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# Pedagogical Foundation and Significance of the ICT Studies for the Teacher Trainees' in Their Studies

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**Abstract:** Finnish national core curriculum (2014) highlights the important of ICT. A strong theoretical model and pedagogical understanding are needed for the innovative teaching use of technology. In this study we describe theoretical background of our ICT education and development of teacher trainees ICT-skills and pedagogical understanding. The students' study module is based on Mishra and Koehler's TPACK-model (2006). The data was collected during two years from two student groups (N=52). Results indicated that, in general, the studies have made it possible to acquire the technological competence and to combine the pedagogical knowledge with the technology. The results of the study clearly state that the education supports understanding the use of ICT. The results show that understanding the pedagogical use of technology has emerged. Technical support given by the ICT and the possibility to adapt ICT that is offered in all the study modules have clearly been useful to the students.

## Introduction

The discussion around the teaching use of ICT has been heated already for years. In Finland, reinforcing the teaching use of ICT is a central education political objective and in connection to this the instructions have been published where the strategic objectives for the teaching use of ICT have been specified (see Ministry of Education and Culture 2010 and the Consultative committee of the everyday information society 2010.) In these instructions the pedagogical models, practices as well as teacher education have been mentioned, among others, as strategic definitions of policy. The task of the teacher education is to guarantee the graduating teachers sufficient and versatile skills and competences for independent operation as teachers. These skills include, among others, the use of information and communication technology (ICT) in teaching and learning. The ICT skills of the teachers and teaching use of ICT have already been widely researched and the Finnish teachers' teaching use of ICT is low according to several reports. This is explained by the factors to do with pedagogics and attitudes as well as the level of equipment (see European commission 2013, the Finnish National Board of Education 2011, the Consultative committee of the everyday information society 2009; ). As the obstacles of establishing the teaching use, among others, the lack of the pedagogical support, the low use of the pedagogical models and practices and the need for updating the teacher education have been mentioned (the Consultative committee of the everyday information society 2009 13-23; Survey of Schools 2013; Taajamo, Puhakka & Välijärvi 2015, 31).

In teacher education the attitude is mainly positive towards the use of ICT and the possibilities it offers to be educated in the use of ICT are good. Instead, the pedagogical teaching use of ICT has received little attention in teacher education (Martinovic & Zhang, 2012). According to the study by Meisalo, Lavonen, Sormunen and Vesisenaho (2010) ICT has to be included in all the study modules of the education and they need to demonstrate how learning with the help of ICT supports, among others, the activity of the learner, community spirit, construction of knowledge, contextual approach and above all increases motivation and interest in learning. It is the task of the teacher education to offer the students learning environments where they are first able to train their ICT skills in their own studies and after that to adapt them with the pupils at school. Understanding the pedagogical use is central. The teaching use of ICT should be supportive of learning with understanding in which case interaction, versatile forms of expression, paying attention to the individual learning styles, meta cognitive learning as well as cooperation and collaboration would be realized in the learning. Generally, the studies have shown that the teachers use ICT mainly by themselves

as a presentational technique in front of the class and in the pupils' individual and independent learning situations. According to Rikala, Hiltunen and Vesisenaho (2014, 2534) teachers need support and knowledge on how to use mobile technologies as well as how to utilize them in a more student-centered way. The curriculum of basic education which came into effect in autumn 2016 requires that ICT is systematically used in all the year groups of the basic education, in the different subjects and in the multidisciplinary learning modules as well as in other schoolwork (the Core Curriculum of Basic Education 2014, 23). The teachers' competence and attitudes have a central role in how the use of technology in teaching takes place (Cicero, 2008). So it is important that the teacher understands ICT as a teaching method which, when used in a pedagogically meaningful way, creates the possibilities for a multi-level learning which utilizes the dimensions of the digital age. This requires first of all the teacher's role to change to be more guiding but also the development of pedagogical and didactic approaches. The attitude towards ICT is also in a crucial position and therefore the positive attitude towards ICT is important.

