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An Examination of Lecturers' Technological Pedagogical Content Knowledge Perceptions at the Faculty of Education in EMU in Cyprus

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Abstract

The use of technology in instruction has brought about different perceptions. The need to know how teachers integrate technology in instruction has brought about different views. Therefore, this study mainly seeks to understand these views on lecturers' technological pedagogical content knowledge (TPACK) perceptions, as it examines how their views differ according to gender, employment status, department and the state of in-service training oriented towards the use of technology. In order to achieve the above stated aim, the researcher statistically examined Eastern Mediterranean University (EMU) Faculty of Education lecturers' TPACK perceptions. In this research, a TPACK survey instrument was administered to 53 lecturers, and a questionnaire was used to ascertain their perception levels across the seven TPACK dimensions. Mean, standard deviation, percentage, frequency and non-parametric tests (Mann-Whitney U test and Kruskal-Wallis test) were used for data analysis. The study reveals that lecturers' perceptions of TPACK were significantly high across all knowledge dimensions and there were statistically significant differences on how lecturers viewed TPACK according to the above listed variables. These differences occurred in Technological Knowledge (TK) and Pedagogical Content Knowledge (PCK) according to gender; Technological Knowledge (TK) and Technological Pedagogical Knowledge (TPK) according to employment status; Technological Knowledge (TK), Technological Pedagogical Knowledge (TPK), and Technological Pedagogical Content Knowledge (TPACK) according to department, and Pedagogical Content Knowledge (PCK) according to in-service training.

Key words: *country-specific developments; framework for educational technology system; improving classroom teaching; teaching/learning strategies; technological pedagogical content knowledge.*

Introduction

Technology usage in the education system has rapidly grown in the 21st century, thereby having a great influence on pedagogical content knowledge. The best way to integrate technology has become a global concern and it very much affects the teachers in the Asian region. According to Mishra and Koehler (2006), for effective instruction, "thoughtful pedagogical uses of technology require the development of a complex, situated form of knowledge that we call Technological Pedagogical Content Knowledge (TPCK)" (p. 1017).

Although technology has been introduced into the education system, the full and effective integration is still lacking. This is because technology alone cannot lead to change (Koehler & Mishra, 2005). The change can only come from the way the teachers make use of technology in the educational processes. For example, having a smart board in the classroom will make little or no difference in the students' learning process unless the teacher develops ways of engaging students in active participation, that is, unless the teacher applies methods of engagement. What is the use of the smart board in the learning process if all that the teacher does is write on it, as if it were an ordinary blackboard? The teacher is expected to have a certain level of technological knowledge or rather to develop technological knowledge (TK) which will aid his or her choice of pedagogy – pedagogical knowledge (PK) towards structuring a specific subject matter, or content knowledge (CK). This is a fundamental notion of constructivism, which views effective learning as being student-centred and having the ability to actively engage the participants (Sessoms, 2008).

Theoretical Framework

Technology Integration

The acceptance of technology in education has given rise to the concept of educational technology. Educational technology is concerned with the design, development, utilization, management, and evaluation of learning processes and learning resources (Luppicini, 2005). This area of study has been receiving great attention from various stakeholders in education all over the world, due to the current efforts of technologically advanced and technologically advancing nations to have ICT included in their schools' learning and teaching techniques (Agyei & Voogt, 2012; Chai, Koh, & Tsai, 2013; Shin et al., 2009).

Amidst this technological development lies a "danger that teachers will not use the tools as they are intended" (Sessoms, 2008, p. 86), because instead of fully making use of technological tools, they rather use it to support the traditionally oriented paradigm. Sessoms (2008) stated that "the problem is that teachers are not trained to think about teaching and learning as an interactive process that encourages the use of technology" (p. 87). Therefore, an accurate framework that allows measurement of teachers' knowledge to aid in aligning the teachers thinking towards the adequate usage of ICT in the educational process is desirable. This makes technological pedagogical content knowledge (TPACK) the ideal framework, since teachers' knowledge has to be described and measured in order to aid the proper integration and improvement of technology in educational process (Jang & Tsai, 2012, 2013; Koehler & Mishra, 2009; Koh & Chai, 2014; Mishra & Koehler, 2006; Schmidt et al., 2009). TPACK is a theoretical framework (Koh, Chai, & Tsai, 2013) that defines and creates a systematic view of the teachers' expertise, i.e. the knowledge teachers need in order to integrate information and communication technology in the teaching process effectively, with the aim of improving students' learning. Chai et al. (2013) defined TPACK as a synthesized form of knowledge for the purpose of integrating ICT/educational technology into classroom teaching and learning. Jang and Tsai (2013) viewed TPACK as a consolidated system that promotes students' learning because of its instrumentality that combines different interacting components designed to work as a coherent entity. What does this coherence do? Koehler and Mishra (2005) emphasized that technology, pedagogy, and content interact with one another and with understanding, as an approach towards technology integration. These entities which are in cohesion make up the so-called TPACK framework.

The TPACK Framework

Over the years, technology take-over in the educational sector has led to so many studies, developments and inquiries by the lecturers, stakeholders in education, and policy makers (NETS 2000, 2008) regarding the most beneficial ways in which technology can be incorporated to make students' learning efficient and effective. According to Koehler and Mishra (2005), Mishra and Koehler (2006), and Niess (2005, 2006), a recent development in technology has changed the view of technology as content and instructional tool. When the investigation into the kind of knowledge required to use and implement ICT in instruction began in the 21st century, Niess (2006) indicated that the teachers who teach mathematics were not trained in using technology tools. Therefore, this causes concern on how to identify the required tools and prepare teachers to teach mathematics in the 21st century. However, this concern does not only affect mathematics but all subject areas. Regarding this issue, Koehler and Mishra (2005) highlighted a similar question: "What do teachers need to know about technology and how can they acquire this knowledge?" This was the genesis of TPACK. These researchers concluded that teachers needed to develop a sense of knowledge structure that allows for the incorporation of subject matter knowledge, pedagogy knowledge and technology knowledge in the curriculum and schools. They also believe that teachers are required to develop pedagogical content knowledge in order to deliver lessons in their subject areas (Koehler & Mishra 2005; Mishra &

Koehler, 2006; Niess, 2005). Through these, many more educators and researchers were able to understand the necessity of technological PCK, i.e. pedagogical content knowledge that incorporates technology. This implies that technology should not be considered as separate and independent from PCK but should be seen as an element equally important as other elements within the context of teaching (Koehler & Mishra, 2005; Lin et al., 2013; Mishra & Koehler, 2006).

Technological Pedagogical Content Knowledge (TPACK) has proven to be that framework, since the introduction of technology leads to the introduction of new concepts and requires the development of sensitivity to the dynamic, transactional relationship between all three components suggested by the framework. Koehler and Mishra (2005) described the relationship between the content, pedagogy and technology, in addition to Shulman's conception of Pedagogical Content Knowledge (PCK), and went even further to conduct an in-depth analysis of the complex interaction of these components. The addition of technology in this analysis gave rise to four more components: TK, TPK, TCK, and TPACK. This framework strongly holds that effective integration of technology into instruction can be achieved when the knowledge of content, pedagogy and technology are integrated as one entity or a system, rather than separate entities.

