PREPARING STUDENT TEACHERS TO TEACH WITH TECHNOLOGY: CASE STUDIES IN FINLAND AND ISRAEL

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ABSTRACT

This quantitative study examines the training of student teachers for ICT-based teaching in two teacher education institution, in Israel and Finland. The data was collected in 2015-2017 using a questionnaire administered to 41 Finnish and 44 Israeli student teachers. The results show that most student teachers had practice in ICT-based teaching. However, about a third of student teachers in both institutions practiced only two times or less using ICT. Those who practiced mostly used a teacher-centred approach as did their college and school mentor teachers who integrated ICT in their lessons. The variable describing competency in ICT-based teaching correlated with student teachers' attitudes, the number of ICT-based lessons they taught, modelling by the school mentor teacher, and the various schools' infrastructures and support. The results show that students in Israeli institutions are better prepared to teach with ICT which can be explained by the impact of the latest national reforms. We conclude that students' perception of their TPACK is the function of a variety of factors: on a personal level (attitudes towards the contribution of ICT to teaching and learning); on an institutional level (curriculum, modelling by faculty, institutional strategies); on a field practice school level (modelling by school mentors, infrastructure, pedagogical, technological, and administrative support); and on a national level (reforms and their implementation models). All these factors must be considered to promote the pedagogically innovative integration of ICT in teacher training and the overall education system. The best strategy to achieve this goal is to support collaboration between TEIs and schools on the national level. Wide-scale implementation of ICT in teaching demands significant investments in infrastructure and training. Hence much of its success depends on the national vision and priorities given to this purpose.

KEYWORDS

Teacher Education, Student teachers, ICT integration in teaching

1. INTRODUCTION

Due to increasing pressure for teachers to incorporate information and communication technologies (ICT) into school teaching, Teacher Education (TE) institutions are expected to prepare student teachers (below: students) for future professional practices by developing ICT-based teaching competencies, such as understanding the reasons and theoretical basis behind using ICT, implementing innovative models of ICT-based teaching and formative assessment, creating learning environments using ICT, communicating online, and managing the learning process ([1],[2]).

Teacher Education Institutions (TEI) employ diverse strategies addressing the development of students' ICT-based teaching competencies; however, as reported by numerous studies, even in advanced countries, they are still far from reaching the stated goals ([3] - [6]).

This study examines the training of students for ICT-based teaching in two TEIs, in Israel and Finland, and describes the interrelations among the factors related to ICT integration in teaching by students.

2. LITERATURE REVIEW

The Information Age presents the education system with a challenge to educate a future generation of children who will live, work, and lead the world that will be managed entirely by ICT. While the teacher-centred pedagogical model that served the education systems previously focused on the development of students' solid subject knowledge, the current age requires a student-centred pedagogy that promotes life-long learning, effective information processing, critical thinking, ability to solve complex problems, creativity, entrepreneurship, collaboration, and communication skills [7],[8]. ICT plays an important role in achieving these pedagogic goals because they enable access to information, diverse learning environments, and communication among teachers, students, and communities in and out of school.

Mishra and Koehler [9] emphasize that a modern teacher should develop not only content and pedagogical knowledge but also know how to integrate technology in meaningful ways in teaching and education. They suggested the model Technological Pedagogical and Content Knowledge (TPACK) that details the types of knowledge required for a modern teacher. Becoming acquainted with TPACK requires accelerated learning and a high workload, while the natural tendency of many teachers is to remain in their "comfort zone," and to adhere to the teaching methods they have developed during their careers [10],[11]. Teachers' traditional belief system of the concepts of "learning" and "teaching" influencing teacher's decisions to change seems to act as a significant barrier in the integration of innovative pedagogy and ICT in education [12].

One of the channels for promoting pedagogical-technological innovation in the education system is during the initial TE programs. The new generation of students studying in TEIs has grown up in the Information Age, and it therefore seems more natural for them to adopt technological innovation and apply it to teaching. However, although students are familiar with technological environments and tools, they still need professional pedagogical knowledge to integrate these tools into teaching in a way that will promote a student-centred pedagogy [11].

TEIs use diverse strategies addressing the development of ICT-based teaching competencies. Gronseth et al. [13] studied the curriculum in 407 Teacher Education Colleges in the United States and found that the majority of them include an educational technology course in the program (in 80% of institutions), discuss the topic in methods courses (80%), and require students, in their field practice, to integrate ICT (60%). Other meaningful factors are related to the modelling of ICT-based teaching by teacher educators and school mentor teachers [1], [14], [15]. In addition to curriculum and modelling factors, research shows that there are factors concerning pre-requisite conditions in TEIs and schools where students acquire experience in teaching: infrastructure and equipment; technical, pedagogical, and administrative support [14], [16]. Strong national policies related to the role of ICT in education in general and, in TE in particular, have a significant impact on preparing students to integrate ICT in teaching [17]. The comparative study of ICT in initial TE in the OECD countries revealed that national policies in these countries were implemented on four different levels: (a) through recommending the use of

ICT in teacher education but with no obligation, (b) proposing national accreditation standards for the programs, (c) implementing competence frameworks, and (d) introducing national certification of teachers [8]. According to this study, successful strategies combined strong national policies that emphasized a bottom-up process "providing incentives for development that are not too prescriptive so that individual trainers, for example, can use them according to their needs and interests" ([8], p. 40).