According to the Information society of education 2020-vision set by the Ministry of Education and Culture (2012) the objective is that all the graduating teachers have good basic competences acquired during their studies to use up-to-date information and communication technology every day as a teacher as a support and an enabler of teaching and other work (see Husu & Toom, 2016, 12; Quakrim-Soivio, Rinkinen & Karjalainen, 2015, 100). The future class teachers must understand the 21<sup>st</sup> century skills (cf. Norrena, Kankaanranta & Nieminen, 2011), and they must have the competence in the teaching approaches which make learning them possible. According to the international study by ITL, the innovative teaching approaches are strongly connected to learning the 21<sup>st</sup> century skills (Norrena et al. 2011). The use of ICT in teaching does not automatically change pedagogics (Balanskat & Sali, 2009) but a wide understanding of the relationship of technology, pedagogics and contents is needed to promote learning. The TPACK-framework developed by Koehler and Mishra (2009) provides the theoretical framework for the profound understanding of ICT-pedagogics. The technology can be best used in the teaching by combining it with approaches that are in accordance with a new conception of learning, such as, the project format, integrating subjects, working approaches which support the pupils' mutual interaction and problem solving. The establishing of ICT as a natural part of learning requires the integration of the use of technology and pedagogical practices. New conceptions of learning in which the social construction of knowledge and cooperation are emphasized can also be realized with the help of ICT. (Kumpulainen & Lipponen, 2010 11,15). A strong theoretical model and pedagogical understanding are needed for the innovative teaching use of technology. According to the ITL study, the innovative teachers used more versatile methods than other teachers, such as, student centered pedagogics, extending teaching outside the classroom as well as integration of information technology in teaching and learning. These teachers combined innovative and traditional teaching methods in teaching. In the teacher education one threat that is seen in connection to the pedagogical models is the fact that the traditional models of teaching transfer as such to the teaching which uses ICT because the pre-service teachers haven't got enough possibilities to practise using ICT in teaching. The technical ICT skills of the students are usually sufficient but the teaching use requires studying. This article shows the implementation of ICT studies in Kokkola University Consortium Chydenius and also the skills of the teacher trainees and their understanding of the pedagogical use of ICT.

## **The Aim of the Research**

The purpose of the study is first of all to analyse the ICT skills of the students and their attitude towards the teaching use of ICT. Furthermore, we clarify how the ICT study module supports the adapting of ICT in the studies. The research data was collected with the help of questionnaires. The second writer of the article planned and carried out the ICT course during the years 2015-2016 and collected the learning diaries concerning the ICT course from the students and transcribed the experiences from the study module.

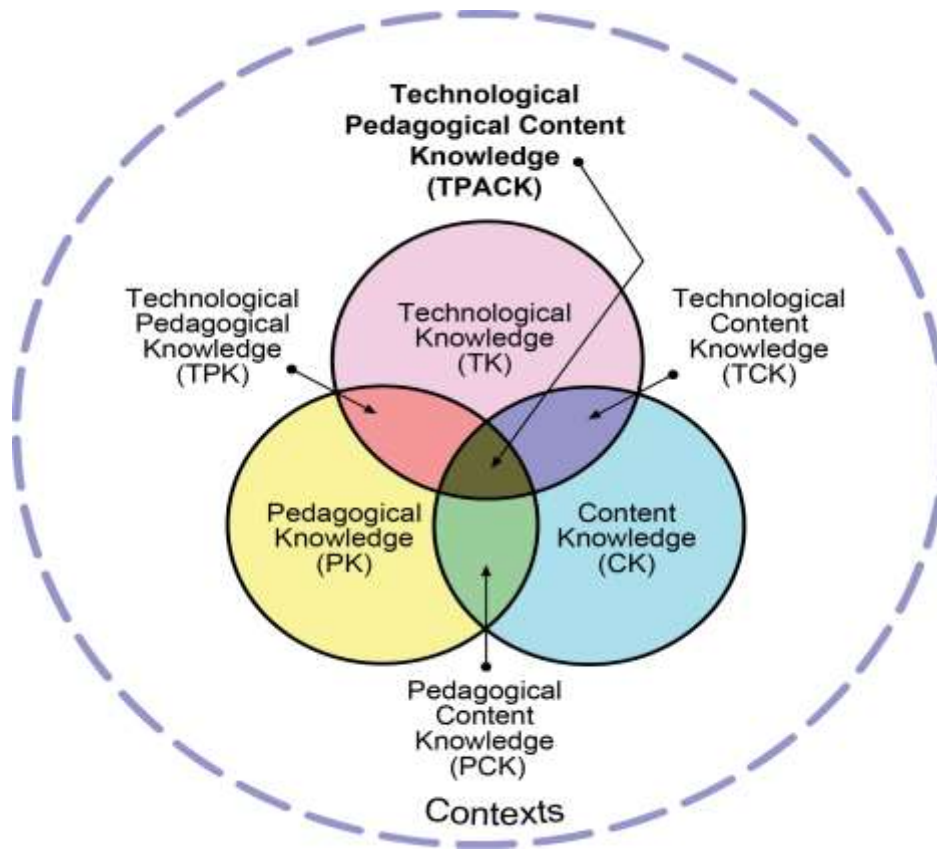
The earlier empirical studies show that it has been fruitless to bring ICT to the university education if the pedagogical questions have not been thought about at all (Pedro 2005). In the government report "Producing and renewing Finland – Digital agenda for 2011-2020" it was identified that the possibilities of the pedagogical operational models and methods are still not widely used in the education. In earlier studies the use of ICT that is related to the students' own studying has also been clarified, but the pedagogic use of ICT has received less attention. The challenge indeed is to reform the teacher education so that during the course of it the students will learn to use ICT as the support for education and learning and in other operations (Council of State 2010). According to the earlier study by the Kokkola University Consortium Chydenius the use of iPads in pedagogically meaningful way requires developing the education (Meriläinen, Piispanen & Valli, 2014, 3251-3253). In Finnish teacher education the collaborative learning theory is emphasized and the use of ICT in the acquisition and handling of information is in many ways supported. Thus one can suppose that teacher trainees have the ability to extend their use of ICT to include pedagogical solutions also in