Components of TPACK Described

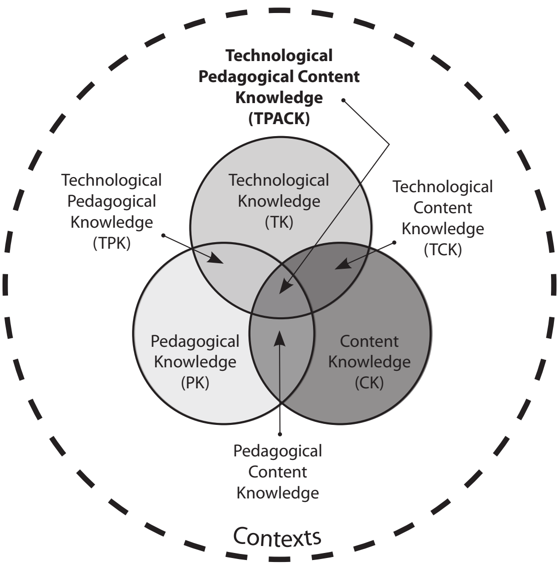

Figure 1. TPACK framework (graphic retrieved from http://tpack.org)

Content Knowledge (CK), also referred to as subject expertise (Shulman, 1994), is the knowledge of a particular subject matter that is to be learned or taught (Koehler & Mishra, 2005; Koh et al., 2013; Mishra & Koehler, 2006; Schmidt et al., 2009). For example, it includes the knowledge of instructional design, Database management, and programming courses (HTML5, C, C++ or PHP). This is the knowledge a teacher has about a particular subject matter.

Pedagogical Knowledge (PK) is the in-depth knowledge of teaching methods, practices, strategies and procedures (Koehler & Mishra, 2005; Koh et al., 2013; Mishra & Koehler, 2006). It refers to the processes and methods of teaching, which include the knowledge of classroom management, lesson plan development, assessment and student learning (Schmidt et al., 2009). It is the knowledge of how to transfer or communicate the content knowledge. Depending on the pedagogical purpose of the teacher, different methods are employed in order to bring out the desired student behaviors and to support students' learning (Kazu & Erten, 2014).

Technological Knowledge (TK) is the knowledge of technology tools (Koh et al., 2013), such as computers, the Internet, digital video, and more commonplace technologies including overhead projectors, interactive white boards, software programs and so forth (Koehler & Mishra, 2005; Koehler & Mishra, 2009; Mishra & Koehler, 2006; Mishra & Koehler, 2008; Schmidt et al., 2009).

Technological Content Knowledge (TCK) is the knowledge of how to use technology to present the subject matter. This is the understanding of technology impact on presenting the content, which enables flexibility of technology use for educational purposes in order to influence the way students practice and understand the concept of a particular subject matter (Kazu & Erten, 2014; Koehler & Mishra, 2005; Koehler & Mishra, 2009; Mishra & Koehler, 2006; Mishra & Koehler, 2008; Schmidt et al., 2009).

Technological Pedagogical Knowledge (TPK) is the knowledge of how to use technology to implement or adopt different methods (Koehler & Mishra, 2005; Koehler & Mishra, 2009; Koh et al., 2013; Mishra & Koehler, 2006; Mishra & Koehler, 2008; Schmidt et al., 2009).

Pedagogical Content Knowledge (PCK) is the knowledge of how a subject matter is to be taught. This includes methods and processes used to deliver the specific content. According to Shulman (1994), this knowledge helps the learning of all subjects as it provides ways of organizing, representing and adapting to different interest and skill of learners (Koehler & Mishra, 2005; Koehler & Mishra, 2009; Koh et al., 2013; Mishra & Koehler, 2006; Mishra & Koehler, 2008; Schmidt et al., 2009).

Technological Pedagogical Content Knowledge (TPACK) is the knowledge which arises from the blending of technology, pedagogy and content. It is the knowledge required by teachers to use technology to implement teaching methods or processes in any subject matter (Koehler & Mishra, 2009; Koh et al., 2013; Schmidt et al., 2009). It goes beyond techno-centrism because it helps teachers in effective and creative thinking (Kazu & Erten, 2014).

The Purpose of the Study

The aim of this study is to investigate the lecturers' views concerning Technological Pedagogical Content Knowledge (TPACK) in the context of their experience at the Faculty of Education. The above-mentioned purpose will be achieved through the following research questions:

What are the perceptions of lecturers regarding their technological pedagogical content knowledge?

How do the perceptions of lecturers differ according to gender, employment status, department and the state of in-service training oriented towards the use of technologies?

Method

The research design of the study is quantitative. Quantitative methods accentuate objective measurements and numerical analysis of data that are generated through surveys such as polls or questionnaires. According to Aliaga and Gunderson (1999), quantitative research approach is used to explain occurrences via the collection of numerical data which are then interpreted based on mathematical statistical methods.

Sample

The study sample consisted of lecturers from the Faculty of Education of Eastern Mediterranean University N. Cyprus in the academic year 2013/2014 in the spring semester. Lecturers from the Faculty of Education were the best sample for this research because they are often in the business of creating and thinking about effective ways of pedagogy in order to facilitate good connections between technology and pedagogy (Elçi, 2012; Mishra & Koehler, 2008). Due to their already gained knowledge about pedagogy and content knowledge, they will better understand the need for this kind of study, thereby enabling the researcher to obtain reliable results for this study.

As shown in Table 1, this study was conducted in six departments. Out of 73 lecturers, response was obtained from 53 lecturers, of which 52.8% were females and 47.2% were males. Furthermore, 71.7% are full-time lecturers and 28.3% are part-time lecturers in five departments only; 18.9% were from Computer Education and Instructional Technologies Department (CITE), 9.4% were from Elementary Education Department (EE), 17.7% were from English Language Teaching Department (ELT), 42.3% were from Educational Sciences Department (ES) and 7.5% were from Turkish Language Teaching Department (TLT). No response was obtained from Fine Arts Education Department (FAE). According to in-service training oriented towards the use of technology, 86.5% agreed that they have received such training, while 13.5% disagreed. Every participant in this study completed the TPACK questionnaire to report his or her opinions and experiences regarding TPACK.

Table 1
Lecturers' Demographic Information Frequencies

Gender	Frequency (f)	Valid Percent (%)
Male	25	47.2
Female	28	52.8
Age		
21-25 years	2	3.8
26–30 years	5	9.4
31–35 years	9	17.0
36–40 years	8	15.1
41–45 years	6	11.3
over 46 years	23	43.4
Period of Service		
1-5 years	12	22.6
6-10 years	6	11.3
11-15 years	6	11.3
16-20 years	8	15.1
21 years and above	21	39.6
Ranking		
Dr.	14	26.4
Assoc. Prof.	6	11.3
Assist. Prof.	15	28.3
Sen. Instructor	14	26.4
Instructor	1	1.9
Res. Assistant	3	5.7
Employment Status		
Full-time	38	71.7
Part-time	15	28.3
Department		
CITE	10	18.9
EE	5	9.4
ELT	9	17.0
ES	25	47.2
TLT	4	7.5
In-service Training		
Yes	45	86.5
No	7	13.5
Total	53	100

Data Collection Instrument and Analysis

The TPACK survey instrument is a questionnaire used by Koh et al. (2013), adapted from Schmidt et al. (2009). According to Mathers, Fox, and Hunn (1998), surveys are advantageous because their validity is both internal and external and they are flexible, efficient and cost-effective. Mathers et al. (1998) also pointed out that questionnaires can either be developed by a researcher or based on an already made index, which was why the questionnaire developed by Koh et al. (2013) was chosen. The questionnaire used for this study contained two sections (demographic information and TPACK survey instrument). The first section consisted of 7 items for obtaining the lecturers' demographic information, while the second section was the TPACK survey instrument used by Koh et al. (2013).