The abovementioned factors are important for students learning to integrate ICT in teaching but they are not effective without the students' motivation. Ajzen's Theory of Planned Behavior (TPB) [18] pointed to three conditions influencing a person's behavioural actions: positive attitudes towards the importance of the action; subjective norms (social norms regarding the action managed in the environment); and the perceived behavioural control (the estimated degree of difficulty in performing the behaviour). Teo and Tan [19] applied the TPB to explain students' behavioural intentions for ICT integration in teaching and learning and found that attitudes are the most influential among the three conditions. Chu and Chen [20] found a similar result but Valtonen et al. [21] warn that the relative weight of three conditions may be different in varying groups of students.

Numerous studies examining the quality of students' ICT-based teaching, even in the advanced countries, indicate that their skills are still insufficient [11]. The literature review of the state of the art in a variety of European countries revealed that ICT is not compulsory in teacher training and the training of pre-service teachers in the pedagogical use of ICT develops sometimes only because of the enthusiasm of the teacher educators [3]. In the USA, according to the National Association of State Boards of Education, only 60 percent of the educators who received certification in educational technology felt prepared to integrate ICT into their pedagogical strategies [22]. Similar problems in teacher training were mentioned in other countries [4], [5]. Moreover, in contrast to expectations that students would adopt a pedagogical innovation, studies indicate their tendency to maintain a traditional teacher-centred approach [4], [23]. Researchers explain these findings by the following five factors: a) inadequate modelling by faculty members and school mentor teachers, b) too few courses dealing directly with developing TPACK, c) lack of implementation in school practice, d) limited cooperation between the schools and TEIs, and e) insufficient infrastructure [4], [23], [24].

2.1. Conceptual Framework of the Research

The research framework is based on the conceptual framework (Fig. 1) developed in the previous study by the research network that examined the impact of National Israeli policy on students' preparation for ICT-based teaching [14]. This framework was built through a comprehensive literature review of the relevant quantitative and qualitative studies and states that students' TPACK is formed under the influence of several factors: students' attitudes towards the contribution of ICT in teaching and learning; components of the teacher education program; pre-requisite conditions needed for ICT integration at a college and the school, and the national policies regarding ICT in the initial TE. Unlike other models that describe the influencing factors on student-teacher training for ICT integration in teaching (for example [1]), in the model presented here, an additional significant factor was taken into account: school conditions consisting of infrastructure and pedagogical, technological, and administrative support.

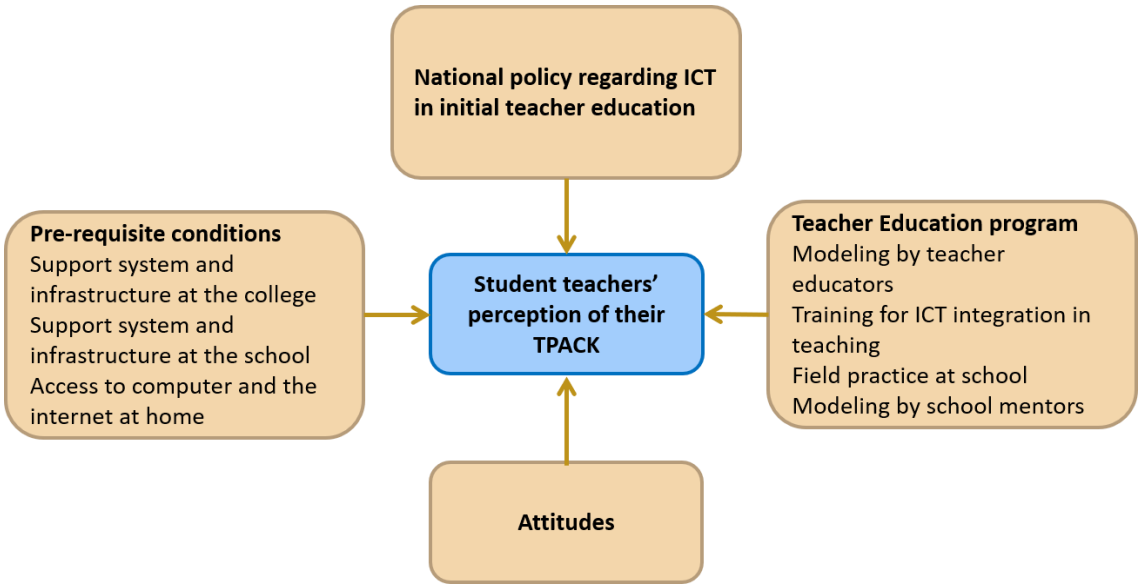

Figure 1. Conceptual framework of the study

3. THE STUDY

This quantitative study examines the training of student teachers for ICT-based teaching in two teacher education institutions, in Israel and Finland and asked the following research questions:

1. To what extent do teacher training programs in TEIs in Finland and in Israel prepare students for the integration of ICT in teaching?
2. What are the students' attitudes towards the contribution of ICT to learning and teaching?
3. To what extent and in what ways do students integrate ICT in their teaching practice?
4. How do students perceive their TPACK?
5. What factors relate most to students' TPACK?

