Students' perceptions of ICT use in higher education context

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Abstract: This research focuses on students' perceptions of Information and Communication Technologies (ICT) use in higher education. This research focuses on students' perceptions of their teachers' knowledge and attitudes as ICT-skilled teachers and how actively different ICT applications are used. The target group of this quantitative study consists of 728 students from one Finnish university. Results indicate that students see their teachers rather as content knowledge experts and the perceptions of teachers' skills and attitudes toward taking advantage of ICT for teaching and learning were lower. In addition, the scope of actively used ICT application for teaching and learning was rather narrow, relying on rather traditional technologies such as email and learning management systems.

Introduction

Currently, the role of ICT is well emphasized within higher education. The development of different technologies for supporting teaching and learning is rapid. Fast development can be seen within yearly Horizon reports (Adams Becker, Cummins, Davis, Freeman, Hall Giesinger, & Ananthanarayanan, 2017) where predictions are made for the next five years in the areas of ICT in education, outlining which developments we can expect within this area. In Table 1 the Horizon reports from 2013 to 2017 are combined, showing the future trends of ICT in education. A variety of technologies are available from wearable technologies to adaptive technologies and maker spaces (Table 1).

Table 1. Development trends within ICT in education

	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
2013	MOOC		Games and Gamification		3D Printing					
	Tablet Computing		Learning Analytics		Wearable Technology					
2014		Flipped Classroom		3D Printing		Quantified Self				
		Learning Analytics		Games and Gamification		Virtual Assistants				
2015			BYOD		Makerspaces		The Internet of Things			
			Flipped Classroom		Wearable Technology		Adaptive Learning Technologies			
2016				BYOD		Augmented and Virtual Reality		Affective Computing		
				Learning Analytics and Adaptive Learning		Makerspaces		Robotics		
2017					Adaptive Learning Technologies		The Internet of Things		Artificial Intelligence	
					Mobile Learning		Next-Generation LMS		Natural User Interfaces	

As the development of technologies is fast, there are high expectations for the use of these technologies within different areas of education. Within the expectations concerning 21st century skills, the use of ICT is seen as a central element (Voogt & Roblin, 2012). ICT is seen as a tool for supporting different learning practices and as a target for learning, i.e., gaining skills to use ICT for various purposes. Within Finland, there is a strong emphasis on the use of ICT in various areas of society referred to as the *Digital Leap* (Junger, 2015). The aim of this leap is to accelerate the productivity and quality of work. This focuses also on education systems. According to Aho (2015), the meaningful use of different technologies can support the development of students' creative, critical and analytical thinking in different social situations (Aho, 2015). Still, despite these expectations, lecture-based teaching with one-way information delivery from lecturer to students is still an actively used way of teaching in higher education (Young, Robinson, & Alberts, 2009).

These expectations pose demands and also present new possibilities for university teachers to use ICT for supporting teaching and learning. Within this paper, the aim is to outline perspectives related to the use of ICT in education in the context of one Finnish university. The paper focuses on students' perceptions of how they perceive their teachers' readiness to use ICT in education and the most actively used technologies to support learning within the target university. The study was conducted using quantitative methods, targeting 728 mainly third-year university students.

Theoretical background

According to Brinkerhoff (2006) the integration of ICT is affected by four larger areas: available resources, institutional and administrative support, training and experience and attitudinal and personality factors. This research focuses on use of ICT from the perspective of students. Due to this reason, the perspective is on attitudinal and personality factors, i.e., students are not necessarily capable of assessing the other areas suggested by Brinkerhoff (2006). *Attitudinal* or *personality* factors refers to skills and self-efficacy to take advantage of ICT and also attitudes and even computer anxiety. In order to study these areas, the two following theoretical frameworks are used: *Technological pedagogical content knowledge* (TPACK) and *Theory of Planned behaviour* (TPB). In short, TPACK is as framework for describing and studying teachers' pedagogically meaningful use of ICT in education (Koehler, Mishra, & Cain, 2013). The TPACK framework consists of three basic level areas: technological knowledge, pedagogical knowledge and content knowledge. Again, these three areas combine as technological pedagogical knowledge, pedagogical content knowledge, technological pedagogical knowledge and altogether as technological pedagogical content knowledge, seven different areas. Collectively, the TPACK framework altogether refers to "an understanding that emerges from interactions among content, pedagogy, and technology knowledge […] knowledge underlying truly meaningful and deeply skilled teaching with technology" (Koehler, Mishra, & Cain, 2013). Since its introduction, TPACK has been used in several studies and according to Harris, Phillips, Koehler and Rosenberg (2017), there are over 1200 publications related to the TPACK framework.

