates a lack of confidence and ability among many teacher educators in this particular field (Enochsson & Rizza, 2009; Groff & Mouza, 2008; Levin & Wadmany, 2008). As a consequence, the need for teacher educators to learn more about ICT and their implications for teaching and learning has been stressed.

However, ICT issues are only in focus in a few self-studies. When Hoban (2007) discussed the pros and cons of ICT in self-studies, he primarily did so from the perspective of using ICT as a tool for supporting self-study, e.g., for data collection, analysis, and the dissemination of results, rather than ICT being a key component in a self-study (how ICT is understood and used as a tool). These issues have a central position in Dourneen and Matthewman’s (2009) self-study and their analysis of the impact of teaching a specific ICT activity. A study of ICT activities in university teaching and lessons in school revealed dilemmas for student teachers regarding subject knowledge, learning, and pedagogy. For instance, what was intuitively recognized as a good lesson was found to be less successful when it was scrutinized more carefully, and vice versa. One of the conclusions drawn from the study is that ICT, “creates an additional layer of complexity within teaching while also allowing the process and problems of learning to be more visually evident” (Dourneen & Matthewman, 2009, p. 73; cf. Collins & Halverson, 2010; Kjällander, 2011).

In a self-study by Nilsson (2010), ICT had a minor and peripheral role; mainly because ICT and web-collaboration were used in the practice of engineering education under scrutiny. In the self-study reported here, the aim was to acquire a deeper understanding of the challenges and opportunities that teacher educators and student teachers encounter while working with, and learning about, ICT as a tool for learning. This learning interest focused on both the practical aspects highlighted during the course and the more theoretical perspectives of knowledge and learning that emerge when technological aspects and tools are included in the process of teaching, learning, and assessing. Accordingly, the theoretical framework of technological pedagogical content knowledge, or TPCK (cf. Mishra & Koehler, 2006, 2008), was used and the way we elaborated and developed our understanding of the framework during the course became an important focus of our self-study.

The Context of the Self-Study and the Theoretical Framework

The data for this self-study research project were collected during a course in the Teacher Education Programme (TEP) with an ICT focus. The course was the last course to be studied before graduation. It was presented for the first time in the autumn of 2010, ran for 12 weeks and gave 7.5 credits in the European Credit Transfer System (ECTS). The course could be regarded as innovative in that its focus, content, form of distribution, teaching, and assessment went beyond what is common in Swedish TEPs (Enochsson, 2009; Ericsson & Löndahl, 2008). The focus of the course was the pedagogical use of ICT (specifically web 2.0 resources) to support learning in preschool and school.

Lectures, seminars, and student–teacher interactions were mainly web-based and students were given considerable freedom in how to reach the course goals. Apart from being a pedagogical ideal at the end of the TEP, the heterogeneity of the group also made this freedom a necessity. The group consisted of 28 individuals becoming preschool teachers and 10 compulsory school and upper secondary school teachers with different subject combinations. Thus, the students needed considerable freedom to achieve the course objectives. These required them to study course literature relating to the pedagogical use of ICT and then choose curricular/syllabi goals and/or subject matter to
transform using web 2.0 applications and Open Educational Resources (OERs) to create their own digital multimedia resources for learning. They did this in a community of practice/learning in which they used social bookmarking tools and wrote and shared reflective and explanatory texts about their reasons for choosing a certain learning goal and digital tool, their experiences while using the tool and how their experiences and thoughts correlated with the course literature. These texts were written in Google documents and students gave us editing rights for assessment purposes, which enabled us to write comments and make suggestions directly into the students’ documents. Examples of the resources used included software/online applications for the following:

- making presentations (e.g., PowerPoint, Prezi),
- video, audio, and image editing (e.g., PhotoFiltre, Picasa),
- creating slideshows and cartoons (e.g., Animoto, Tondoo),
- making Screencasts (e.g., Screencast-o-matic, Screenr),
- finding OERs with Creative Commons licenses (e.g. Flickr),
- sharing and organizing digital content (e.g., Google Reader, Diigo).