The instrument contained 29 items for lecturers' self-assessment of their level of TPACK and TPACK related components. The TPACK instrument had 7 dimensions: 6 TK items for assessing technological knowledge; 3 CK items for assessing content knowledge; 5 PK items for assessing pedagogical knowledge; 3 PCK items for assessing pedagogical content knowledge; 3 TCK items for assessing technological content knowledge; 5 TPK items for assessing technological pedagogical knowledge, and 4 TPACK items for assessing technological pedagogical content knowledge. The 29 items were answered using the following seven-point Likert scale: strongly disagree, disagree, slightly disagree, neither agree nor disagree, slightly agree, agree, and strongly agree. Other slight changes were made – "the first teaching subject" changed to "teaching subject" in 3 occurrences which are insignificant to the reliability and validity of the instrument. These changes were made in three sections: CK, PCK and TCK. Content validity and reliability test was not applied since other researchers on the instrument had previously performed it. The analysis was carried out with a statistical package called IBM SPSS (Statistical Package for the Social Sciences) Statistics version 20. In this study, a non-parametric test was conducted because the majority of the data groups were not normally distributed and the homogeneity of variance assumption was violated. Mean, standard deviation, percentage, and frequency were determined, and non-parametric tests (Mann-Whitney U test and Kruskal-Wallis test) were used to calculate differences between groups. The value of significance level *(p)* was taken as 0.05 in the study.

Results

Findings on Lecturers' Perceived Knowledge with Regard to TPACK

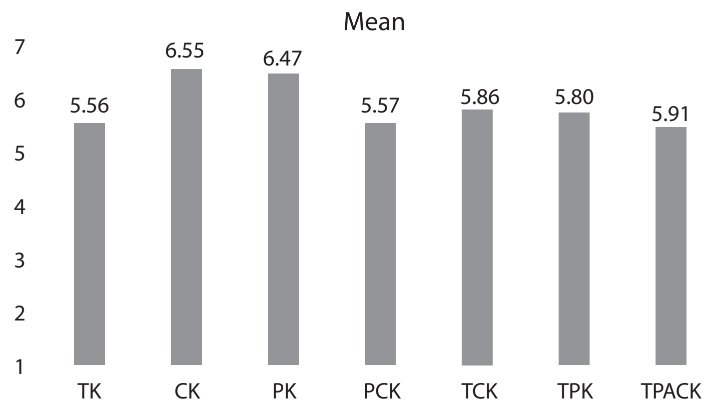

Figure 2. Lecturers' perceived knowledge of the 7 TPACK dimensions

In regard to the first research question, "What are the perceptions of lecturers regarding their technological pedagogical content knowledge?", Figure 2 above shows the mean distribution across the 7 TPACK dimensions. According to the lecturers' self-reports given, all the dimensions were above the "agree" level. It can be concluded that they were all significantly high (see Table 2).

Table 2

Lecturers' perceived knowledge of the 7 TPACK dimensions

Items	Mean	SD
Technology Knowledge (TK)	5.56	1.05
Content Knowledge (CK)	6.55	0.69
Pedagogical Knowledge (PK)	6.47	0.56
Pedagogical Content Knowledge (PCK)	5.57	1.28
Technological Content Knowledge (TCK)	5.86	0.93
Technological Pedagogical Knowledge (TPK)	5.80	0.97
Technological Pedagogical Content Knowledge (TPACK)	5.91	0.84

When the reported perceived knowledge of the lecturers regarding Technology Knowledge dimension (M=5.56, SD=1.05) in Table 2 was analyzed, it indicated that the majority of lecturers perceived TK to be at the "slightly agree" level. It was found that out of 6 TK items, Item 4 was below the "agree" level, which suggests that lecturers need more opportunities to use the already gained technology knowledge in solving their own technical problems. This implies that the lecturers need to have sufficient knowledge of their own subject areas to be able to develop strategies of technology application since it has nowadays become an integral part of learning.

The analysis of the lecturers' Content Knowledge (CK) perceptions (M=6.55, SD=.695) dimension in Table 2 indicated that the majority of the lecturers selected "strongly agree" for their perceived CK level, i.e. their knowledge of their specific subject areas. It was found that out of the 3 CK questions, the lecturers expressed confidence in having sufficient knowledge of their teaching subject – CK1 (M=6.62, SD=.66), and having sufficient knowledge of their teaching subject as a subject matter expert – CK2 (M=6.55, SD=.67) at the "strongly agree" level. In addition, the ability to develop deeper understanding about the content of their teaching subject CK3 (M=6.49, SD=.91) was at the "agree" level. This implies that the lecturers are fully in control of the content of their lesson and have high level of perceived knowledge. It can be concluded from the opinions of the lecturers regarding their specific subject areas that their content knowledge appears to be satisfactory.

It was observed that the lecturers' opinions on their Pedagogical Knowledge perceptions (PK)(M=6.47, SD=.56) were at the "agree" level. The analysis of PK dimension in Table 2 suggests that the lecturers know how to assess students' performance in a subject, adopt different teaching styles depending on the students' performance, develop learning activities according to what the students understood or not, incorporate different teaching approaches such as project-based learning, questioning learning, collaborative learning, directed learning and so forth. It can be concluded that the lecturers' perceived PK is satisfactory in terms of learning and teaching principles, methodologies, practices, and classroom management.

The lecturers' Pedagogical Content Knowledge perceptions (PCK) (M=5.57, SD=1.28) presented in Table 2 were found to be at the "agree" level. Out of the 3 PCK questions, the lecturers gave their "agree" opinions for PCK2 (M=5.68, SD=1.48) and PCK3 (M=5.53, SD=1.51). On the other hand, the lecturers know how to address the common misconceptions of their students without using technology PCK1 (M=5.49, SD=1.40), which was indicated at the "slightly agree" level but with M=0.1 away from "agree". Therefore, the lecturers' knowledge of PCK seems adequate. It can be concluded that the lecturers can teach their specific subject and that they confidently possess a high level of perceived knowledge of their specific subject matters, of which they take advantage in managing the teaching process.

When Technological Content Knowledge - TCK (M=5.86, SD=.93) was examined, the findings in Table 2 indicated that the lecturers' TCK perceptions were found to be at the "agree" level. Out of the 3 TCK questions, the lecturers presented their opinions on their knowledge of technologies used in research and their understanding of the content of their teaching subjects TCK2 (M=5.34, SD=1.73). They also evaluated their usage of appropriate technologies (e.g. multimedia resources, simulation) while presenting the content of their teaching subject TCK3 (M=6.15, SD=.82). Their answers to all 3 items were at the "agree" level. Furthermore, the lecturers' usage of the software that has been created explicitly for their teaching subject (instructional material design) TCK3 (M=6.08, SD=.94) was found to be at the "slightly agree" level. These results show that the lecturers have high levels of perceived knowledge and possess the required knowledge and understanding of technology, which they use in teaching their students specific concepts in their subject areas.

When Technological Pedagogical Knowledge TPK (M=5.80, SD=.97) was examined, it was found that the lecturers' perceived knowledge was at the "agree" level (Table 2). Answers to all 5 TPK questions were found to be at the "agree" level. The lecturers were able to help students use technology to find more information, to facilitate the usage of technology to plan and monitor their learning, to use technology to construct different forms of knowledge representation, and to collaborate with the students using technology independently. These findings suggest that the lecturers have vast knowledge of determining the usage of teaching methods and teaching technologies, as well as good and thorough thinking of arising consequences.

Finally, the lecturers' Technological Pedagogical Content Knowledge perceptions - TPACK (M=5.91, SD=.84) were found to be at the "agree" level (Table 2). The lecturers' perceived knowledge regarding this dimension indicates that they can teach lessons that appropriately combine the subject matter, technologies, and teaching approaches – TPACK1 (M=5.98, SD=1.10) and that for the use in their classroom they select technologies that enhance what they teach, how they teach, and what students learn – TPACK2 (M=6.06, SD=.79). They also use strategies that combine content, technologies, and teaching approaches that they have learned about in classroom coursework – TPACK3 (M=6.00, SD=.89), and provide leadership in helping others to coordinate the use of content, technologies, and teaching approaches at school and/or district –TPACK4 (M=5.73, SD=1.16). This can imply that lecturers have a high level of TPACK confidence and that they can sufficiently integrate technology into teaching.

Findings on Lecturers' TPACK Perceptions according to Gender

The results of the Mann-Whitney U test that was performed to determine the lecturers' knowledge perceptions of TPACK according to gender variable are presented in Table 3.