The second theoretical framework, TPB, is based on the assumption that there are three factors: attitudes, subjective norms and perceived behavioural control, that affect one's intentions to conduct certain behaviour (Aijzen, 1991). In this study, the behaviour is the use of ICT in education. *Attitudes* refers to whether certain behaviour is negatively or positively valued by a person. *Subjective norms* refers to expectations of others related to certain behaviours; how important others see the behaviour. The last perceived area, *perceived behavioural control*, refers to one's possibilities to act out certain behaviours, whether they have the resources and skills needed for the behaviour. The TPB frameworks has been actively used in various research settings, i.e., focusing on different behaviours. Within the case of ICT in education, especially the role of attitudes has been suggested as the most important factor affecting teachers' intentions to use ICT in education (Lee, Cerreto & Lee, 2010).

Within this research, parts of these two theoretical frameworks are used in order to outline students' perceptions of ICT use within the higher education context aligning with *attitudinal* and *personality* factors described by Brinkerhoff (2006). From the TPACK framework *content knowledge*, i.e., how students assess their faculty members' content expertise and *technological pedagogical knowledge*, i.e., how students assess their faculty members' skills to use ICT in pedagogically meaningful ways, are used. From the TPB framework,

the *attitudes* toward the use of ICT in education are used based on their important role affecting the actual use of ICT in education (Lee, Cerreto & Lee, 2010). The aim is that these areas provide a rather general-level description of faculty members' readiness to use ICT in education, considering also content area expertise. TPACK and TPB models are typically utilized using self-evaluation forms for compiling research material, i.e., teachers assess themselves from the perspective of these models (Lee, Cerreto & Lee, 2010). Instead, studies in which teachers' ICT skills and attitudes are approached from the perspective of students are rare (Shih & Chuang, 2013). However, raising student perspectives is important for developing teaching methods, technologies and practices to better meet the demands of today's world (Shih & Chuang, 2013).

Methodology

This paper focuses on students' perspectives on:
1. Faculty members' skills in content knowledge area and technological pedagogical knowledge area
2. Faculty members' attitudes toward the use of technology for teaching and learning
3. Use of technologies in the university

The research material was collected during the autumn of 2015 in one Finnish university. The study involved 728 students (65.4% of women) from different faculties. The average age of respondents was 26.6 years (SD = 8.0); age range was between 19 and 64 years. The collection of the data was carried out in close cooperation with the faculties and departments. The material was collected mainly during contact periods of different courses. In addition, the students were provided with information about the research via different course platforms, e-mail or through (electronic) bulletin boards. The survey was carried out both electronically and via a pen-paper version. The target group of the survey consisted of students who already had experience studying at the university. As a result, mainly third-year students were selected as target groups. Participation in this study was voluntary and respondents were informed about the research, the questionnaire itself, the survey objectives and reporting.

The questionnaire consisted of the areas described in the following section. Parts of the questionnaire measuring TPACK and TPB frameworks were modified from validated instruments from previous studies: the TPACK21 questionnaire (Valtonen, Sointu, Mäkitalo-Siegl & Kukkonen, 2015) and ICT-TPB questionnaire (Valtonen, Kukkonen, Kontkanen, Sormunen, Dillon & Sointu, 2015). TPACK was measured from the perspective of content knowledge (CK) and technological pedagogical knowledge (TPK). Aligning with the TPACK-21 questionnaire, the TPK part contained two sub areas (TPK and TPK-21): the first focuses on general-level use of ICT in education; the second area (TPK-21) focuses on the use of ICT for supporting students' self-regulated and collaborative learning. TPACK and TPB questionnaires were liker-type questionnaires using a scale of 1 to 6: 1=totally disagree, 2= disagree, 3=slightly disagree, 4= slightly agree, 5=agree, 6=totally agree. The second part of the questionnaire measuring the use of different ICT applications was built based on the ICT applications currently used within the target university, i.e., official and supported applications in the university. Options for each application were 1 = I do not use, 2 = use very rarely, 3 = use monthly, 4 = use weekly 5 = used daily. The analysis of the material was based on the descriptive statistics. Statements are reported both separately and as mean value sub-scales for CK, TPK, TPK-21 and Attitudes. Alpha values for all subscales were adequate, above 0.80. The materials were analysed using the SPSS v 22 application.