their teaching. Therefore the attention has been paid together in this study to the introduction of pedagogics and ICT. In the study the approach of our education with the objective to support the development of the students' own ICT skills but also to internalize the profound pedagogical way of thinking of ICT is described.

## **Tpack -Framework as a Theoretical Background for ICT –Education**

The ICT teaching of the teacher education has to be based on a strong theoretical framework which can be used to pedagogically justify ICT education. In the core of the high-quality technology teaching there are three central factors: contents, pedagogics and technology as well as the relationships between them (Koehler & Mishra 2009, 62). The technology has to merge to serve the objectives and contents through a functioning pedagogical understanding. TPACK –model presented by Koehler and Mishra (2009) is based on Schulman's (1986) descriptions of the relationships between pedagogics, contents and knowledge (PCK) but it tries to describe how the technology education and PCK -frame operate among themselves in interaction and direct the teacher to plan high quality and functioning learning situations which utilize the technology. In the TPACK –model the teacher's knowledge is described through three principal components: contents, pedagogics and technology. When the model is examined, the subject of interest is the equal manifestation of the interaction between these separate components of knowledge. These sectors are pedagogical content knowledge (PCK), technological content knowledge (TCK), technological pedagogical knowledge (TPK) and technological pedagogical content knowledge, TPACK.

According to Koehler and Mishra (2009) the content, pedagogical and technological knowledge has to be profound. The TPACK-model is divided into different components of knowledge when opened up. The technological knowledge (TK) means knowledge about the use of devices and about adapting the technology to the situations in everyday life as well as the ability to identify the possibilities of technology to reach the learning objectives. The teacher has to have a strong command of the technology and also the knowledge and skills of the current technology. This comprises the media literacy and the understanding of how the technology can be used in a variety of ways to accomplish learning (TK). The pedagogical knowledge (PK) comprises the knowledge of the processes of learning, the methods of managing the group, the planning of teaching, evaluation and of the professional experience of the teacher. Content knowledge (CK) refers to the scientific theory and knowledge about the contents, the concepts, the subject in question to be taught and about its scope. It is important that teaching is based on the solid and scientific theory based contents knowledge (CK) but equally the teacher's pedagogical knowledge (PK) has to be the profound understanding of the processes, methods and practices of learning and of their suitability to the pupils thus forming the pedagogical contents knowledge (PCK). The technological contents knowledge (TCK) is knowledge about the use of the programs, devices and applications to promote the learning of the contents in different subjects whereas the technological pedagogical knowledge (TPK) is an understanding of the effect of the technology to the change in the processes of learning and teaching.



