TPACK as shared, distributed knowledge

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Abstract: This article is summing up experiences from five years of *Learning Networks* established to facilitate the implementation of basic skills in all subjects and on all levels of primary and secondary education in Norway. Among the basic skills is *digital literacy*. The local schools and their school managers and teachers are expected to be professionals and responsible for interpreting the new curriculums and transform them to local plans, setting focus on content, tasks, working methods and the use of technology. The distributed responsibility for the development of local plans claims a common frame for discussions and interpretations. In this setting TPACK has turned out to b a useful model for understanding practice and management today, for defining competence needs among teachers and school managers and as a strategy tool for school development.

Background

In the years 2004-2009 there have been established several *Learning Networks* in all regions in Norway, linking different schools, municipalities, county governors and teacher training colleges together. The aim was to establish a common understanding of digital literacy as a part of the national curriculum reform, *the Knowledge Promotion* (Ministry of Education and Research, 2006), and to support the schools in their implementation work. In addition, the networks should encourage new practice and reflections and support knowledge creation on ICT in teaching and learning at each schools. The functionality of networks like this is described by Veugelers and Zijlstra (Veugelers & O'Hair, 2005).

The Nordic model of labour relations is based on a democratic understanding, meaning contributions from all participants in a society (Dølvik 2007). The impact on schools and education is contribution from pupils, teachers, parents and school managers in development processes. Thus the implementation of ICT in Norwegian schools is not a simply a question of implementing national defined models and methods. It is also a question of finding and making new tracks together in communities of practice. Schools as learning organizations claim for other models of understanding (Senge 2000).

Digital literacy is defined as skills, knowledge and attitudes through the use of digital media for mastery in the learning society (Erstad, 2005). There have been several projects underlining the importance of using ICT in schools and learning processes in Norway during the last fifteen years. Despite the efforts of these projects, surveys (ITU-monitor) shows large differences between municipalities, schools and teachers regarding the extent to which ICT is used in learning activities (Arnseth et al, 2007). To counteract the digital divide as a result of these differences, it is a challenge to increase the use of ICT in learning activities on a broader level, making it a part of the learning culture and the digital landscape both in schools, businesses, municipalities and teacher training. The learning landscape has become more complex and the context is continuously changing. This calls for several social, organizational and pedagogical dimensions (Krumsvik, 2007; Hauge et al, 2007). Students are digital learners and used to more collective ways of thinking and learning, and are familiar to knowledge building across borders (Tapscott, 2009, Pedro, 2006 & Brown, 2008). The physical space of learning is expanded with a new virtual learning space where both students and teachers become parts of more collaborative knowledge building (Østerud 2009). In this context, the teacher's role turns into a manager and designer of learning (Hauge, et al., 2007; Krumsvik, 2007).

A central part of school management and school development, as well as teacher training programs, are the continuing changing role of teachers. In Norway, schools are rated low as learning organizations compared to other branches (Hagen et al, 2004). Thus, school development and school management is more focused on the Knowledge Promotion Reform and the implementation of the new national curriculum. To succeed with the implementation of the national education policies including digital literacy, school managers need tools for understanding the complexity and supporting the development of learning organizations.

The TPACK model is significant in this context, because it highlights the complex knowledge areas needed for the 21st century. The theoretical framework can play a significant part in the understanding of teachers' knowledge and ideas in relation to the use of ICT in a teaching context, while it also can contribute to the debate about *what* teachers need to know and *how* such knowledge can be developed (Mishra & Koehler, 2006). This model is based on Lee S. Shulman's research on the teacher's practice with a holistic view, where the teacher's pedagogical skills are viewed in the context of the teachers' professional knowledge and not as two separate knowledge areas (Shulman, 1986, 1987). TPACK is often used for professionalization of teachers either in teacher training programs or as reflections on the individual teacher's practices in schools (Pierson, 2008). Our experiences in *Learning Networks* have made visible that there are challenges beyond the model's individual-oriented focus. The TPACK model has also proven to be useful to describe the complexity of skills required at other learning arenas and other levels in the educational system.

TPACK can be used as a framework that makes visible the interplay between the knowledge of content, pedagogy and technology. The challenge to understand practice is to recognize that these three knowledge areas are dynamic, flexible and interdependent. The Scandinavian tradition of "didactics" holds such combined perspectives and can be related to Shulman´s concept of pedagogical content knowledge (Shulman, 1986, 1987). The Scandinavian use and understanding of "didactics", builds on the German tradition of "bildung theories" going back to Comenius in the early seventeen century. In Scandinavia, didactics has gradually evolved into a separate field of research (Lorentzen et al, 1998). It is the field of *subject-matter didaktics* (Fachdidaktik) which has a lot in common with PCK, and thereby TPACK. In the study of subject-matter didaktik, students learn how to combine subject matter with pedagogy to find the best possible ways to teach a specific content.