The Self-Study Research Project and Its Methodological Implications

Collaboration was an important tool in the planning, teaching, and evaluation of the course, as well as in the self-study. As we had different backgrounds and expertise, this collaboration was important for the course and was a driving force for the self-study. In their self-study, Hug and Möller (2005) discuss the driving forces for collaboration in terms of intellectual, emotional, and pedagogical connectedness. We too recognized these driving forces, even though our pedagogical connectedness was somewhat asymmetric: one of us had considerably longer experience as a teacher educator and a better understanding of pedagogical theory, whereas the other had more experience in using web 2.0 resources and knew more about the practical didactic implications of such use. With regard to ICT, the pedagogical connectedness mainly focused on the common ambition to develop ICT competence at an organizational and institutional level of teacher education as well as at an individual level, i.e. as student teachers and teacher educators.

In self-study research, collaboration has been emphasized as an important and integral component (Bullock & Ritter, 2011; Sandretto, 2009; Tuval, Barak, & Gidron, 2011). One of the main challenges of self-study is to go beyond one’s own perspectives and taken-for-granted assumptions to look at and understand practice in new ways (Loughran, 2007). However, as Sandretto (2009) notes, collaboration does not guarantee that this will occur, although the potential for it may increase.

Another way of challenging one’s own perspectives is to use theory to reframe the context and thus challenge one’s own understanding of the context and one’s own practices (Sandretto, 2009). Accurate theories may contribute to this if they explain or challenge taken-for-granted assumptions (Sandretto, 2009). During the self-study process, the theoretical framework of TPACK (Mishra & Koehler, 2006, 2008) both helped and challenged us when analyzing and organizing our understanding of the educational context and our own and the students’ TPACK. For instance, the framework forced us to discuss, analyze, and determine how we interpret and understand the various aspects of the theory and our own teaching practices. In fact, our self-study also became an analysis of how our understanding of TPACK emerged and developed. In that sense, the teaching practice has challenged and developed our understanding of the theoretical framework of TPACK and vice versa.
Theories may also contribute to make the personal elements of knowledge in self-studies more accessible to a wider audience. In this, Loughran (2007) stresses the importance of the trustworthiness of self-studies. Hence, it may become important to use mixed methods, allow for the scrutiny of data and methods, and apply critical perspectives to contexts and to one’s own perspectives and stories. The methods we have used (or more precisely, the sources of input for our individual and common reflections and self-analyses) have been manifold. One source of information has been our experiences during the course, i.e. what we have seen, heard, done, reflected on, and felt. Other sources have included two surveys undertaken by the students, one on the first day of the course and another at the end. However, the main data have been our common reflections. After every seminar, lecture or examination, the two of us met to analyze what we had experienced and learned. Sometimes non-scheduled student contacts also provoked further analysis. Data were recorded digitally and notes were taken. A total of 5 hours of recordings were made on eight occasions during the course. In between these more organized situations for reflection, many informal discussions took place about the course, the students, theories, and ICT issues, as well as much reading of research. So far, our self-study process has stretched over a period of 14 months, from the initial planning of the course to the writing of this paper.

The Theoretical Framework of TPACK

Realizing that technological knowledge is an integrated aspect of teacher knowledge, Mishra and Koehler (2006, 2008) draw on Shulman’s (1986, 1987) pedagogical content knowledge (PCK) to create a framework that includes the specialized, applied, and situated knowledge that helps us to understand how different aspects of knowledge (may) interact and become integrated, i.e. how technological knowledge, pedagogical knowledge (PK), and content knowledge (CK) can be integrated. They call this framework of knowledge TPACK (or TPCK).

As indicated in Figure 1, TPACK is the intersection of teachers’ knowledge of pedagogy, (curriculum) content, and technology. Developing TPACK means:

- developing a nuanced understanding of the complex relationships between technology, content, and pedagogy, and using this understanding to develop appropriate, context-specific strategies and representations. (Mishra & Koehler, 2006, p. 1029)

Thus, TPACK emerges as the intersection of teachers’ knowledge about PK, CK, and technological knowledge (TK). In this sense, TPACK is a complex form of knowledge shaped by a large number of contextual factors (such as school organization, curricula, students’ socioeconomic backgrounds, and technology), many in constant flux or rapid development.