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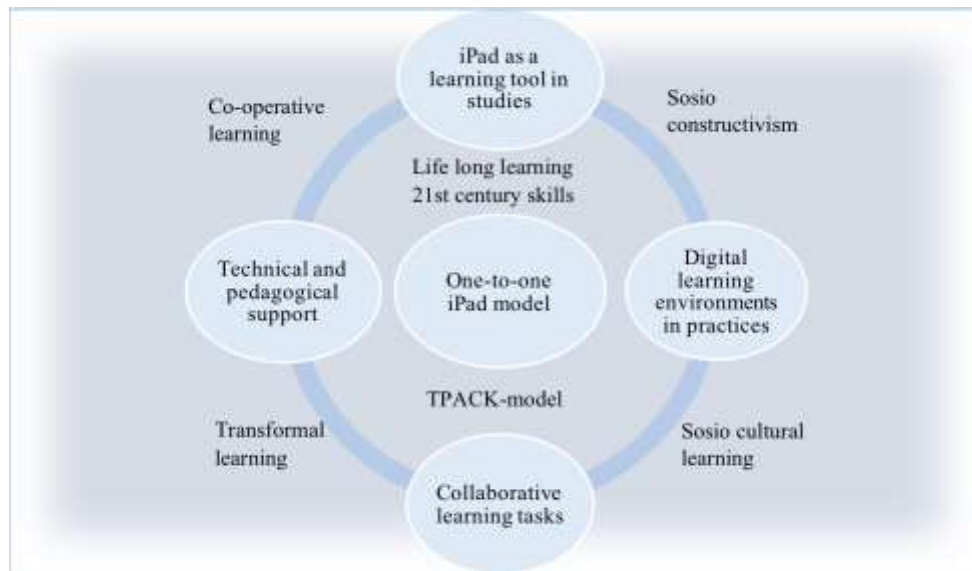
The technology education to be implemented has to be examined according to the model in the light of the combinations of these three main components of knowledge. In order for the ICT education to be as high level and versatile as possible from the point of view of the pupil, it should be formed by a deep combination of pedagogical content knowledge (PK), content knowledge (CK) and technological knowledge (TK). The most central level of the TPACK-model is technological pedagogical content knowledge. This core level merges all the above mentioned components of knowledge together. The foundation of the efficient teaching which uses the technology is in this core and it has to be reformed and developed continuously so that, the levels of different knowledge components remain balanced (Mishra & Koehler 2006, 1028 –1029). The starting point in the integration of technology into learning and teaching should not be technology centered but the focus of the approach has to be the merging of the tool, the available resources, the contents and the levels of pupil's action. The TPACK-model does not describe how this has to take place but gives a clear framework to the educational introduction of technology which justifies where the teaching which utilizes the technology has to be based. (Harris, Mishra & Koehler 2009, 403-405.)

## ICT Integration in Adult Teacher Training Programme

The central objective in national and local strategies of the Finnish teacher education has already for a long time been the integration of learning the pedagogical use of ICT in all the study modules and in the teaching practice periods (Myllyviita & Lavonen, 2014, 118). In order to develop further, the teacher education needs, according to Niinimäki and Salmia (2014, 133) the rapid introduction of the pedagogical practices of mobile learning, good models and

examples with the help of which the educational institutions can further develop the education they provide. Myllyviita and Lavonen (2014 123) have outlined a five-step strategy with the help of which teacher education should develop the use of ICT. 1) The resources and the devices have to be up-to-date together with the visions of pedagogical use. 2) The student has to gain competence to use new devices and programmes and to learn pedagogics at a general level. 3) the ICT competence of the teacher educators has to be developed and their use of ICT supported, 4) the degree requirements of teacher education must indicate the objectives of ICT competence and of the pedagogical use of ICT and 5) the teacher education needs to actively start research projects in developing ICT.