Results

The students' perceptions of their teachers' skills were studied from the point of view of subject matter knowledge (CK) and from the point of view of technological pedagogical knowledge (TPK). The results show that students appreciate their teaching staff strongly as content experts. The mean value of the content knowledge subscale was close to five with a small standard deviation, indicating this was a consensus opinion (Mean 4.78, SD = .85 α = .73) (Separate statements in Figure 1).
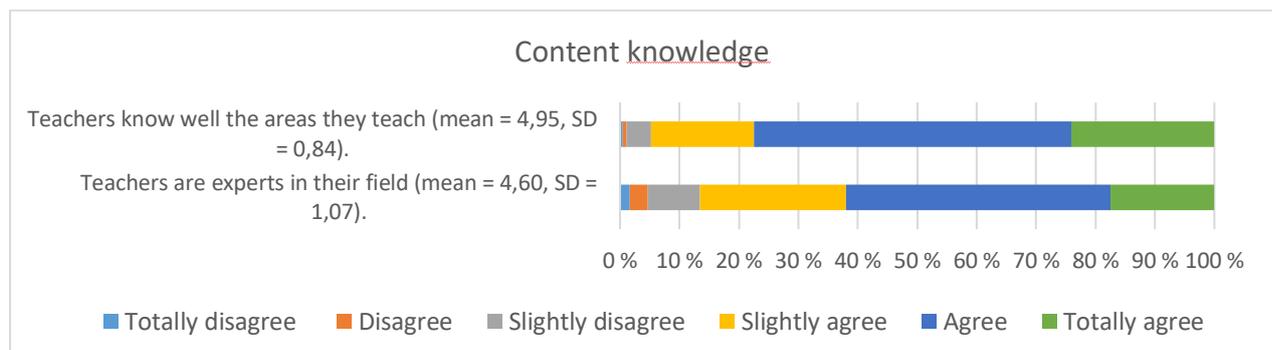

Figure 1. Content knowledge

The mean values of the sub-scales measuring technological pedagogical knowledge were lower than the content knowledge sub-scale. The mean value of the TPK subscale focusing on using ICT application for supporting students' collaborative and self-regulative learning was rather low (Mean 3.03, SD.95, α = .85). The mean values of separate statements varied from 2.98 to 3.09 (Figure 2). The lowest value of 2.98 was assessed for supporting ICT for problem-solving tasks in small groups.
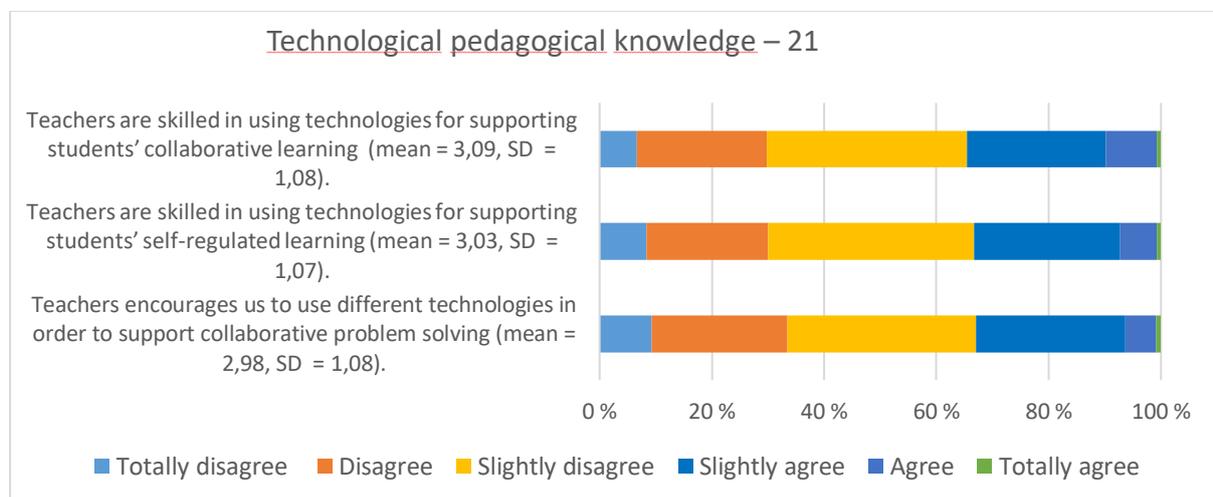