In the framework of TPACK, PCK, technological content knowledge (TCK), and technological pedagogical knowledge (TPK) have central positions. According to Mishra and Koehler (2006, p. 1027), PCK is about: “the representation and formulation of concepts, pedagogical techniques, knowledge of what makes concepts difficult or easy to learn, knowledge of students’ prior knowledge, and theories of epistemology.” This includes a knowledge of teaching strategies and their implications for learning, as well as knowledge about what the learner brings to the learning situation. They regard TCK as an, “understanding of the manner in which technology and content influence and constrain one another” (Mishra & Koehler, 2008, p. 7). This includes the understanding of how subject matter “can be changed by the application of technology” and what kind of technologies can be used to facilitate the learning of subject matter.
TPK can be regarded as “an understanding of how teaching and learning changes when particular technologies are used” (Mishra & Koehler, 2008, p. 9). This implies knowledge about pedagogical constraints and the potential of technological tools when used in different ways and situations in a specific subject or disciplinary context. Put together and integrated, PCK, TCK, and TPK constitute TPACK. Although the TPACK framework has been well received in the field of educational technology, it still needs further clarification (Graham, 2011). The lack of clear definitions for the different concepts of the TPACK framework and the difficulty of separating the different domains of the framework are some of the issues that have been highlighted in previous research (Angeli & Valanides, 2009; Archambault & Barnett, 2010). In our self-study, we used the conceptual framework of TPACK to visualize and analyze our own prerequisites, understanding, and actions when using technology to support learning. In other words, we analyzed our own PCK, TCK, and TPK and how these aspects of TPACK (and thus our own TPACK) might evolve during the design and realization of the course. In this, our understanding of the teaching practice has challenged and developed our understanding of the theoretical framework. Thus, there has been a dialectic process between the theoretical framework and the teaching practice.

Developing and Understanding TPACK through Self-Study

In this section, we present our understanding of how various components of the framework of TPACK have influenced the course and how during the course we developed and changed our TPACK.
Planning and Teaching the Course

We believe that purposeful use of ICT for learning cannot effectively be taught as a separate skill, but must be learnt actively by practicing in a context in which the dynamic relationship among ICT, content, and pedagogy is recognized (Harris & Hofer, 2009; Koehler & Mishra, 2005). Thus, we decided not to offer a traditional course with us as teachers primarily instructing and students copying, but to instead adopt a learning-by-design approach (Kjällander, 2011; Koehler & Mishra, 2005). This meant that students were asked to use curriculum and syllabi objectives as starting points and then design their own learning processes by exploring ICT (in particular web 2.0 tools) and learn how to use the tools while considering their relationship with and suitability for content and pedagogy. These are regarded as basic steps in developing one’s TPACK. Making decisions about course design and ways of working was based on our PCK, i.e. what we knew about ICT as a learning tool and how it should be taught and learned in this context.

The subject matter of the course was the pedagogical use of ICT for teaching and learning. In other words, the CK in this course included knowledge about technology (TK) and pedagogy (PK). This sometimes made it difficult to determine whether what we saw, or did, were signs of TCK, TPK, or even TPACK. However, we believe that our experiences also confirm some of the concerns that have been raised about the TPACK framework, specifically, the difficulty of defining and/or separating the different domains of the framework (Archambault & Barnett, 2010). We illustrate this by using an example from the course where a student used a Prezi to illustrate the different steps involved in making a cake. (Prezi is an online visual presentation tool that allows the audience to interact with the content by moving around and zooming in and out on a large canvas that can be filled with images, video, and text.) When opening the Prezi, an overview of the complete process was given, with ingredients, utensils, and the finished cake all visible. The zooming function in Prezi then allowed users to zoom in on the different steps of the process and get more specific information when a particular step was enlarged. Students’ use of the digital tool (Prezi) could be labeled as TCK, where CK in this case could be home economics and the TCK label would refer to how the use of the tool helped users understand how to bake a cake. However, understanding and focusing on the pedagogical potential of Prezi as a tool that potentially changes learning by admitting interactivity, zoomability and thus a viewer-centered experience could be labeled TPK.

One way in which both we and the students developed our CK, TCK, and TPK was in our understanding of how the user is likely to experience the digital learning object. Will he or she understand the potentials of the tool and will the outcome be the intended one? The fact that the usefulness of ICT as a tool for learning is currently being researched and practically tested in schools all over the world makes such considerations vital for teachers. For example, when using a book we may take it for granted that everyone knows how to use it and not think much about PK and TK. For example, we rarely say:

Turn the book so that the front cover is visible. The front cover is the one with the biggest letters and perhaps a picture on it. With your left hand reach over to the right side of the book and open its cover. After turning a few pages you might find what we call a contents page.