In the class teachers' adult education in the Kokkola University Consortium a personal introduction of technology and topicality, have been guaranteed since 2014 by giving every teacher trainee an iPad for their own use for the duration of the studies which secures the necessary resources (see Lavonen & Myllyviita, 2014). This prepares them for the integration of technology in all the studies and gives an opportunity for understanding and experiencing its pedagogical teaching use. The students get technological guidance and "easing in" side by side as well as a continuously deepening understanding of the pedagogical possibilities to use technology as a tool of learning and teaching. Learning ICT skills has been planned as a comprehensive part of the student's studies (Tab. 1). Also the general wholeness of the education program supports the internalization of ICT skills and the understanding of adapting its pedagogical use. The study module "Teacher's information and communication technology" (Teacher's ICT) contains 7 times 3 hours of contact teaching and 60 hours of independent study. It offers the basic abilities to use ICT in different learning environments and in developing them. The objective is also to realize the pedagogical and social significance of ICT in their own teaching. The use of different applications and the versatile properties together with the utilization of the web-based platforms and social media are included in the contents of the course. In the advanced studies the students can study the pedagogical approaches of media education and gain competence to plan and to implement media pedagogical learning modules through the study module "Media in teaching and learning". The objective of the study module is to direct the student in understanding the possibilities of implementing the media education in studying of contents and in integration as well as deepen the ICT pedagogical skills. (The curriculum of the class teachers' adult education 2014-2017).



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**Table 1:** iPad pedagogy and integration into the curriculum in adult teacher education program

The teacher's ICT -study module provides the competence in the command of the device and the use of the basic software is learned: iMovie, Pages, Keynote, GarageBand, Book Creator, as well as cloud services, such as Google services and YouTube. Furthermore, the students become acquainted with a number of applications which facilitate learning, such as different animation, measuring, image processing and learning game applications as well as learning platforms. The basic guide into introduction of the device is shared through iBooks as an e-book guide. Applications, such as iMovie, GarageBand and Keynote programs are learned by the students by producing the content at the same by themselves, in other words, the application is used directly in a pedagogically meaningful way and the students get learning tasks to realize the pedagogical possibilities to use those applications. The students produce a documentary in small groups of the possibilities of ICT in teaching which includes an interview task. When learning the GarageBand



application, the music is created for the background of their own document, and when Keynote program is learned, the students create teaching material to enliven the narration by using animation. Also the shared storage spaces, such as Showbie and Dropbox will become familiar. The teaching has been designed so that the learning tasks will support the practice, internalization and understanding of the applications, technology and the pedagogical dimension. An attempt is made to open a pedagogical connection through use; using technology has to be meaningful from the point of view of the learning process and it has to be based on personal experience, on active operation, community and self-direction also from the adult student's point of view.

The included example represents how the TPACK-model was adapted in practice in the ICT in teaching -course. The new skill, and learning it, were linked to already existing skills and knowledge and the challenge was increased gradually so that the technology skills of the students developed without their noticing through the exercises, and the skills that had already been learned were recapped using the applications again (TCK). The learning task was on the whole target-oriented rather than only from the point of view of the technological learning. The main objective was to create the news item in connection with space, so not the learning of technology itself. To make it possible, suitable applications were used for learning only the properties which were essential from the point of view of the task (TPK). The technological pedagogical dimension was foremost and inside it was the acquisition of the content knowledge, which in this context was touched upon in a news item (TCK). With the pupils, the information would be found out about rockets, planets and space and the matter would be dealt with in more depth (PCK). The students' technological pedagogical understanding (TPK) increased, likewise they gained a point of view into how to use technology in a pedagogically inspiring way as a channel for learning the contents and knowledge in a comprehensive learning task (TPACK).

The learning tasks of the ICT -study module and learning the technological skills have been built following this model so that teacher trainees would reach the expertise in adapting the TPACK-model in their work as teachers. It also is an aim to develop good and active models to develop the teacher education (cf. Niinimäki & Salmia, 2014).