Sigrun Gudmundsdottir was among the first to bring the construct of PCK to the Scandinavian research tradition. She was one of the original contributors to Shulmans "Knowledge Growth in a profession"-project in the mid-eighties at Stanford, and she continued to work closely with Shulman and published extensively in the field of educational research. Gudmundsdottir used the term *PCK* and *fachdidaktik* as alternating terms, but pointed out that the term *didactic* incorporated more specific values, deriving from the *bildung* tradition (Gudmundsdottir, 1990). Others have also discussed the relationship between didaktik and PCK, trying to bridge the distance between two separate traditions (Alexander, 2004; Hamilton, 1999; Kansanen, 2009). In the Anglo-Saxon culture and language the use of didactics has until recently been associated with negative connotations. Riquarts and Hopmann (1995) have resolved to avoid this problem by writing *Didaktik* as in the German tradition.

The field of didaktik is continuously developing and new areas of didaktik are coming up according to the development of knowledge in the society. For example, there is a growing interest for what we in English language can call inter-subject didaktik that sets focus on how to teach several subject-areas as a whole. Basic skills like reading, writing, mathematics and digital literacy are included in all subjects on all educational levels as a part of The Knowledge Promotion reform in Norway. As such content can be reading Norwegian, mathematical calculation and history. Not only history. In vocational subjects the content can be writing, mathematics and physics in addition to production, technical services and quality at the same time. The new curriculums in Norway are based on competences and outcomes are measured by the pupil's abilities to show their knowledge in practical situations through complex tasks/challenges. Complex tasks claim for inter-subject thinking. The questions about what the student will learn and how and why to learn this, is a natural starting point in all teachers planning. In this way the expert knowledge is "didaktified" through the operationalization of the knowledge field into teaching (Ongstad, 2006). These questions are equally important when we start to use ICT in teaching. ICT in teaching gives rise to new tension between content and ICT and between pedagogy and ICT. In addition, *The Knowledge Promotion* includes tensions between traditional subject content and claims for entirety and coherence throughout all levels in primary, secondary and upper secondary education.

School development and school management in a digital landscape

The Norwegian curriculum reform gives managers both a possibility to act, to create and take the digital learning landscape in use. This includes cooperation with teachers, students, parents, businesses and suppliers of technology. It also includes interdisciplinary collaboration. For managers it asks for knowledge in several areas such as learning, ICT and learning, changing organizations and transfer of learning across arenas (Halland, 2005). Learning in organizations is comparable to individual learning. Both are linked to the learning of solving complex problems through interdisciplinary approaches in a community and to be prepared to changing environments (Engeström, 1987; Engeström & Young, 2001; Säljö, 2001).

In addition, a digital learning landscape involves learning arenas outside schools and these arenas are different from the school, in terms of content, form and culture. Thus transfer of knowledge between the arenas brings about great challenges both for teachers and managers (Engeström & Tuomi-Gröhn, 2003). Managers have to facilitate students, teachers and managers in their knowledge building through reflections and documentations across arenas. A part of this facilitation includes the use of technology suitable on all arenas. Another perspective is given by Ludvigsen (2007) who focuses on learning and learning outcomes that are closely tied to mastery and an expert knowledge and therefore expand the concept of factual knowledge. Thus it encompasses a balance between the given and the new for both learning and teaching and as such becomes a challenge also for school management.

This complexity thrives for professional school management including the skills, knowledge and ability to organize and support learning in a digital landscape. In projects within the *Learning Networks* we have experienced that TPACK works as a fruitful model for understanding practice and management today, for defining competence needs among teachers and school managers and as a strategy tool for school development.

TPACK as shared, distributed knowledge in learning organizations

One of the founding ideas in the *Learning Networks* project was seeing schools and their collaborating partners as learning organizations. Senge (1990) defines learning organizations as *"Organizations where people continually expand their capacity to create the results they truly desire, where new and expansive patterns of thinking are nurtured, where collective aspiration is set free, and where people are continually learning to learn together."* Participants in the *Learning Networks* has pointed out that the networks have given them courage and confidence to go "outside the black-box" and try new things. Together they have worked with challenges in daily practice. By using TPACK to structure and systematize experiences, we have seen a professionalization of the work with implementing the digital literacy of the Norwegian Knowledge Promotion Reform. To be more professional bettering this setting is to understand the complexity and the interplay between content, technology and pedagogy. In addition the professional way of working foster deeper didaktik discussions across expertise fields, between teachers and managers and between managers and municipalities or county governors. More professional work also implies that they are able to state the reasons for their planning and organizing of the learning processes by using concepts and theories that form the basis of the TPACK model. TPACK becomes shared and distributed.