Figure 2. Technological content knowledge 21

When considering the TPK at a general level, without certain pedagogical practices, the results were slightly higher. The mean value of the sub-scale was 3.26 (SD = .95; α = .86), i.e., students' perceptions of their teachers knowledge related to the use of ICT in education were rather moderate (Figure 3).
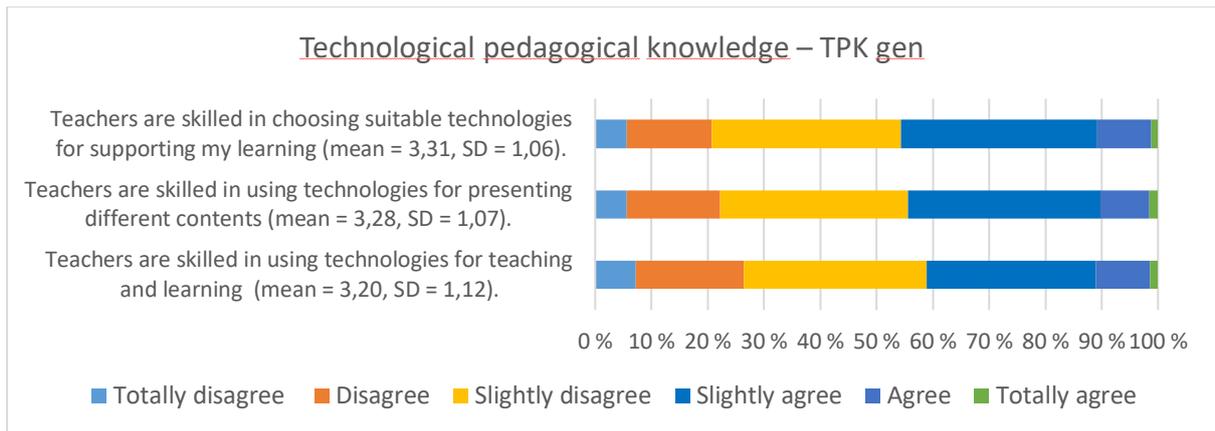
Figure 3. Technological content knowledge