*The students got a task to accomplish a Talk Show on the subject of "information and communication technology in the schools" in the small groups. The objective was to learn to use the basic functions of the iPad in ordinary learning situations and to provide basis for learning to use iMovie. It was an independent task to draw up and to video the interview on the same theme for the pupils. The students drew up the questions themselves and carried out the interview in their home town. The learning task was to create a news item on the subject of "ICT in school, in learning and in teaching", and they had the Talk Show material and the videoed interview as material. They created the news items in the style chosen by them. They had to practise editing, sound editing, the adding of text and headings, adding the music, fading out and editing of images and video clips as well as exporting the film to the pictures folder and to the cloud service. The ready news was viewed together and it was also learned how the Apple TV functions and projecting to the screen through the VGA-wire. (Lähdesmäki, S. Description of the study module 16.2.2015 and 18.2.2016)*

For many the news report was the first ever self-made product with the movie making tool. The technical learning of the program was performed side by side with the production of the contents (TKC) and the students were motivated to make the news report with care because the material had been produced by themselves. The learning module modelled the pedagogical control of a device and a program. According to the TPACK-model the objective of teaching is to connect technical knowledge, content objectives and pedagogics into the wholeness which promotes the student's professional thinking as well as their own competences.

*At t the ICT -buffet the students had to present in their small groups a 15 minutes session in which they taught one of the applications that were covered in the course or another program chosen by them in a pedagogically meaningful way. The objective was to direct the students to share the programs they had found to be useful and which are suitable for ICT teaching and to provide an experience of implementing ICT education. It was mentioned without exception in the diaries how useful an experience the ICT -buffet was both in increasing the teaching experience and because of the numerous new ideas they were getting. (Lähdesmäki, S. Description of the study module 15.3.2015 and 16.3.16)*

To achieve the real TPACK understanding Koehler and Mishra (2005) have emphasized that the best method for adopting the approach is to internalize it by "learning-by-design", in other words, by learning through planning (Kurt, Akyel, Kocoglu & Mishra, 2014). It is a central objective of the ICT -market place to promote the students' understanding why certain application is used, how it assists learning and the pupils' skills to learn and how the technical knowledge is secured. To make even deeper understanding possible the students get a learning task to plan and to carry out a teaching module which pedagogically serves the contents and uses the technology in their teaching

practice. The first teaching practice of the education is carried out in April and it is a four weeks long practical practice period in the teaching practice school.

## Research Methods and Data Collection

The survey was carried out at the beginning of the first study year 2015 (n=15) and 2016 (n=37) from two different student groups (n=52). Only those students in whose studies included the ICT study module responded to the questionnaire which explains the difference in the size of the different study groups. So the material represents the students' experiences and opinions that have been gathered regarding the ICT study module carried out at the beginning of the studies and the study experiences during the first spring term in their studies. The responders got a link to the inquiry and were asked to answer during the data collection timeframe. The research data was collected by questionnaire using Webropol inquiry which included 18 qualitative and 5 quantitative questions. The questions were connected to the students' own ICT skills but also to the meaningfulness of the ICT study module and to the use of ICT in their own studies. The students' own ICT skills and the meaningfulness of the ICT study module were questioned with the five-point Likert scale. Furthermore, the use of ICT in other studies was asked for with the help of the ready response choices and with open questions. In this study we focused on qualitative data and have only little interest on quantitative data. In results the data were analyzed by examining the replays procentual divisions at five-point Likert scale (Valli 2015, 36-37; 57-59).

## Results

When asked about the ICT skills of the students, the ICT skills of both student groups are good or extremely good for about half (52%) of the students according to the research results. 40% of the students considered their own skills moderate. In their opinion, 65% of the students had adopted the ICT skills well or extremely well and almost 40% of the respondents told that they managed the pedagogical adapting of ICT well or extremely well. Only just over 10% told that their command of pedagogical adapting of ICT was poor. An interesting result is connected to the differences between the 2015 and 2016 student groups. Less than half (46%) of the students of 2015 told that they were acquiring the ICT skills well, whereas, in 2016 the number of these students had increased to nearly two thirds (65%). There was also a similar difference in the command of ICT skills. This result points to the fact that the command and adoption of ICT are easier with the future student groups because the role of ICT is going to be bigger still in people's everyday life and the technology will already be familiar. The result also refers to the fact that developing the ICT study module has significance (cf. Myllyviita & Lavonen, 2014). The study module had been developed since 2015 in the ways that, among others, e-learning environment Showbie was attached in the study module and an e-book 'Getting familiar with ICT' was drawn up for the students (Lähdesmäki 2016) to support the independent use of the basic skills of ICT.