Table 3
Lecturers' opinions on TPACK according to gender

	Gender	N	Mean Rank	U	p
TK TOTAL	Male	24	30.94	229.50	.050*
	Female	28	22.70		
PCK TOTAL	Male	25	32.52	212.00	.013*
	Female	28	22.07		

Our findings indicated that there is a significant difference in the lecturers' TK (*MWU*=229.50, $p<0.05$) and PCK (*MWU*=212.00, $p<0.05$) domains across the gender group. It was found that males (M=30.94) had a higher mean rank than females (M=22.70). Therefore, it was a remarkable difference in favor of the male lecturers. This was further justified by a large difference discovered between their mean from the descriptive analysis, which implied that male lecturers see themselves as more competent in TK and PCK domains than female lecturers. According to the findings presented above, it can be concluded that the male lecturers' perceived knowledge was at a high level with regard to using technology in the teaching process and methods, as well as in conducting the teaching process and applying the methodology itself.

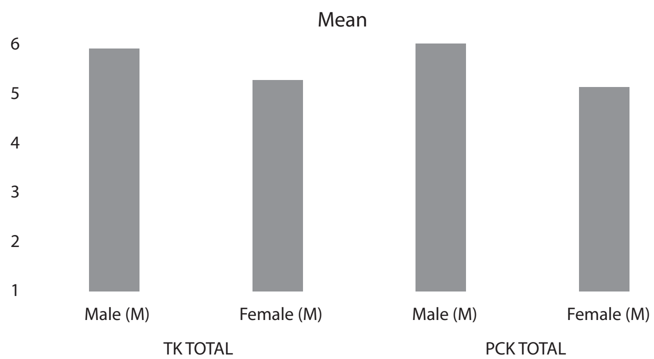

Figure 3. Mean representation of lecturers' TPACK perceptions according to gender, showing the dimensions where significant differences occurred

From the data presented in Figure 3 it can be concluded that the values for the male group were statistically significantly higher than those for the female group in TK Mean (M=5.89, F=5.29) and PCK Mean (M=5.99, F=5.19).

Findings on Lecturers' TPACK Perceptions according to Employment Status

The results of the Mann-Whitney U test that was performed to determine the lecturers' TPACK perceptions according to employment status variable are given in Table 4.

Table 4
Lecturers' opinions on TPACK according to employment status

	Employment status	N	Mean Rank	U	p
TK TOTAL	Full-time	37	23.51	167.00	.025*
	Part-time	15	33.87		
	Total	52			
TPK TOTAL	Full-time	38	23.64	157.50	.024*
	Part-time	14	34.25		
	Total	52			

*p < 0.05

According to the results from Table 4, a significant difference was determined between full-time and part-time lecturers' perceptions of TK (*MWU*=167.00, $p<0.05$) and TPK (*MWU*=157.50, $p<0.05$). These two domains significantly differentiated according to the variable of employment status, and this differentiation was in favor of the part-time lecturers. A further analysis was carried out by using the mean representation, as shown in Figure 4.

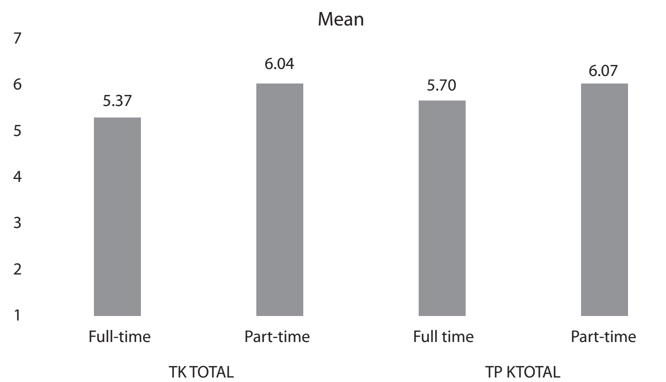

Figure 4. Mean representation of lecturers' TPACK perceptions according to employment status, showing the dimensions where significant differences occurred

According to Figure 4 above, it was found that each mean comparison between the employment status suggested that the part-time lecturers have a higher-level perception with regard to TK (M=6.04) and TPK (M=6.07) than full-time lecturers in the TK (M=5.37) and TPK (M=5.70) domains. This may imply that all lecturers possess a high level of TPACK and its sub-dimension, but the part-time lecturers have higher levels of perceived knowledge. This may be because they spend more time exploring new technologies and find new ways to engage students and make learning effective for them.

Findings on Lecturers' TPACK Perceptions according to Department

The Kruskal-Wallis test was performed to determine the difference between the lecturers' TPACK perceptions according to various departments in which they taught. The Kruskal-Wallis test indicated that there were significant differences across three domains: TK ($p<0.05$), TPK ($p<0.05$) and TPACK ($p<0.05$). The figure below shows the graphical representations of the mean, respectively:

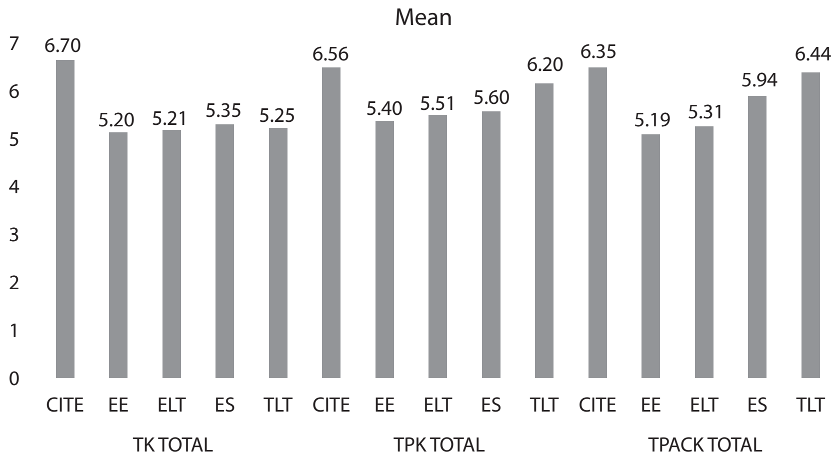

Figure 5. Mean representation of lecturers' TPACK perceptions according to department, showing the dimensions where significant differences occurred

As shown in Figure 5, the comparison was carried out of the mean in each sub-dimension of the lecturers' opinions on their perceived knowledge in which significant differences were found. Computer Education and Instructional Technologies department had the highest mean for TK (M=6.70), TPK (M=6.56) and TPACK (M=6.53). This implies that the lecturers in CITE department may be thought to have a higher level of perceived knowledge towards the use of technology, adoption of different teaching methods using technology and various kinds of subject matter. Their professional and personal usage of technology compared with other lecturers is higher.

Findings on Lecturers' TPACK Perceptions according to In-Service Training that is Oriented to the Use of Technologies

The results of the Mann-Whitney U test that was performed to determine the lecturers' knowledge perceptions of TPACK according to the variable of in-service training that is oriented to the use of technologies such as computers, smart boards, projectors, software programs, digital cameras/videos and others are given in Table 5.

Table 5

Lecturers' opinions on TPACK according to in-service training that is oriented to the use of technologies

	In-service training	N	Mean Rank	U	p
PCK TOTAL	Yes	46	25.18	77.50	.026*
	No	7	38.93		
	Total	53			

**p*< 0.05

According to Table 5, which presents information on the in-service training oriented towards the use of technologies received by the lecturers, a significant difference was determined between the lecturers' PCK perceptions (*MWU*=77.50, *p*<0.05). The differentiation in this sub-dimension was in favor of the lecturers whose response was "no". This may mean that although in-service training oriented towards the use of technologies was provided, it was not directed in a way to affect other sub-dimensions. Further comparisons were made using the mean descriptive in Figure 6 below.