Before we delve into the research methods, we address the historical background on the process of ICT integration in education and TE in the respective two countries.

3.1. ICT Integration in Teacher Education in Finland and Israel: Historical Background

3.1.1. Finland

Beginning from the 1974-1975 academic year, TE became part of universities who have autonomy in planning renewal processes and redesigning their academic curricula. Since the Ministry of Education and Culture gives funding for the TE programs, national strategies in developing ICT in education have always been important. The first national strategy related to ICT integration in education was introduced between 1986–1989 [5]. Its main goals were concerned with providing software for computer-assisted learning, developing the basic ICT skills of teacher educators and students, and training ICT teachers. The next national strategy (published in 1995) focused on creating web-content and online learning environments as well as integrating ICT in learning. In the year 2000, national strategy aimed at upgrading the ICT infrastructure of schools and libraries, promoting the pedagogical use of ICT in face-to-face and online (distance) learning. During the years 2004-2006, the strategies encouraged institutions to

implement new, innovative learning styles and teaching skills with close integration of ICT in initial and life-long education. Teacher educators took an active part in the professional development workshops to improve their ICT competency. In addition, several national projects in general and vocational education have focused on enhancing the use of ICT in education [25].

Two Finnish TEIs participated in an international study initiated by the OECD in 2010 to evaluate ICT integration in TE in European countries [5]. The study revealed high motivation by students, teacher educators, and school mentor teachers to use ICT in teaching. Both TEIs had institutional ICT centres, aimed at providing support to students and staff. The access to ICT was found satisfactory. The respondents emphasized the need for peer support and cooperation. The main challenge then was the rapid technological development requiring continuous upgrading of the ICT equipment and facilities, and the high workload needed for faculty members to prepare digital materials. Students also related that the schools seemed to be more conservative than the expressed intentions of the school mentors.

The last national strategy was published in the new National Curriculum Framework (FNCF) in 2014 [26]. This curriculum, which was adopted in practice in 2016, focuses on developing possibilities for ICT use for both students and teachers as well as integrating instruction by the multi and interdisciplinary projects in which ICT serves an important role. The FNCF also recognizes the necessity of ICT, multiliteracy, and digital competencies in the modern age.

3.1.2. Israel

The integration of computers in the educational system began in Israel about 40 years ago but significant changes occurred only from 1992 when a national ICT project "Tomorrow ‘98" was launched by the Committee for Computerizing the Education System. ICT integration in teacher education colleges began as a top-down process, initiated by the Department of Teacher Education in the Ministry of Education that led to, in the following years, a bottom-up process when innovative teacher educators initiated ICT-based projects. It was a wide-scale program of investments which included setting up the infrastructure in the colleges of education as well as the training of teacher educators. Efforts were focused on developing computer literacy among teacher educators and students and the development of support for technology-enhanced innovative projects. Later, at the beginning of 2000s, digital courseware development and online education were promoted in teacher education colleges. All teacher education colleges received funding for the specific purpose of technological infrastructure maintenance, development of web-based and online courses, pedagogical and technical support, maintenance of ICT support centres, and for the purchasing of services from the Intercollegiate Communications Centre.

In the period 2007-2010, the ICT integration process slowed down, caused by overall shortcomings in the general budget of the Ministry of Education, organizational changes in the teacher education system (e.g., merging colleges), and the emergence of a new reform in teacher education programs [10]. The last National program initiated by the Ministry of Education in 2010 aimed at transforming education and teacher education systems to meet the demands of the 21st century [27], [28]. This initiative emphasized the need to develop 21st century skills: ICT literacy, critical thinking, inquiry and problem solving, self-oriented learning, communicating and teamwork, ethics, and cybernetics. The program implementation included: improving the TEIs’ infrastructure and equipment, professional development of teacher educators, the promoting of implementation processes in the colleges of education, and curriculum changes. The large-scale research conducted between 2013–2016 years [14] revealed a significant impact of the program on students' skills to integrate ICT in teaching but found that still about one-third of students graduated without having had any meaningful practice in ICT-based teaching.

Regarding the pedagogical aspect of ICT integration, it was found that most students, as well as their school mentors and teacher educators, used technology in ways supporting traditional teaching methods. Hence, the current challenge facing the Israeli colleges of education is to promote innovative ways of ICT-based teaching.

3.2. Methodology

In this study, we used descriptive, correlational, and comparative quantitative methods. Descriptive methods laid the ground to evaluate measurements of operational variables and, based on these data, the internal consistency reliability (alpha Cronbach) of variables was examined and averages were calculated as the value of the theoretical variables. Correlational methods revealed which variables were statistically significant in relation to students' TPACK. A comparative method (T-test) was used to examine the differences of variables between two groups of students.