The students of 2016 were asked some questions in connection with a personal iPad tablet. 60% of the students said that they managed the use of iPad well or extremely well. Instead, the adapting of iPad pedagogically was commanded well or extremely well by only 40% of the students. Almost half of the students thought that they commanded it only moderately and 10% of the students poorly. A little over half (54%) of the students responded that the use of ICT was well- or extremely well-suited to their teaching style, and 40% moderately. 65% of these students considered the role of ICT in the learning fairly important or of some importance. In our opinion this result indicates the fact that the practices in teaching of ICT have not yet formed into clear and profound models which the students would know how to combine with their own teaching style or to see ICT as an important tool for learning (cf. Norrena et al. 2011). The result is uniform with the observation by Balanskat and Sali (2009) of the fact that the use of ICT does not automatically change pedagogics but the teacher has to understand how the technology, pedagogics and content together promote learning. Even though many considered the role of ICT fairly important or of some importance in learning, 70% of the students considered using ICT systematically in the basic education as extremely or very important. So one can think that the obligation of the teaching use of ICT defined by the curriculum (see Finnish national core curriculum 2014, 23) has been well internalised but ICT is not thought as a precondition for learning.

The students were asked about their attitude towards teaching use of ICT. The result was clear when the importance of technical skills and understanding the pedagogical use was asked about. In both matters 90% of the students considered it extremely or very important. Instead, learning the contents with the help of ICT were considered important or extremely important by less than half of the students. When this result is considered in relation to the TPACK-model, this describes, in our opinion, the students' understanding that for the most students' it is important to



use the technology in a pedagogical way but learning contents with its help was not so important. One can conclude from this that when technology is used, it must be pedagogically justified in the students' opinion but the contents can be learned otherwise than with the help of technology. The result can be explained partly on that, the pedagogical knowledge is strong through the earlier theoretical studies and teaching experiences but the students haven't known yet to combine content knowledge, in other words, the contents of the subject to be taught, generally with the teaching of ICT. This can be partly due also to the fact that the ICT study module is arranged immediately in the beginning of the studies and the proportion of the content knowledge of different disciplines (the subjects) is not yet very large. So one can conclude that the students' technological content knowledge (TCK), in other words, the knowledge about which technologies best support the teaching and learning of a subject still requires practice. Instead, the technological pedagogical knowledge (TPK) is important to most in which case it refers to the understanding that teaching and learning change when technology is used.

It was interesting to note that only a quarter of the students thought the role of ICT in learning very or extremely important even though the majority of the students saw technological pedagogical knowledge as important. 60% of the students considered the role of ICT as fairly important. This reflects, in our opinion, that the students' conception at this stage in the studies is that ICT is seen neither as necessary from the point of view of learning nor as a tool for multi-level learning.

When it is asked how the ICT study module provided competence to use ICT, 85% of the students answered extremely well or well. 80% of the students had been able to apply the ICT skills that had been learned in the ICT study unit either extremely well or well in the studies. Also the rest experienced that they were able to do so moderately. During the first spring term of studies the students had 14 different study modules and they had used ICT in each one of them. Most (88%) had used ICT in six study modules and nine study modules were of such a nature where about half of the students had used ICT. In five study modules the use of ICT was less. An open question was used to survey how ICT had been used in each study module. The methods of use were very versatile and abundant. The students had used ICT as a tool for their own learning in all the study modules and in the study modules of all the taught subjects (8) ICT had been used in a pedagogical way. The students were still asked how they had learned with the help of the education to understand ICT-pedagogics. 85% answered that they had learned it extremely well or well. Also the rest answered that they had learned it moderately well. So one can say that the pedagogical use of ICT has opened up well with studies.