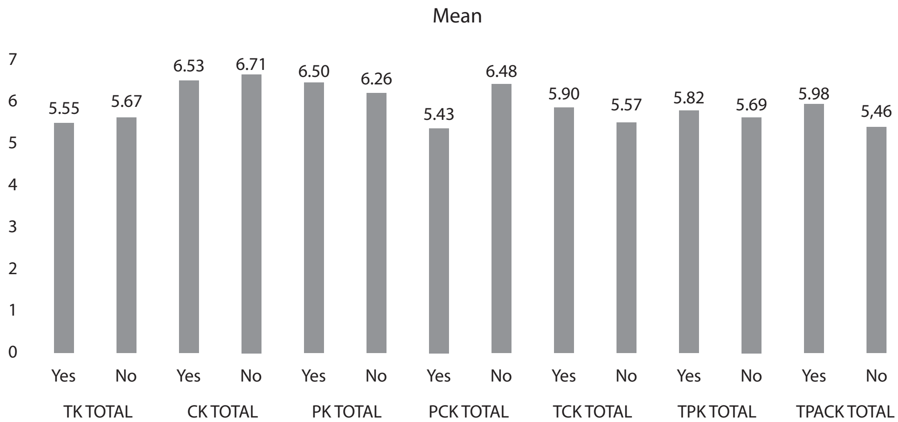

Figure 6. Mean representation of lecturers' TPACK perceptions according to in-service training that is oriented to the use of technologies, showing the dimensions where significant differences occurred

According to Figure 6, the number of the lecturers who provided a "yes" answer regarding receiving in-service training oriented towards the use of technologies was higher than the number of those who are not receiving it, except for PCK. The number of lecturers who said that they do not have in-service training (M=6.48) was higher than the number of those who have in-service training (M=5.43). This implies that although in-service training oriented towards the use of technologies has increased the perceived knowledge of lecturers in TK, CK, PK, TPK, TCK, TPACK domains, it did not influence PCK. This may be because the in-service training provided is not sufficient to increase the level of their perceived knowledge. Although not significantly numerous, there were positive effects on PK, TCK, TPK and TPACK when considering the mean.

Discussion

The findings presented in this study show the lecturers' perceived TPACK across all the seven components examined: TK, CK, PK, PCK, TCK, TPK and TPACK. The perception level was indicated to be at the "agree" level, showing that the lecturers have a high level of perceived knowledge.

It was concluded from the study that the lecturers' perception on TPACK changed in TK and PCK areas according to gender, whereas there were no changes in the perception of TPACK in CK, PK, TCK, TPK and TPACK according to gender. The results obtained showed that the male lecturers had a higher level of perception about these two knowledge dimensions in which the change occurred, which was consistent with other research results (Jang & Tsai, 2013; Koh et al., 2010; Lin et al., 2013). Kazu and Erten (2014) stated that the female teachers' level of perceived knowledge was found to be higher than that of male teachers. This implies that many lecturers had more skills beyond the standard technologies and are able to put in operation particular technologies. They also reported higher skills in different ways of interaction in a subject matter and different teaching practices which can enable a student to learn the subject matter. Lin et al. (2013) examined the relationship between science teachers' TPACK and gender in their study. Their findings showed that female teachers perceived their PK higher and TK lower than the male teachers, which is consistent with the findings of this study.

It was determined from the results of this study that lecturers' perception of TK and TPK changed according to employment status, whereas CK, PK, PCK, TCK and TPACK did not change according to employment status. It was concluded that part-time lecturers perceived higher levels of TK and TPK when compared with full-time lecturers. This finding may be such due to the fact that part-time lecturers spend more time in developing their skills of using technology and are able to create and adopt different teaching methods with the use of technology. They may be more enthusiastic about keeping up to date on new technologies and skills, both from personal and professional perspectives. Full-time lecturers should be motivated to keep up to date and use different technologies, since these two elements can affect students' learning in a different way (Shin et al., 2009).

Finally, the lecturers' opinions of PCK change according to receiving in-service training oriented towards the use of technologies such as computers, smart boards, digital cameras and videos, projectors, software programs and others. While there was no significant change in TK, CK, PK, TPK, TCK, and TPACK, there were positive effects on PK, TCK, TPK, and TPACK when considering the mean rank. In-service training oriented towards the use of technologies such as computers (22.6%), smart boards (46.1%), digital cameras and videos (7.5%), projectors (17%), software programs (11.3%) and other technologies which are not listed (9.4%) did not have a significant effect on their PCK perceptions. Kazu and Erten (2014) pointed out that the increase in the teachers' knowledge of technology usage causes similar increase in their control, teaching process and their perceived knowledge. This implies that if in-service training oriented towards the use of technologies leads to no increase in PCK or any of the knowledge areas, the training was not utilized effectively or was not sufficient. Therefore, appropriate attention should be given to in-service training in order to achieve a positive effect on the knowledge areas.

Considering the results in descending order, they are listed as CK (M=6.55), PK (M=6.47), TPACK (M=5.91), TCK (M=5.80), TPK (M=5.86), PCK (M=5.57) and TK (M=5.5641), respective to their mean. The lecturers possessed a high level of content, pedagogical, and technological knowledge although varying, through their understanding of better ways to interact with these kinds of knowledge (Jang &Tsai, 2012, 2013). These better ways have evolved through the transformation of technology, pedagogy, and content (Kazu & Erten, 2014). This means that they are well-oriented towards the knowledge of the subject matter which they teach and that they know how this knowledge can best interact with and be transferred to students, which can be a result of the amount of time spent in service, as well as some other factors which were also examined. Based on the overall analysis of TPACK, it was concluded that lecturers have a high understanding of the interplay and relationship complexity between themselves, their students, the content, practices, and technologies. Kazu and Erten (2014) shared this same view. They possess the knowledge of strategies to combine technologies and the teaching approaches, coordinate the content used in teaching and ways to enhance students' learning in a technologically enhanced learning environment. In addition, improving PCK and TK will help the lecturers to use technology as a tool, which will be a part of the whole process of teaching and not just a tool to assist the teaching process.

Conclusion

Considering the first research question, it was concluded that the lecturers had a high level of TPACK perceptions. The study was able to help in understanding various ways lecturers perceived their TPACK. This study reveals the differences that were identified in the lecturers' perception of TPACK in each knowledge dimension. Significant differences were reported for lecturers' perceived Technological Knowledge (TK) and Pedagogical Content Knowledge (PCK) dimensions according to gender, for lecturers' perceived Technological Knowledge (TK) and Technological Pedagogical Knowledge (TPK) dimensions according to employment status, for lecturers' perceived Technological Knowledge (TK), Technological Pedagogical Knowledge (TPK), and Technological Pedagogical Content Knowledge (TPACK) dimensions according to department and for lecturers' perceived Pedagogical Content Knowledge (PCK) dimension according to in-service training.

Considering the second research question, these are the conclusions:

1. According to gender, male lecturers' TPACK perceptions were higher than those of female lecturers, with significant differences in TK and PCK.

2. According to employment status, part-time lecturers' TPACK perceptions were higher than those of full-time lecturers, with significant differences in TK and TPK.
3. According to department, lecturers from the CITE department perceived their level of TPACK to be higher than the lecturers from other departments, with significant differences in TK, TPK and TPACK.
4. According to in-service training oriented towards the use of technologies, the number of lecturers whose response was negative was higher than the number of those whose answer was positive. The lecturers who perceived a higher level of PCK had more negative responses than others did.

According to Elçi (2012), "Most of the participants from the educational faculty (83.3%) stated that they want to learn in order to help students to solve problems and think critically" (p. 140). Throughout this research we found that the significant differences were high, which shows that the lecturers actually developed technological knowledge in connection with pedagogy in order to facilitate their students' learning during the period of Elçi's study and now. It was concluded that the TPACK framework is an accurate tool for measuring and developing lecturers' technology integration knowledge.