You will recognize this by…

However, when using new technologies like those we used in the course, we had to use our PK, and because these were digital, we also had to use our TK to explain pedagogically how to use the tools technically. One example was the use of Google documents in the course. Because the interface of Google Docs is similar to that of ordinary word-processing software, the students often tended to search their hard drives for the documents they had...
created and had difficulty in understanding our instructions to share the link to their documents. Realizing that it was not physically stored on their hard drives and that we could collaborate on the same document without them sending it to us required students to take a conceptual leap to include this as part of their TK and TPK.

As teachers we made sure that we used all the digital tools we recommended to the students. This was done in order to gain proficiency in the use of the tools (TK), exemplify how they could be used (TCK) and develop a better understanding of the potential of the tools and how using them might change teaching and learning (TPK). In short, we learned and developed TPACK, or parts of it, together with the students.

Given the multimodal nature of the course, we realized that written instructions alone would be insufficient. We therefore supplied the students with an interactive and multimedia-rich website that offered visual and/or audio examples of possible digital resources to use, ideas about how to use some of these resources from a pedagogical perspective and links to, or short explanatory texts about, how to learn how to use them. Understanding that using written instructions alone would be limiting and that a website with audio, images, and video would help us transform CK was a sign of TK (we knew how to make a website) and of TCK (we used technology in a way we thought would help students learn subject matter). It was also a sign of PCK, given that we considered the prerequisites and context of the course, interpreted the subject matter and represented it in several ways (Mishra & Koehler, 2008, p. 7).

Using technology to create digital multimodal learning objects such as those found on the course website required us to develop and display TK and TCK. We decided to make these digital multimodal learning objects available because we knew that this was a complex and relatively new domain for many of the students (CK) and that providing experienced and motivated university students with audiovisual examples that they could access whenever they wished would support their learning (PK and TPK). For example, realizing that some of the students experienced the course environment as new and confusing, we made a Prezi in order to help students visualize the different parts of the course environment and how they interacted with each other. We also made screencasts that showed students how to create blog entries and from there upload, embed, or link to their digital learning resources. Student conversations and the course evaluation responses showed that the Prezis, screencasts and what we said in them had been useful supports of student learning, which indicates that here we possibly displayed TPACK.

The Assessment and Evaluation Process

Assessment of the students’ productions revealed aspects of the students’ challenges in integrating PCK, TCK, and TPK into TPACK. The challenge for us as teachers in ascertaining, assessing, and aggregating the different aspects of TPACK was also made visible. One major challenge was to adopt a holistic approach to TPACK and not to focus on the different aspects of PCK, TCK, and TPK in the productions. This was especially obvious in the productions where something deviant was clearly revealed, e.g., major lapses in technological, pedagogical, or content knowledge revealing flaws in PCK, TCK, or TPK. For instance, in one situation we evaluated a student’s story of the cycle of water. In the story, the animated water drop, Stina, with human characteristics, completed the cycle in one day. From being a water drop in a lake, the sun shone and she became hot and “flew” with animated wings up to the clouds. There it was colder and she started to freeze and turned into a piece of ice. She then fell down into the water again, but luckily had an umbrella. With human characteristics, a name, wings, an umbrella, and the story teller’s
voice, the animation made the story come alive. From a technological and pedagogical perspective, it was impressive and seemed to reveal TK, TCK, PK, and PCK about how to attract children’s attention and stimulate their imagination. If someone with a limited CK had evaluated the animation, it would have been possible to ignore the weaknesses in the CK and thus also the PCK presented. However, someone with a good CK would probably identify a chain of factual errors in the presentation, and someone with TCK would most likely identify some of the shortcomings influencing the PCK. Thus, in the extensive analyses of this animation, both the tensions and dynamics of the different aspects of TPACK emerged. From this, we learned that it is important to understand these factors in order to adopt a holistic approach to the whole TPACK framework, and not just its parts.

As indicated above, it was sometimes challenging to evaluate the quality of student assignments, i.e. their digital learning objects. Our instructions may have contributed to this. The fact that the potential of many digital tools allows them to be used in so many ways means that teachers have to be very careful about how they word their instructions if they want students to understand the desired learning outcome. If you give someone a piece of paper and ask them to fold it in a way that will make it fly, you will get differently constructed paper planes but will still be able to grade the person on esthetic design and flying ability. However, if you ask someone to make a web quest you have to carefully specify what you will actually be assessing (quality and complexity of the questions, choice of tools for the web quest, choice of multimedia content, etc.).