Even 40% of the students answered that their own ICT skills were moderate but in spite of that ICT had been used in the studies. This is partly made possible by the fact that in the education the collaborative learning, where new knowledge is constructed through working together, is emphasized. This operational model facilitates students having moderate ICT skills to use ICT in the learning, when the peer support is available all the time. The development of ICT skills is also a continuous process and the reassurance in using it increases through the experience. The adoption of ICT skills was also considered good by many from which one can conclude that ICT is already familiar to many adult students. Both the ICT skills and use of iPad were adopted equally well in which case the learning of ICT can be generally thought to be easy for more than half of the students. The pedagogical adapting of TV and iPad was easy for less than half, in other words, pedagogical use was considered important but the adapting was not regarded yet as very easy. The results tell, in our opinion, that the students have learned a lot at the level of thinking but transferring the skills requires still more practice, especially when connected to learning of contents.

According to the results, the students have good ICT skills and they have an ability to adopt new things. According to the students, ICT is not necessarily suitable for their own teaching style. The teaching of technical skills and the pedagogical use were considered important but the role of ICT in learning contents or generally in learning was not so important. The studies provided well for the competences to use ICT and to adapt it in all the studies.

## **Conclusions**

The strategic objectives which are related to the teaching use of ICT and the strategy that has been outlined for developing the use of ICT in the teacher education have been the starting points for organizing the teacher education. The students have been guaranteed up-to-date and sufficient resources and they have been provided with competence for the use of the devices and for understanding pedagogics. The teacher educators' own ICT competence has been supported and thus its use has been made possible in all the study modules. Also in the degree requirements the targets have been set for the ICT competence and in our teacher education the research and clarification on the subject have been conducted.

The central conclusion of this study is that the teaching use of ICT requires combining the use of the technology and the pedagogical practices. The results of the study clearly state that the education supports understanding the use of

ICT which is in accordance with the TPACK-model (Koehler & Mishra, 2009). In particular, the technological pedagogical knowledge has increased and understanding the pedagogical use of technology has emerged. Technical support given by the ICT study module and the possibility to adapt ICT that is offered in all the study modules have clearly been useful to the students. The structure of the studies has made it possible to acquire the technological competence and to combine the pedagogical knowledge with the technology. These skills have been deepened in all the study modules during the first spring semester. The study shows that the education has to support the pedagogical use of ICT in planning of the teaching, which is in accordance with the new curriculum. Planning is indeed seen as a central factor in understanding the teaching use of ICT and in the profound internalization. This has been supported in the teacher education in the teaching practices with the planning and implementation of teaching which is in accordance with the TPACK-model. The study showed that during the first spring semester a very deep understanding of the technological content knowledge (TCK) has not yet been reached. This will be enforced at the later stage of studies in a more advanced study module "Media in teaching and learning, 3 study credits" and also in the different study modules which are connected to the studies of the teaching subjects. Information that has been gathered from the studies (Myllyviita & Lavonen, 2014) shows that the teacher trainees have the willingness to learn the use of new devices and the innovative teaching approaches. Even though the teacher education has progressed to some extent in the use of ICT in the teaching, considerable challenges still exist (see Meisalo et al. 2010). It indeed is necessary to study in the future how the technological pedagogical content knowledge (TPACK) on the whole will be realized during the studies and how the students succeed in transferring it into practice to the work with the pupils. The Finnish National Board of Education has already granted project money for several years for the projects which promote resourcing hardware and for the projects that promote the pedagogical use of ICT. It is indeed important that the Finnish National Board of Education still further secures sufficient resources for the projects which develop pedagogical ICT education.

In this study the iPad was selected as the tablet computer as an ICT tool because of its user friendliness and versatility. The education attempts to provide the students with as thorough skills and experience as possible in the use of one device and through its properties. With this an attempt is made to secure the fact that it is possible for the students to adopt more lasting and more meaningful pedagogical ideas and competences. However, it is important to pay attention to the fact that ICT comprises a wide array of different devices and technology. In the future the study could be extended to include technology and mobile learning more generally.

Future teachers need knowledge about how the technology can be used in learning the contents with different pupils in different learning environments. It is important to transfer to the students the knowledge about how information technology can be used meaningfully and to promote learning in different situations (see Husu & Toom, 2016). This study has concentrated on the studies that have taken place in the beginning of teacher education and in the future we will also build the study units to support the students' idea of how the activity, individuality, construction of knowledge and motivation for the learning of the learner are achieved with the help of ICT (see Meisalo et al. 2010). In all teacher education one should indeed concentrate on the pedagogical innovations which use the technology and on practising the use which supports the curriculum.

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