The sample included 41 students from the University of Tampere (Finland) (UTA) and 44 students from the Kaye Academic College of Education (Israel) (Kaye) in the advanced stages of their initial TE studies. Finnish students studied in the Master's Degree program while the Israelis students were in their third or fourth years of their Bachelor-degree in Education (B.Ed.) studies.
The data were collected using a questionnaire developed in the previous study by the research network of the Israeli teacher educators [14]. It included eight questions related to demographical background and 14 Likert scale questions aimed at gathering data on modelling by faculty members and school mentor teachers, students' experiences in teaching ICT-based lessons in school, TPACK, the attitudes towards integrating ICT in learning and teaching, the pre-requisites (access to computers and the internet at colleges, schools, and the homes of students), and the availability of support at the colleges and schools. A detailed description of the measures is presented in the following section. The questionnaire was administered during the years 2015 - 2016 (Israel) and 2016 - 2017 (Finland). The statistical analysis was made by SPSS.

3.3. Results

The results are presented in accordance with the research questions.

3.3.1. To what extent do the teacher training programs in TEIs in Finland and in Israel prepare students for the integration of ICT in teaching?

We evaluated three components of the teacher training programs: assignments devoted to planning and teaching ICT-based lessons, modelling by college lecturers, and modelling by school mentors.

The assignments devoted to planning and teaching ICT-based lessons usually related to courses dealing with teaching methods or educational technology. They were measured by the number of courses (on a scale 1-in none of the courses, 2–in one or two courses, 3–in three or four courses, 4–in five or six courses and 5-in 7 courses or more) in which the assignments were integrated. The group means and standard deviations are presented in Table 1. As can be seen in Table 1, on average, UTA's students performed assignments devoted to planning and teaching ICT-based lessons in one or two courses, and Kaye's students did so in three or four courses. The students of both TEIs learned the use of Learning Management Systems (LMS) in teaching in two or three courses.

Table 1. The assignments devoted to planning and teaching ICT-based lessons

Assignment	UTA		Kaye	
	Mean	StD	Mean	StD
Planning ICT-based teaching units	1.86	0.79	2.88	1.05
Teaching ICT-based lessons as part of school practice	1.84	0.80	2.84	1.27
Using LMS in teaching at school (for example, building teaching materials on platforms, such as Moodle or the school website)	2.54	1.33	2.82	1.37

For the purposes of data reduction, we created a new variable called training to teach ICT-based lessons (or, in short, training to teach) whose values were calculated as the mean of the above three items (Cronbach's alpha 0.77).

Modelling by faculty members was measured by the number of courses where the students were required to perform fifteen ICT-based assignments using the same scale as the assignment devoted to planning and teaching ICT-based lessons (Fig. 2).

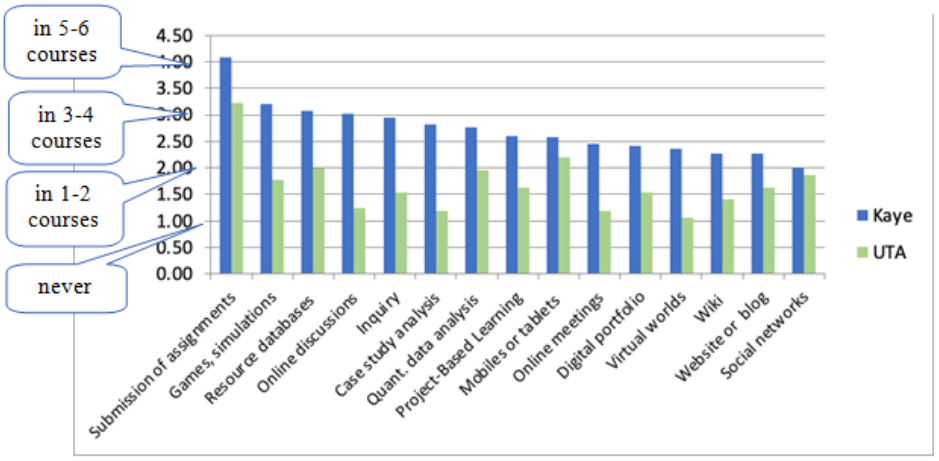

Figure 2. The number of courses where the students were required to perform various ICT-based assignments

The most popular assignment in both the TEIs was related to learning management (submission of assignments in a digital manner) that was integrated in three or four courses on average in UTAand in in five or six courses in Kaye College.. The students in the UTA's dealt with assignments related to games and simulations, databases, quantitative data analysis, project-based learning, digital portfolios wikis, blogs, social networks, and used mobile equipment in two courses or less, while the use of online discussions, online meetings, case study analysis using online environments and virtual worlds were very rare. The Kaye College students performed most of their assignments in two-three courses. Compared to the overall number of courses (about 30-40) in the training programs, the frequency of courses incorporating ICT is not high.
The mean of fifteen assignments served as a new variable - modelling by faculty (Cronbach's alpha 0.94). It reflects a diversity of ways incorporating ICT in teaching.