In addition, the complexity of the tools does not provide the user with many clues as to how and why to use them. This is also true for less complex technology, but even more so for many digital tools today. Student assignments in the form of a web quest will probably all turn out very differently – much more so than when making a paper plane – and therefore be harder to assess.

The Power of Different Skills

Another thing that really struck us was the power of our different skills and experiences and how this could shape our focus and understanding of the theoretical framework and practice of TPCK. However, this should not be taken to mean that we had not previously understood that people with different experiences and perspectives conceptualize things in different ways and because of that act differently. On the contrary, we were very aware of this. Our point here is that through the self-study analyses, we really became aware of how these different skills and experiences could come together in a course and in our own self-analyses and thus shape and focus our understanding and actions. Some examples of this will be given later, but before that we would like to discuss specific aspects of our different skills and experiences.

We had rather different experiences of the content and the technology used in this course and of being teacher educators and researchers. Fransson has been a teacher educator for nearly 15 years, is involved in research and has a PhD, but has limited experience of using OERs or web 2.0 resources. Holmberg has been partly involved in teacher education for the last 5 years but has extensive experience of using OERs and web 2.0 resources in innovative ways, both privately and as an upper secondary school teacher.

When these different experiences came together in the planning, teaching, and evaluation of the course and in the self-study reflections, we often became aware of our taken-for-granted assumptions and had to renegotiate our own understandings and perspectives. For instance, the one with less experience of using OERs or web 2.0 resources,
but with a greater experience of teaching student teachers, was more often able to identify some of the students’ reactions and challenges during the course, because to a certain extent he had undertaken a similar “journey of learning” to that of the students. For instance, he knew what kind of challenges the students would be facing at the very beginning of the course when they tried to conceptualize how they would organize the submission of their examination tasks in the web 2.0 application (i.e. he had a better PCK). Both the students and the teacher were using submitting tasks in the university’s earlier versions of its Learning Management System (LMS), but in this course the tasks would be submitted via an upgraded version of the LMS with greater web 2.0 functionality. He also used words and metaphors from daily life to try to explain this difference in an “ordinary way,” exemplifying the way the earlier LMS worked by referring to how one organized papers in a binder, with folders and headlines, but how this way of thinking was not always applicable in the new LMS and in this course. In this context, he experienced and tried to adopt a student perspective which, together with his PK and CK, enabled him to use relevant analogies to “transfer” CK to PCK. Based on these experiences, it could be claimed that in some cases being an “expert” might make one take certain things for granted, which in turn might lead to missing students’ proximal zone of development (cf. Sandretto, 2009).

Because the less technologically knowledgeable teacher was not familiar with all the digital tools used in the course, he did not always know what could be achieved with them and how they might best be used. This could be seen as a lack of TK and thus a fragmented TPACK. However, in this course, and because of our different skills combined with structured reflections, our TK, TCK, and TPK actually increased, since he asked questions and saw possibilities for which the tools were perhaps not originally intended. For example, when talking to a student who had made a presentation with photos, audio, and text describing different objects, he wondered whether the tool had a “karaoke function” that would make it possible to change the color of the text at the same time as the words were being read aloud. The fact that he did not know that the tool had no such karaoke function (combined with his PK) made him ask that question. This idea led to the student finding a “work around” and using the tool in a way other than intended to achieve the karaoke function, thus expanding everyone’s TK.

On the other hand, the more technologically knowledgeable teacher had a greater understanding of the potential of the different digital resources and could thus advise students more accurately about which tools to use to transform a certain content or achieve a certain pedagogical result (because of his TCK and TPK). His greater experience of using ICT to support learning also made it easier for him to understand and prevent problems the students might come across when using certain technology. Because of his TK, he knew what might cause confusion when using a certain tool.

However, knowing what might or might not be accomplished with a certain tool also proved somewhat problematic when considering how to support and assess students. The more technologically knowledgeable teacher found himself sometimes giving credit to students for showing the potential of technology, or asking why students had not used the full potential of a certain tool. When discussing these examples with the less technologically knowledgeable teacher, he had not always “seen” this. This illustrated how our own TK, TCK, and TPK enabled or limited us when assessing the pedagogical use of technologies. We learned the importance (and difficulty) of considering how transparent the potentials of certain digital applications were, and to what extent the students could be expected to take advantage of the potentials. This dilemma was illustrated by a sports analogy written during one of our self-study sessions:
If assessing a pole vaulter, should you only assess him/her based on how high he/she jumped or should you take into consideration, and base your assessment on, the fact that you know that he/she would probably have jumped even higher if he/she had chosen a softer or harder pole?