Responses within both TPK categories were rather low. When looking at the students' perceptions of teachers' attitudes towards use of ICT in education, the results are slightly higher (Figure 4); the mean value of the sub-scale was 3.59 (SD = .95; α = .87 α = .87). The statement, 'teachers have positive attitudes toward the use of ICT in education', gained the highest value of attitude statements (Mean = 3.85, SD. 1.08). On the other hand, the statement about genuine interest in new technologies in general gained lower assessments (Mean = 3.3, SD 1.12).
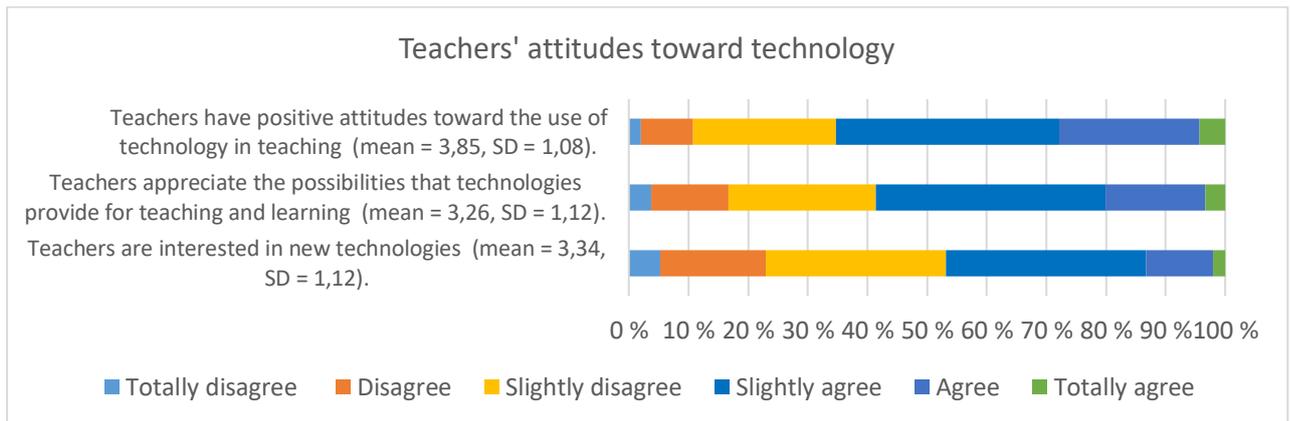

Figure 4. Attitudes towards ICT in education

When examining the use of the ICT applications within university courses, large differences can be observed between the use of different applications (see Figure 5). The results show that email (Mean 4.56), the *Moodle* learning management system (Mean 4.37) and *Office tools* (Mean 3.87) were clearly the most actively used applications. In addition, these applications were familiar to all respondents. On the contrary, the *Adobe Connect* video conferencing system (Mean 1.42), the University wiki (*Confluence*) (Mean 1.52), and *Refworks* reference management system (Mean 1.59) were rarely used; the mean values were clearly below two. The rest of the applications were between these extremes, with mean values ranging from less than four to two. This category of applications also included the *Office 365* (O365) cloud service, which was divided into three subsections. The *O365* provides students with free *Office software* that was well received. By contrast, other sub-areas of *O365* were used less frequently, especially the use of the *O365* entity as a learning environment was rather unknown for students (Mean 2.66).
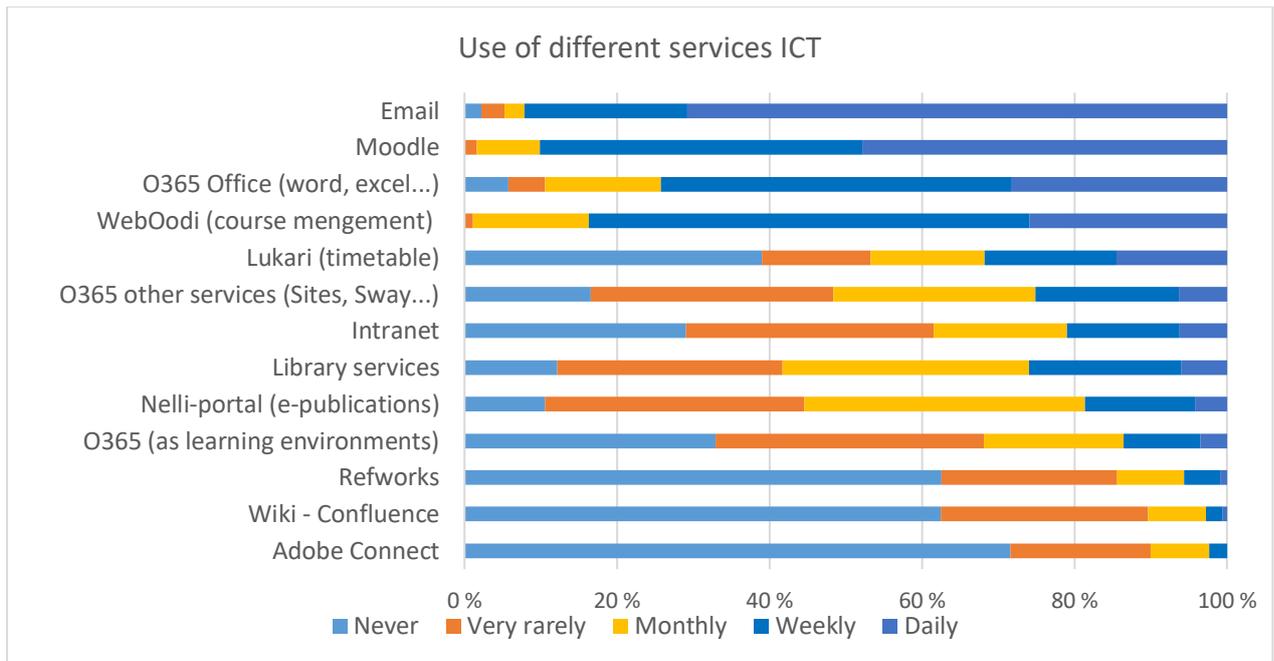
Figure 5. The use of ICT applications