For the evaluation of modelling by school mentor teachers, the respondents were asked to report if their mentor integrated ICT in teaching and to specify which of the ten teaching methods were incorporated (Table 2). It was found that 72% of the UTA's students and 50% of Kaye College students observed ICT-based lessons given by their mentors.

Table 2. The school mentors' teaching methods in ICT-based lessons

ICT was used for	UTA n=23	Kaye n=22
Demonstration and illustration	65.6%	95.5%
Preparing PowerPoint presentations	46.9%	59.1%
Educational games	46.9%	76.2%
Word processing	75.0%	61.9%
Searching for information	46.9%	71.4%
Problem-based learning	43.8%	52.4%
Web-based inquiry	25.0%	55.0%
Online discussions	78.1%	81.0%
Communication with peers	75.0%	90.5%
Drill and practice	46.9%	60.0%

As can be concluded from Table 2, the most popular uses of ICT by school mentor teachers in both the TEIs were for demonstration, communication with peers, and online discussion. The least popular were web-based inquiry and problem-based learning. This shows that mentors tend to use teacher-centred teaching styles. The mean of the ten items was used as a new variable named modelling by mentors (Cronbach's alpha 0.80) which represents a diversity of ways of ICT-based teaching by school mentor teachers.

3.3.2. What Are the Students' Attitudes Towards the Contribution of ICT to Learning and Teaching?

Students' attitudes towards the contribution of ICT to learning and teaching were measured by five items on a five-point Likert scale of agreement (from 1–strongly disagree to 5-strongly agree). The first three items were formulated as positive attitudes while the last two as negative. The group means (presented in Table 3) show that the Kaye college students had positive attitudes towards the contribution of ICT to learning regarding the students themselves and the school pupils as well as the contribution of ICT to teaching skills while the UTA students' responses on average are somewhat higher than the neutral stances. All students in both countries did not agree with the statements that the disadvantages of using ICT in lessons at schools outweigh the benefits and that the use of ICT is not suitable for teaching in their areas of expertise.

Table 3. Attitudes towards the contribution of ICT to learning and teaching

Attitudes	UTA		Kaye	
	Mean	StD	Mean	StD
a. The use of ICT in teaching by college lecturers improves the quality of student learning.	3.27	0.84	4.07	0.96
b. The use of ICT in teaching by school teachers improves the quality of pupil learning.	3.35	1.23	3.95	0.78
c. The use of ICT improves the quality of my teaching.	3.32	0.78	3.93	0.89
d. The disadvantages of using ICT in lessons at schools outweigh the benefits.	1.81	0.57	1.05	1.02
e. The use of ICT is not suitable for teaching in my areas of expertise.	1.84	0.87	1.70	1.19

A factor analysis of the five items revealed two factors: positive attitudes (the first three, Cronbach's alpha 0.88) and negative (last two, Cronbach's alpha 0.54). Since the reliability of the second factor was low, for further computations we used only the first factor. The mean of the first three items was calculated as a new variable called positive attitudes (or in short, attitudes).

3.3.3. To What Extent and in What Ways Do Students Integrate ICT in Their Teaching Practice?

To evaluate student practice in ICT-based teaching, we used two indicators: the number of ICT-based lessons they taught during their school practice and the different ways of ICT integration they used in their teaching. The number of lessons was evaluated on a five-point Likert scale. As can be seen in Fig. 3, approximately half the students in both TEIs taught six or more ICT-based lessons while one third taught one or two lessons or never taught using ICT.

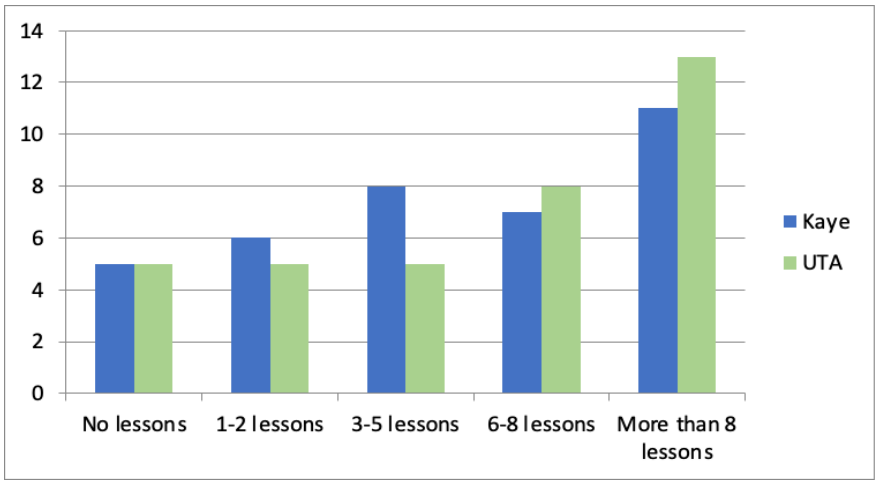

Figure 3. The number of ICT-based lessons taught by students

The students were asked to indicate which of the ten teaching ways they used to integrate ICT in their lessons (Table 4). The list of the teaching ways was the same as for describing the modelling by their school mentor teachers. The most popular ways in both groups were the use for demonstration and illustration, preparing a Power-Point presentation, word processing, and searching for information. The other teaching ways were less popular; their use among UTA's students ranged from 17 to 39 percent and among Kaye college students – from 56 to 79 percent.