Recommendations for Further Research

There have been rapid changes in learning and teaching processes, as well as in the syllabi at the Faculty of Education, which is due to the increasing integration of technology into teaching. Amidst these developments, female lecturers should be motivated and engaged in technological development in order to improve their TPACK. This research study has also determined significant implications which TPACK has on the professional development of lecturers from the point of view of their perceived knowledge. This makes it a proper framework that can aid the lecturer to go beyond the traditionally-skilled way of teaching into a more techno-contextual way of teaching which appreciates the rich relationships between technology, content (the subject matter) and pedagogy (pedagogical principles and methods). However, this can only be achieved if lecturers adopt various ways of teaching, such as the "learning by design approach" (Koehler & Mishra, 2005), as has been suggested by many other researchers.

Apart from educators training the pre-service teachers on how to use technology for effective pedagogy, more attention should be directed to the training of full-time lecturers on how to integrate technological and pedagogical approaches, which will aid students in a better understanding of courses and educational practices. More opportunities need to be created for the practice and implementation of the TPACK framework in other departments to bridge the technological gap that exists when compared with CITE department.

In addition, lecturers' TPACK perceptions and competences should be determined from time to time in order to motivate and encourage lecturers towards developing technological pedagogical content knowledge – TPACK. Following the conclusion of this study, the researcher recommends that more research should be carried out to go beyond understanding the lecturers' TPACK from the point of view of perceived knowledge alone, and to consider the observed attitudes that can help in understanding and determining the actual TPACK competences of lecturers in Eastern Mediterranean University Faculty of Education.

Finally, further research should adopt a qualitative approach or mixed approach in order to understand more deeply the results and reach more generalizable conclusions (Koehler & Mishra, 2005; Shin et al., 2009). The results of this research could be used to form a base for other research studies within Eastern Mediterranean University, schools in N. Cyprus and in other countries.

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Istraživanje o procjeni pedagoškog i predmetnog tehnološkog znanja predavača na Učiteljskom fakultetu Istočnog mediteranskog sveučilišta u Cipru

Sažetak

Upotreba tehnologije u nastavi rezultirala je različitim stavovima. Potreba za spoznajama o tome kako nastavnici integriraju tehnologiju u nastavu stvorila je različita gledišta. Stoga se ovim istraživanjem pokušavaju razumjeti gledišta o procijenjenom pedagoškom i predmetnom tehnološkom znanju (engl. TPACK) predavača, jer se u njemu ispituje kako se ta gledišta razlikuju s obzirom na spol, vrstu zaposlenja, odsjek u kojem predaju i način stručnog usavršavanja na radu koje je usmjereno na upotrebu tehnologije. Da bi se postigao navedeni cilj, istraživač je statistički ispitao procijenjeno pedagoško i predmetno tehnološko znanje predavača na Učiteljskom fakultetu Istočnog mediteranskog sveučilišta. U ovom su istraživanju 53 predavača dobila instrument istraživanja o pedagoškom i predmetnom tehnološkom znanju, a anketa se koristila da bi se odredio stupanj njihova procijenjenog znanja o sedam dimenzija pedagoškog i predmetnog tehnološkog znanja. Srednje vrijednosti, standardna devijacija, postotak, frekvencija i neparametrijski testovi (Mann-Whitney U test i Kruskal-Wallis test) koristili su se pri analizi podataka. Istraživanje je pokazalo da je stupanj procijenjenog pedagoškog i predmetnog tehnološkog znanja predavača bio značajno visok u svim dimenzijama znanja. Utvrđene su statistički značajne razlike u tome kako predavači shvaćaju pedagoško i predmetno tehnološko znanje prema navedenim varijablama. Te su se razlike javile u tehnološkom znanju (TK) i pedagoško-predmetnom znanju (PCK) s obzirom na spol; u tehnološkom znanju (TK) i tehnološko-pedagoškom znanju (TPK) s obzirom na vrstu zaposlenja; u tehnološkom znanju (TK), tehnološko-pedagoškom znanju (TPK) i pedagoškom i predmetnom tehnološkom znanju (TPACK) s obzirom na odsjek u kojem predavači rade te u pedagoškom predmetnom znanju (PCK) s obzirom na stručno usavršavanje na radu.

Ključne riječi: *okvir sustava za obrazovnu tehnologiju; pedagoško i predmetno tehnološko znanje; poboljšanje nastavnog procesa; promjene specifične za državu; strategije učenja i poučavanja.*

Uvod

Upotreba tehnologije u obrazovnom sustavu naglo je porasla tijekom 21. stoljeća te je tako imala i velik utjecaj na pedagoško predmetno znanje. Najbolji način integriranja tehnologije u nastavu postao je svjetsko pitanje i ono u velikoj mjeri utječe na nastavnike u azijskoj regiji. Prema Mishri i Koehleru (2008), za uspješnu nastavu „dobro promišljena pedagoška upotreba tehnologije zahtijeva razvoj kompleksnog, skupnog znanja koje nazivamo pedagoško i predmetno tehnološko znanje (TPACK)" (str. 1017).

Iako je tehnologija uvedena u obrazovni sustav, njezina puna i učinkovita integracija još uvijek nije postignuta. Razlog je tomu što tehnologija sama po sebi ne može dovesti do promjene (Koehler i Mishra, 2005). Do promjene može doći samo putem načina na koji se nastavnici koriste tehnologijom u obrazovnom procesu. Na primjer ako u učionici postoji pametna ploča, to kod učenika u procesu učenja neće imati utjecaja ako nastavnik ne osmisli načine na koje će učenike na aktivan način uključiti u rad, tj. ako nastavnik ne primijeni metode angažiranja učenika. Kakva je korist od pametne ploče u procesu učenja ako je sve što nastavnik radi s tom pločom pisanje po njoj, isto kao što bi pisao po običnoj školskoj ploči? Od nastavnika se očekuje određeni stupanj tehnološkog znanja ili, još bolje, od njega se očekuje da će razvijati tehnološko znanje koje će mu pomoći pri odabiru pedagogije – to je pedagoško znanje (PK) kojim će strukturirati specifični predmetni sadržaj, što podrazumijeva predmetno znanje (CK). To je osnovni pojam konstruktivizma, prema kojemu je učinkovito učenje usmjereno na učenika te ima sposobnost aktivno uključiti sudionike (Sessoms, 2008).

Teorijski okvir

Integracija tehnologije

Prihvaćanje tehnologije u obrazovanju dovelo je do stvaranja pojma obrazovne tehnologije. Obrazovna tehnologija bavi se izradom, razvojem, korištenjem, vođenjem i procjenom procesa i izvora učenja (Luppicini, 2005). Tom području istraživanja poklanja se velika pažnja raznih dionika u obrazovanju u cijelom svijetu, zahvaljujući naporima tehnološki naprednih zemalja i zemalja u tehnološkom razvoju da se informacijska i komunikacijska tehnologija uključi u tehnike učenja i poučavanja u njihovim školama (Agyei i Voogt, 2012; Chai, Koh, i Tsai, 2013; Shin i sur. 2009).