In this, we for instance learned that we needed to have a better idea of whether or not the students (pole vaulters) had well-considered reasons for using a certain digital application (pole) in a certain way.

There were also other examples of how our different skills, frames, and points of departures influenced the process of assessing the students’ texts. For instance, the teacher with a formal academic degree tended to focus on traditional academic skills and content in the students’ texts, e.g., how the literature was integrated in their arguments, or on the analytical level of the discussions. However, on reading the same texts the teacher with a greater experience of using ICT tended to focus on the pedagogical added value the students addressed. When we identified our different focuses, we concluded that being able to critically scrutinize whether or not ICT brings any added value was a more important skill, especially as the formulation of the course goals required students to expressively motivate their use of ICT and avoid techno-centrism and the use of ICT “for its own sake.”

**Concluding Comments**

In this self-study, the theoretical framework of TPACK has been used in our analyses and in our understanding of practice. At the same time, the practice has been fundamental for developing and understanding the theoretical framework of TPACK. Thus, the dialectical process between theory and practice has been crucial in our learning process. We stress our understanding that theory and practice are two inseparable aspects of the same coin (Bullock & Christou, 2009). Through our self-study, we have to some extent taken further steps in integrating theory and practice.

One of the learning interests of this self-study was to analyze how we elaborated and developed our understanding of the theoretical framework of TPACK. By systematically relating the different components of the theoretical framework to various aspects of our teaching practice and students’ digital multimedia resources for learning, we have shown how we conceptualized various aspects of the TPACK framework. When analyzing how we elaborated and developed our understanding of the theoretical framework, we learned how we understood the theoretical perspective from different perspectives and points of view. For instance, the teacher who had more experience of teaching ICT found it easier to understand and relate to the theory than the teacher who was more academically oriented. Our conclusion is, therefore, that having extended experience of the practical implications of ICT makes it easier to fully understand aspects of the theory and, consequently, be in a better position to integrate theory and practice.

It is clear to us that during the process of designing and teaching the course, we were developing our CK, PK, and TK. We also developed a greater understanding of how technology and content influence and constrain each other (TCK) and how teaching and learning change depending on which technologies are used (TPK). Thus, we have moved one step further in our development of TPACK. Exactly in which situations we as individual teachers have displayed TPACK during the course is more difficult to say, because this is a complex and situated form of knowledge. However, working together closely, comparing our experiences, and discussing our own and the students’ shortcomings and realizations have not only helped us to analyze and develop our TPACK and the aspects it constitutes but also given our students access to a teacher team...
with complementary skills. In this sense, we came closer to displaying TPACK than we would have done as individuals or as a teacher team without the planned exchange of experiences and reflections.

Some conclusions at organizational and institutional levels can be drawn. First, the way in which we have tried to understand the theoretical framework of TPACK does not follow familiar ways of learning to understand theories in the academic world, where theories are often said to be learnt by reading theoretical works or research. Thus, this way of practicing, analyzing, and elaborating an understanding of both practice and the theoretical framework of TPACK, via a dialectic alteration between theory and practice, to some extent goes beyond institutionalized academic ways of learning.

Second, the innovative elements of the course, such as the students’ greater freedom and the ICT tools used, challenged them more than they were used to. Thus, our self-study has revealed taken-for-granted organizational and institutional assumptions about teaching, learning, and assessment in teacher education.

Third, in addition to understanding what constitutes CK, PK, and PCK for different categories of teachers (pre-, compulsory-, and upper secondary school teachers), a teacher educator today should ideally have an understanding of the TK, TCK, and TPK that each category of student teacher should have. Given that technology is constantly changing the nature of TK (and hence TCK and TPK), this will also change quite rapidly, thereby posing new challenges for teacher education at the individual level as well as at organizational and institutional levels. Finally, this research has strengthened our conviction that self-study research is a powerful tool for professional development. There is thus a greater potential at organizational and institutional levels to implement and document self-study research for the professional learning and professionalization of teacher educators.

References