Table 4. The students' teaching ways in ICT-based lessons

ICT was used for	**UTA**	**Kaye**
Demonstration and illustration	65.9%	91.4%
Preparing a PowerPoint presentation	87.8%	85.3%
Educational games	36.6%	79.4%
Word processing	75.6%	76.5%
Searching for information	73.2%	67.6%
Problem-based learning	22.0%	64.7%
Web-based inquiry	36.6%	61.8%
Online discussion	17.1%	61.8%
Communication with peers	39.0%	58.8%
Drill and practice	17.1%	55.9%

For further calculation, a new variable variety of teaching ways with ICT (in short, teaching ways) was created with the value as the mean of ten items (Cronbach's alpha 0.75).

3.3.4. How Do Students Perceive Their TPACK?

Students' perception of their TPACK was measured using seven items (Table 5) on a five-point Likert scale of agreement (from 1–strongly disagree to 5-strongly agree).

The first five items concern students' self-efficacy in appropriately integrating technologies in teaching. As can be seen in Table 5, the UTA students on average tend to neutral stances while Kaye College students mostly agree with the statements. The last two statements relate to the impact of a study on students' TPACK and there was a lower level of agreement in both groups. The factor analysis of the items revealed a single factor having high reliability (Cronbach's alpha 0.93), hence a new variable was created, named students' TPACK (or in short, TPACK).

Table 5. Technological, Pedagogical, and Content Knowledge (TPACK)

Item	UTA		Kaye	
	Mean	**StD**	**Mean**	**StD**
a. I can choose technologies that enhance the teaching approaches for a lesson.	3.30	0.57	4.07	0.75
b. I can choose technologies that enhance student learning.	3.14	0.54	4.00	0.86
c. I can design lessons that appropriately combine technologies with the subject matter I teach.	3.19	0.58	3.90	1.01
d. I can teach lessons that appropriately combine technologies with the subject matter I teach.	3.17	0.57	3.95	0.85
e. I can provide leadership in helping others coordinate the use of technologies with the subject matter I teach at my school.	3.03	0.90	3.64	1.03
f. I participated in classes in which I was trained to appropriately combine technologies in teaching.	2.69	1.06	3.51	1.21
g. Following the teaching methods to which I was exposed in the courses at my university/college, I can appropriately combine technologies in teaching.	2.70	1.15	3.71	1.20

3.3.5. What Factors Relate Most to Students' TPACK?

According to the conceptual framework of the research, students' perception of their TPACK may be influenced by their attitudes towards the contribution of ICT to learning and teaching, the components of the teacher training program, and the pre-requisite conditions in schools where they practiced their teaching. The question about school conditions referred to six parameters measured on a scale of 1-strongly disagree to 6-strongly agree: access to computers and internet, encouragement by the school mentor teacher, support by school stakeholders, and the availability of pedagogical support for integrating ICT in teaching (Table 6).

Table 6. Pre-requisite conditions at schools

Condition	UTA		Kaye	
	Mean	Std. Dev.	Mean	Std. Dev.
a. The school mentor teacher encouraged me to teach ICT-based lessons.	3.28	1.61	4.95	1.25
b. School stakeholders supported ICT-based teaching.	3.25	1.27	4.61	1.53
c. A computer and a projector were available in the classroom.	5.00	1.39	4.72	1.40
d. There was good wireless communication at the school.	3.58	1.68	4.66	1.30
e. It was possible to provide students with computers/tablets during class.	3.45	1.70	4.14	1.59
f. Pedagogical support for ICT integration in teaching was available at the school.	3.15	1.52	4.31	1.47

The UTA's students found that there was availability of a computer and a projector in the classroom and tended to agree with the availability of wireless communication while not having the other supporting conditions. Kaye College students found that they had all kinds of pre-requisite conditions. Since the reliability of the items was high (Cronbach's alpha 0.90), a new variable was created: school support with the values calculated as the means of the six items.

To examine interrelations between variables, Pearson correlation coefficients were calculated for the two TEIs separately (Table 7 and Table 8).

Table 7. Pearson correlation coefficients between variables calculated for the UTA sample

Variable		TPACK	2	3	4	5	6	7
Attitudes	2	0.41*						
Number of ICT-based lessons taught	3	0.64*	0.20					
Teaching ways	4	0.22	-0.16	0.04				
Training to teach	5	0.40*	-0.09	0.77*	0.15			
Modelling by faculty	6	0.35	0.20	0.30	0.07	0.43*		
Modelling by mentor	7	0.55*	0.04	0.66*	-0.08	0.24	0.27	
School support	8	0.56*	0.35	0.74*	0.21	0.31	0.27	0.68*

* $p<0.05$

As can be seen in Table 7, the UTA students' TPACK correlates with five variables; the three with the highest coefficients are: number of ICT-based lessons taught, modelling by mentor, and school support. Two variables – teaching ways and modelling by faculty members - do not correlate with TPACK. The variable number of ICT-based lessons taught is highly correlated to the variables TPACK, training to teach, modelling by mentor, and school support. The variable teaching ways does not correlate with other variables, meaning that school mentors and supervisors (responsible for training to teach at TEI) encourage students to teach more ICT-based lessons but do not influence the diversity of teaching ways. The variable school support correlates with modelling by mentors and number of ICT-based lessons taught as well as with TPACK. Thus, pre-requisite conditions at school are important for developing students' TPACK. It is interesting that the variable attitudes is correlated only with TPACK.