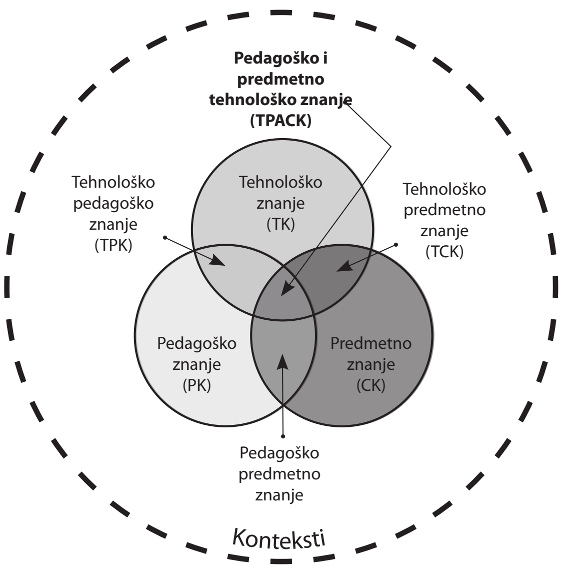
U središtu tehnološkog razvoja jest i „opasnost da se nastavnici neće koristiti alatima onako kako je to zamišljeno" (Sessos, 2008, str. 86) jer umjesto da se potpuno koriste tehnološkim alatima u nastavi, oni se njima koriste kao dodatkom tradicionalno orijentiranoj paradigmi. Sessoms (2008) je naveo da „je problem u tome da nastavnici nisu osposobljeni razmišljati o poučavanju i učenju kao interaktivnom procesu koji potiče korištenje tehnologije" (str. 87). Stoga je poželjno izraditi precizan okvir koji omogućava mjerenje znanja nastavnika koje bi pomoglo uskladiti razmišljanja nastavnika s odgovarajućom upotrebom informacijske i komunikacijske tehnologije u obrazovnom procesu. To čini pedagoško i predmetno tehnološko znanje idealnim okvirom, tim više što se znanje nastavnika mora opisati i izmjeriti da bi se olakšala pravilna integracija i poboljšanje tehnologije u nastavnom procesu (Jang i Tsai, 2012, 2013; Koh i Chai, 2014; Koehler i Mishra, 2009; Mishra i Koehler, 2006; Schmidt i sur., 2009). Pedagoško i predmetno tehnološko znanje je teorijski okvir (Koh, Chai i Tsai, 2013) koji definira i stvara sustavni pregled nastavnikove stručnosti, tj. znanje koje nastavnici trebaju imati da bi integrirali informacijsku i komunikacijsku tehnologiju u učinkovito poučavanje, a s ciljem poboljšanja procesa učenja kod učenika. Chai i sur. (2013) definirali su pedagoško i predmetno tehnološko znanje kao sintetizirani oblik znanja sa svrhom integriranja informacijske i komunikacijske tehnologije/obrazovne tehnologije u nastavni proces i proces učenja. Jang i Tsai (2013) objasnili su pedagoško i predmetno tehnološko znanje kao konsolidirani sustav koji poboljšava proces učenja upravo zbog svoje instrumentalnosti koja kombinira različite komponente koje su u međusobnoj interakciji, a osmišljene su tako da djeluju kao usklađena cjelina. Što ta usklađenost čini? Koehler i Mishra (2005) su naglasili da su tehnologija, pedagogija i predmetni sadržaj u međusobnoj interakciji s razumijevanjem, kao jedan pristup integraciji tehnologije. Te usklađene komponente čine okvir takozvanog pedagoškog i predmetnog tehnološkog znanja.

Okvir pedagoškog i predmetnog tehnološkog znanja

Tijekom godina prevladavanje tehnologije u obrazovnom sektoru dovelo je do mnogih istraživanja, promjena i upita od predavača, raznih dionika u obrazovanju i kreatora obrazovne politike (NETS 2000, 2008) o najboljim načinima uključivanja tehnologije u nastavni proces da bi se učenicima omogućilo učinkovito i uspješno učenje. Prema Koehleru i Mishri (2005), Mishri i Koehleru (2006) i Niess (2005, 2006), nove spoznaje u tehnologiji promijenile su poglede na tehnologiju kao sadržaj i kao nastavni alat. Kada je u 21. stoljeću započelo istraživanje o vrsti znanja potrebnog da bi se koristila i primijenila informacijska i komunikacijska tehnologija u nastavi, Niess (2006) je istaknula da nastavnici matematike nisu osposobljeni koristiti se tehnološkim alatima, što je izazvalo zabrinutost zbog problema utvrđivanja potrebnih alata i pripreme nastavnika za poučavanje matematike u 21. stoljeću. Međutim, ta zabrinutost ne odnosi se samo na matematiku već i na sva druga predmetna područja. U vezi s tim problemom Koehler i Mishra (2005) su istaknuli slično pitanje: „Što nastavnici trebaju znati o tehnologiji i kako mogu steći takvo znanje?" To je bio početak pedagoškog i predmetnog tehnološkog znanja. Ti istraživači zaključili su da nastavnici trebaju razviti svijest o strukturi znanja koje omogućava uključivanje znanja o predmetnim sadržajima, znanja o pedagogiji i znanja o tehnologiji u kurikul i u škole. Također smatraju da nastavnici moraju razviti pedagoško predmetno znanje da bi mogli održavati nastavu svojih nastavnih predmeta (Koehler i Mishra, 2005; Mishra i Koehler, 2006; Niess, 2005). I mnogi drugi obrazovni stručnjaci i istraživači tako su mogli shvatiti važnost pedagoškog i predmetnog tehnološkog znanja, tj. pedagoškog predmetnog znanja koje uključuje tehnologiju. To upućuje na činjenicu da se tehnologija ne bi trebala smatrati komponentom koja je odvojena i neovisna o pedagoškom predmetnom znanju, nego bi se trebala smatrati jednako važnom komponentom u kontekstu poučavanja (Koehler i Mishra, 2005; Lin i sur., 2013; Mishra i Koehler, 2006).

Pokazalo se da je upravo pedagoško i predmetno tehnološko znanje takav okvir budući da integracija tehnologije vodi uvođenju novih pojmova i zahtijeva osjetljivost na dinamične i transakcijske veze između svih triju komponenti koje predlaže okvir pedagoškog i predmetnog tehnološkog znanja. Koehler i Mishra (2005) su opisali vezu između predmetnog sadržaja, pedagogije i tehnologije, kao dodatak Shulmanovu pojmu pedagoškog predmetnog znanja, no otišli su i korak dalje i proveli detaljnu analizu kompleksne interakcije između tih komponenti. Dodatak tehnologije toj analizi doveo je do stvaranja još četiriju komponenti: tehnološkog znanja, tehnološkog pedagoškog znanja, tehnološkog predmetnog znanja te pedagoškog i predmetnog tehnološkog znanja. Taj okvir ima čvrstu pretpostavku da se tehnologija može uspješno uvesti u nastavni proces kada su znanja o predmetnom sadržaju, pedagogiji i tehnologiji integrirana u jednu cjelinu ili sustav, a ne kada se gledaju kao zasebne komponente.

Opis komponenti pedagoškog i predmetnog tehnološkog znanja



Prikaz 1. TPACK okvir (grafički prikaz preuzet s: http://tpack.org)

Predmetno znanje (CK), koje se još naziva predmetnom stručnošću (Shulman, 1994), je znanje o određenom predmetnom sadržaju koji će se poučavati ili naučiti (Koehler i Mishra, 2005; Koh i sur., 2013; Mishra i Koehler, 2006; Schmidt i sur., 2009). Na primjer, ono obuhvaća znanje o izradi nastavnih planova, upravljanja bazama podataka, tečajevima programiranja (HTML5, C, C++ ili PHP). Ovo je znanje kojega nastavnik ima o određenom predmetnom sadržaju.

Pedagoško znanje (PK) je detaljno znanje o nastavnoj praksi i nastavnim metodama, strategijama i postupcima (Koehler i Mishra, 2005; Koh i sur., 2013; Mishra i Koehler, 2006;). Ono obuhvaća znanje o postupcima i metodama poučavanja, koje uključuju znanje o upravljanju razredom, izradi nastavnih priprava, ocjenjivanju i procesu učenja učenika (Schmidt i sur., 2009). To je znanje o tome kako prenijeti ili predavati o predmetnom znanju. Ovisno o pedagoškoj svrsi nastavnika koriste se raznolike metode da bi se izazvala poželjna ponašanja učenika i da bi se potpomoglo njihovo učenje (Kazu i Erten, 2014).