Both teachers and managers have become more aware of their own competences and lack of competences through the *Learning Networks*. In Norway municipalities and county governors are as school owners responsible for recruiting and for in-service training of teachers and managers. Bringing TPACK into the didaktik discussions in Norwegian teacher training has been successful. As an extension of *Learning Networks*, we are now planning in-service training of teachers and managers that is related to the use of ICT in teaching and learning and the implementation of students´ digital literacy. In this work, the TPACK model will be used in cooperation with the municipalities and county governors.

With the Norwegian *Knowledge Promotion*, workplaces have become a part of the learning landscape together with schools and social web. Using TPACK to understand the differences and the strengths and weaknesses on the different arenas has been helpful.

We have also experienced that working with the implementation of ICT does not need to be an individual school project, but can be stimulated by the active involvement of the municipality and the managers in the network. A local plan is not synonymous with a plan for each school. A well-designed common planning may be appropriate where many small schools find it difficult to implement comprehensive planning and to provide room for local adaptations. Furthermore, joint efforts by the municipality or county governor provide favorable conditions for the overall training and joint procurement of technology. Through the *Learning Networks*, we have learned that a local ICT plan that is developed in one school district can be adapted and used as template in another school district.

We have learned from the examples in the *Learning networks* that school development can emerge from discussions between students, teachers and managers and lead to:

- the use of many different learning arenas and assessing their suitability in relation to learning and knowledge building
- a greater openness and a sharing culture among both teachers and students
- a focus on the school as a learning organization
- documentation of learning and knowledge-building in social software (wiki and blogs outside LMS)
- networking with emphasis on scientific and methodological innovation
- the involvement of school owners in the development processes

For some of the schools, the TPACK model has been used as a tool in this process. Based on these experiences we suggest using the TPACK model to inspire, reflect on consequences and state the reasons in other schools, becoming a shared framework for mangers in their work of implementing digital literacy according to the request of the Knowledge Reform.
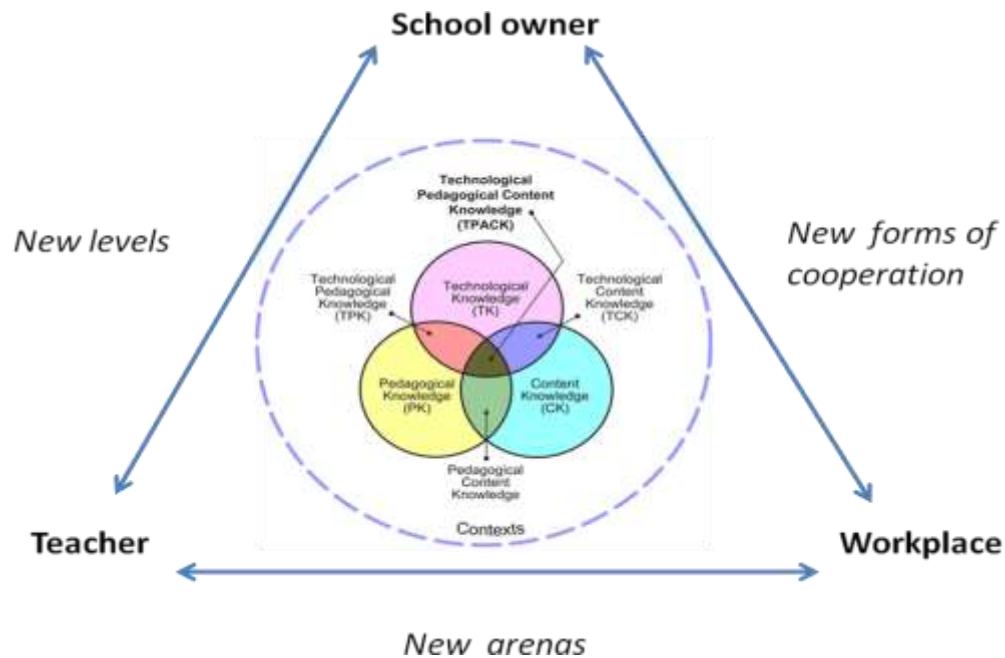

Figure 1 TPACK in new arenas and new levels in education

The TPACK model, which is originally designed with the primary purpose to describe the individual teacher's compound didaktik ICT skills, has proven to be useful to describe the complexity of skills required in other *arenas* and other *levels* in education. In addition to the challenges we face in schools as traditional learning arena,

we see new arenas that require reflection on the integration of ICT in scientific-pedagogical activity. The workplace is also a learning arena that requires professional and pedagogical ICT skills. Similarly, we see that the work on the integration of ICT can be lifted to the level of "school owners" as municipalities and county governors, but requires an awareness of the complexity of the didaktik ICT competence.

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