Table 8. Pearson correlation coefficients among variables calculated for the Kaye College sample

Variable		**TPACK**	**2**	**3**	**4**	**5**	**6**	**7**
Attitudes	2	0.64*						
Number of ICT-based lessons taught	3	0.59*	0.36*					
Teaching ways	4	0.40*	0.38*	0.64*				
Training to teach	5	0.48*	0.50*	0.39*	0.56*			
Modelling by faculty	6	0.43*	0.48*	0.19	0.56*	0.80*		
Modelling by mentor	7	0.66*	0.36	0.64*	0.58*	0.53*	0.58*	
School support	8	0.64*	0.30	0.41*	0.26	0.33*	0.38*	0.53*

* $p<0.05$

As for the Kaye College sample, the variable TPACK correlates with all other variables with the highest coefficients to attitudes, modelling by mentor, school support, and number of ICT-based lessons taught. The variable number of ICT-based lessons taught has the highest correlation to TPACK, modelling by mentors, and teaching ways, and a lower correlation with the variables, school support and teaching ways, and no correlation with modelling by faculty. The variable teaching ways correlates with all variables except school support.

In contrast to the UTA, we see that supervisors and mentors influence not only the number of lessons students taught at school but also the diversity of ways of integrating ICT in teaching. The highest correlations for the variable support at school were found for the variables TPACK, modelling by mentors, and number of ICT-based lessons taught (similar to UTA). The variable attitudes, in contrast to the case of UTA, correlates not only to TPACK, but also to other variables (except modelling by mentor and school support).

3.3.6. Comparison of Results Found in Two TEIs

To find similarities and differences in integration of ICT in two TEIs, the T-test calculation was performed for eight variables (Table 9).

Table 9. T-test results of two groups

Item	**UTA**		**Kaye**		**Range**	**Cohen's d effect size**
	Mean	**SD**	**Mean**	**SD**		
TPACK	3.02	0.60	3.83	0.81	1-5	0.80*
Attitudes	3.19	0.52	3.98	0.85	1-5	0.79*
Number of ICT-based lessons taught	3.53	1.46	3.35	1.42	1-5	-0.09
Teaching ways	1.50	0.15	1.71	0.30	1-2	0.62*
Training to teach	1.86	0.81	2.86	1.03	1-5	0.77*
Modelling by faculty members	1.67	0.33	2.73	0.90	1-5	1.11*
Modelling by school mentor teacher	1.57	0.32	1.68	0.24	1-2	0.29
Support at schools	3.61	1.21	4.56	1.15	1-6	0.57*

* $p<0.005$

As can be seen in Table 9, on average, Kaye's students positively evaluated their TPACK while the UTA's students on average were neutral. The same can be said about attitudes towards ICT integration in teaching and learning. No significant difference was found in the variable number of ICT-based lessons taught at school: in both TEIs, students taught on average five-six lessons during their studies. Regarding the diversity in teaching ways implemented in ICT-based lessons, the mean variable is higher in Kaye College. The high differences were found in the variables training to teach and modelling by faculty members: in Kaye College, assignments devoted to planning and teaching ICT-based lessons and ICT-based assignments for learning purposes were offered on average in three-four courses while in the UTA, it was offered in one-two courses. There was no significant difference in the variable modelling by mentors: the mentors covered on average half of the teaching ways mentioned in the questionnaire. However, it should be noted that the UTA's students had more opportunity to observe ICT-based lessons of their mentors: half of Kaye College's students reported that their mentors did not teach with ICT in contrast to one-fifth in the the UTA's sample. Regarding the support system at the teaching schools, Kaye College students agreed with its availability while the UTA students on average were neutral. In summary, a comparison of the means of the variables shows higher values by Kaye's students except for two variables: number of lessons taught at school and modelling by school mentors.

There are few limitations regarding this comparison. The samples of students from each TEI are small and not representative enough to generalize to a larger population. Also, Kaye College is considered one of the advanced in ICT integration compared to 23 other Israeli colleges of education.

4. DISCUSSION AND CONCLUSIONS

In this study, we examined different components of teacher training programs in two TEIs in Finland and Israel. We found that both institutions invest substantial efforts to prepare students to teach with ICT but there are several challenges in both situations. Firstly, one-third of students in both TEIs did not practice or did not have enough practice in teaching ICT-based lessons at school. This shows that this kind of practice is not obligatory in both TEIs. In light of the demands of the 21st century, it is evident that teacher training programs should include such a practice as an obligatory subject.