Conclusion

The aim of the study was to investigate how the use of ICT at the university level is evident from the perspective of students. These results indicate that the use of ICT was mainly based on rather traditional technologies and teachers' readiness to use ICT in education is not at the level one might expect based on the expectation related to using ICT in education (see Aho 2015; Adams Becker et al., 2017). When considering the TPACK framework, the results indicate that students see their teachers merely as content experts; the results were higher compared to students' assessments of their teachers as expert in using ICT for teaching and learning. The results for technological pedagogical knowledge were lower. According to Young et al. (2009), traditional lecture-based teaching is still popular among universities. This aligns with the results of this study, i.e., the role of lecturing teacher emphasizes content expertise, one-way communication from lecturer to students (see Young et al., 2009) instead of meaningful interaction between pedagogical, technological and content knowledge (c.f. Koehler, Mishra & Cain, 2013). In the study of students' perceptions of their teachers' attitudes toward the use of ICT in education, the results align with results from technological pedagogical knowledge. Results were slightly higher, however the interest in ICT use in education remains moderate. The results outlining the technologies used for teaching and learning provide a picture of a rather traditional level of technologies. Email, learning management systems and office tools and course management systems were the only applications that were typically used on a daily or weekly basis. With other applications, use was mainly monthly or even less frequently. Currently, the Office 365 platform is available for teachers and students to be used as an environment for learning, however its role as a learning environment remains minor. From the perspective of more personal learning environments (see Valtonen, Hacklin, Dillon, Vesisenaho, Kukkonen, & Hietanen, 2012), environments like Office 365 still provide interesting possibilities worthy of development.

These results suggest that the use of ICT in the higher education context is not at the level as one might expect, based on predictions. According to Brinkerhoff (2006), the resources available, institutional and administrative support, training and experience and attitudinal and personality factors affect the integration of ICT in education. Ertmer (1999) also emphasized the role of teachers' pedagogical beliefs, i.e., teaching and learning practices need to rely on meaningful and collaborative learning practices. One of the approaches mentioned also within Horizon reports is the Flipped Classroom (FC). The idea of FC is to replace the traditional lectures with materials that students go through before classes, typically short video clips (see Chen, Wang, & Chen, 2014). The aim is that instead of listening to lectures, the classes are used for more student-

centred approaches, collaborating and working with the topics covered in the pre-materials. We assume that the FC-model could be a well-working way to also support the use of ICT in education. The FC-model provides more opportunities for the use of ICT in pedagogically meaningful ways, i.e., instead of lecturing for collaborative and student-centred approaches (c.f. Ertmer, 1999). With this kind of pedagogical development, with new pedagogical actions and needs, there could also be a stronger need for integrating different kinds of ICT applications in new ways to support student-centred learning practices.

Limitations and future studies

The results of different technologies used are based on the official and supported technologies available at the target university. The scope of technologies used might have been wider if the data would have been collected with open questions, i.e., the un-supported technologies as if social software applications could have changed the results. This will be important for future research. In addition, for the future it will be important to challenge students, to bring up their ideas regarding how to better take advantage of ICT within the higher education context. It will also be important to widen the scope for other areas, such as physical learning environments, i.e., how students assess the current learning environments, what kind of hopes and development ideas they have for developing teaching and learning environments in the higher education context.

Acknowledgements

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