Secondly, many students (a quarter in the UTA and half in Kaye College) pointed out that their school mentors did not integrate ICT in teaching. This finding also reflects the fact that training programs in both TEIs do not pay careful enough attention when choosing field practice schools and mentor teachers. Thus, the students find themselves under conditions, such as mentor teachers not modelling ICT lessons, which are necessary for eventual integration of ICT in their own lessons. Research shows that modelling by mentors has a significant impact on student teacher training [1], [3], [15].

Thirdly, students integrated ICT mostly in the ways supporting traditional teacher-centred ways, such as the use of ICT for demonstration and illustration, using Office applications and searching for information while integration of active student-centred assignments (i.e., practice exercises, communication with peers, online discussions and web-based inquiry) were rare. The teacher-centred activities were also popular among school mentor teachers and faculty members. We found positive correlations between teaching ways of students and their mentors and frequency of assignments aimed at planning and teaching ICT-based lessons in both TEIs. This leads us to understand that mentor teachers and supervisors play an essential role in shaping students' TPACK. The challenge for the TEI, then, is to provide pedagogical support for mentors and faculty members for creating innovative student-centred ways of ICT integration in teaching.

Then the mentors and faculty members can model and shape students' teaching practice appropriately.

The tendency of student teachers to integrate ICT in the traditional teacher-centred approach and importance of modelling have also been reported by several scholars [1], [11], [29], [30]. Kontkanen et al. [30] explain that because of the lack of learning practice in the students' previous schooling period as well as in their TEI, they do not make use of innovative student-centred activities. These scholars emphasize that developing TPACK takes a long time for students till they mature during their teacher training and early professional careers.

Fourthly, we found a correlation between two variables related to student practice at school (modelling by mentors and number of lessons taught by students) and support at school. The variable support at school relates to the availability of equipment and the internet, encouragement by school stakeholders, and the existence of technological and pedagogical support. Hence, TEIs need to choose appropriate, well-equipped partner schools which have an adequate support system and whose staff is experienced in ICT integration in teaching. This type of positive climate regarding ICT integration can enforce subjective norms mentioned by Ajzen's Theory of Planned Behavior [18], such as strengthening a person's decision to take action. In contrast, schools with a poor infrastructure and a negatively oriented staff towards ICT can diminish students' willingness to use ICT in teaching.

To promote innovative ICT-based pedagogy, the best strategy is to build cooperation between supervisors, school mentors, and students in planning and teaching ICT-based lessons. This cooperation can help with sharing ideas and knowledge and enhance creative teaching methods on all sides. According to Polly et al. [31], such a collaboration was shown as meaningful in the framework of the project "Preparing Tomorrow's Teachers to Use Technology" (PT3) launched by the U.S. Department of Education between 1999–2003.

We found differences between the groups in some variables. Students' attitudes towards ICT integration in teaching on average were close to neutral among the UTA students while Kaye College students had positive attitudes. This may be due to a more traditional approach of teaching in the Finnish context [5]. Other reasons may be related to more intensive support from school mentors to integrate ICT in practice teaching for the students from Kaye College.

Kaye College students on average perceived themselves as having TPACK while the UTA students were neutral. Kaye students also reported a higher level of proficiency in ICT-based teaching, a higher level of the components of training, and better conditions at school than the UTA's students. The possible explanation may be due to a difference in the priority given to ICT integration in two TEIs. In general, Finnish TEIs are autonomous in establishing their own institutional strategies although they take national policy recommendations into account. In contrast, Israeli TEIs are usually more influenced by educational reforms of the Ministry of Education (MoE). To achieve the goals of a reform, the Israeli MoE often uses a combination of the centralistic top-down mechanism for promoting reforms (for example, by purposeful funding) and encouraging bottom-up initiatives of TEIs. There are different situations in Israel and Finland regarding the latest reforms in educational systems. The Israeli MoE initiated a National Program to transform education and teacher education systems to meet the demands of the 21st century in 2010 (Israeli MoE, 2011). According to large-scale evaluation studies, a significant impact of the Program was found in ICT integration in schools [32] and in TEIs [14]. In Finland, the new National Curriculum Framework also emphasizes the importance of digital competencies and ICT integration in all subjects. However, implementation began in Autumn 2016 (FNCF, 2016), and perhaps its impact has not yet been expressed in the education system during the current research.

We conclude that students' perception of their TPACK is the function of a variety of factors: on a personal level (attitudes towards contribution of ICT to teaching and learning); on an institutional level (curriculum, modelling by faculty, institutional strategies); on a field practice school level (modelling by school mentors, infrastructure, pedagogical technological and administrative support); and national level (reforms and their implementation models). All these factors must be considered in promoting a pedagogically innovative integration of ICT in teacher training and the overall education system. The best strategy to achieve this goal can be to support collaboration between TEIs and schools on the national level. Wide-scale implementation of ICT in teaching demands significant investments in infrastructure and training. Hence, its success depends on the national vision and priorities given for this purpose.

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