Tehnološko znanje (TK) je znanje o tehnološkim alatima (Koh i sur., 2013) poput računala, interneta, digitalnih videomaterijala i mnogim uobičajenim tehnologijama kao što su grafoskop, interaktivne pametne ploče, programski softver itd. (Koehler i Mishra, 2005; Koehler i Mishra, 2009; Mishra i Koehler, 2006; Mishra i Koehler, 2008; Schmidt i sur., 2009).

Tehnološko predmetno znanje (TCK) je znanje o tome kako upotrebljavati tehnologiju u prezentiranju predmetnog gradiva. To je razumijevanje utjecaja koji tehnologija ima na prezentiranje nastavnog sadržaja, što omogućava fleksibilnost upotrebe tehnologije u obrazovne svrhe da bi se utjecalo na način na koji učenici vježbaju i shvaćaju pojmove određenog nastavnog gradiva pojedinog nastavnog predmeta (Kazu i Erten, 2014; Koehler i Mishra, 2005; Koehler i Mishra, 2009; Mishra i Koehler, 2006; Mishra i Koehler, 2008; Schmidt i sur., 2009).

Tehnološko pedagoško znanje (TPK) je znanje o tome kako upotrebljavati tehnologiju u primjeni i prilagodbi različitih metoda (Koehler i Mishra, 2005; Koehler i Mishra, 2009; Koh i sur., 2013; Mishra i Koehler, 2006; Mishra i Koehler, 2008; Schmidt i sur., 2009).

Pedagoško predmetno znanje (PCK) je znanje o tome kako poučavati određeni predmetni sadržaj. Ono uključuje metode i postupke koji se koriste da bi se prezentirao određeni predmetni sadržaj. Prema Shulmanu (1994), takvo znanje pomaže u učenju svih nastavnih predmeta jer pokazuje načine organiziranja, prezentiranja i prilagodbe različitim interesima i vještinama učenika (Koehler i Mishra, 2005; Koehler i Mishra, 2009; Koh i sur., 2013; Mishra i Koehler, 2006; Mishra i Koehler, 2008; Schmidt i sur. 2009).

Pedagoško i predmetno tehnološko znanje (TPACK) jest znanje koje nastaje spajanjem tehnologije, pedagogije i predmetnog sadržaja. To je znanje koje nastavnici trebaju imati da bi upotrijebili tehnologiju u provedbi nastavnih metoda i postupaka u bilo kojem predmetnom sadržaju (Koehler i Mishra, 2009; Koh i sur., 2013; Schmidt i sur., 2009). To znanje nadilazi granice tehnocentrizma jer pomaže nastavnicima u učinkovitom i kreativnom mišljenju (Kazu i Erten, 2014).

Svrha ovog istraživanja

Svrha je ovog istraživanja ispitati gledišta predavača o pedagoškom i predmetnom tehnološkom znanju u kontekstu njihova iskustva na Učiteljskom fakultetu. Navedena svrha ostvarit će se putem sljedećih istraživačkih pitanja:

1. Kako predavači procjenjuju svoje pedagoško i predmetno tehnološko znanje?
2. Kako se procjene predavača razlikuju s obzirom na njihov spol, vrstu zaposlenja, odsjek na kojem rade i stanje stručnog usavršavanja na radu usmjerenog na upotrebu tehnologije?

Metoda

Prema dizajnu ovo je kvantitativno istraživanje. Kvantitativne metode naglašavaju objektivna mjerenja i numeričku analizu podataka koji se dobivaju upitnicima poput ankete ili anketnog listića. Prema Aliagi i Gundersonu (1999), kvantitativni pristup istraživanju koristi se za objašnjavanje pojava prikupljanjem brojčanih podataka koji se potom tumače na temelju matematičkih statističkih metoda.

Uzorak

Uzorak koji je sudjelovao u ovom istraživanju sastojao se od predavača Učiteljskog fakulteta Istočnog mediteranskog sveučilišta u Cipru tijekom proljetnog semestra akademske godine 2013./2014. Predavači s Učiteljskog fakulteta bili su najbolji uzorak za ovo istraživanje jer se oni sami često nalaze u situaciji kada moraju stvarati i razmišljati o učinkovitim pedagoškim postupcima da bi se osigurale dobre poveznice između tehnologije i pedagogije (Elçi, 2012; Mishra i Koehler, 2008). Zahvaljujući njihovu već stečenom pedagoškom i predmetnom znanju, oni će moći bolje razumjeti potrebu za istraživanjem i tako istraživaču omogućiti dobivanje pouzdanih rezultata za ovo istraživanje.

Tablica 1

Kako prikazuje Tablica 1., ovo je istraživanje provedeno na šest odsjeka. Od 73 predavača njih 53 ispunilo je upitnik. 52,8 % predavača bilo je ženskog spola, a njih 47,2 % muškog spola. Na samo pet odsjeka 71,7 % predavača bilo je zaposleno na puno radno vrijeme, a 28,3 % predavača bilo je zaposleno honorarno. 18,9 % ih je bilo zaposleno na Odsjeku za računalno obrazovanje i nastavne tehnologije (CITE), 9,4 % na Odsjeku za osnovnoškolsko obrazovanje (EE), 17,7 % bilo je s Odsjeka za nastavu engleskog jezika (ELT), 42,3 % s Odsjeka za obrazovne znanosti (ES) i 7,5 % ih je bilo s Odsjeka za nastavu turskog jezika (TLT). Predavači s Odsjeka za nastavu likovne umjetnosti (FAE) nisu ispunili upitnik. Prema rezultatima dobivenima za stručno usavršavanje na radu usmjereno na upotrebu tehnologije, 86,5 % predavača složilo se s tvrdnjom da su prošli kroz takvo stručno usavršavanje, a njih 13,5 % se nije složilo s tom tvrdnjom. Svaki sudionik u istraživanju ispunio je Upitnik o pedagoškom i predmetnom tehnološkom znanju da bi izrazio svoje mišljenje i iskustva vezana uz pedagoško i predmetno tehnološko znanje.

Instrument za prikupljanje podataka i analiza podataka

Instrument za istraživanje pedagoškog i predmetnog tehnološkog znanja bio je anketni listić kojim su se koristili i Koh i sur. (2013). Prema Mathersu, Foxu i Hunnu (1998), ankete imaju prednost jer je njihova valjanost i unutarnja i vanjska te su fleksibilne, učinkovite i ekonomične. Mathers i sur. (1998) također su istaknuli da anketu može izraditi istraživač ili da se ona može izraditi na temelju već napravljenog indeksa, pa je to razlog zašto se koristio anketni listić koji su izradili Koh i sur. (2013). Upitnik koji se koristio u ovom istraživanju sastojao se od dva dijela (demografskih podataka i instrumenta za prikupljanje podataka o pedagoškom i predmetnom tehnološkom znanju). Prvi dio sadržavao je 7 tvrdnji da bi se dobili demografski podaci o predavačima, a drugi je dio bio instrument istraživanja o pedagoškom i predmetnom tehnološkom znanju kojim su se koristili Koh i sur. (2013).

Instrument je sadržavao 29 tvrdnji da bi se dobila procjena predavača o pedagoškom i predmetnom tehnološkom znanju i drugim srodnim komponentama. Instrument o pedagoškom i predmetnom tehnološkom znanju imao je 7 dimenzija: 6 TK tvrdnji za procjenu tehnološkog znanja, 3 CK tvrdnje za procjenu predmetnog znanja, 5 PK tvrdnji za procjenu pedagoškog znanja, 3 PCK tvrdnje za procjenu pedagoškog predmetnog znanja, 3 TCK tvrdnje za procjenu tehnološkog predmetnog znanja, 5 TPK tvrdnji za procjenu tehnološkog predmetnog znanja i 4 TPACK tvrdnje za procjenu pedagoškog i predmetnog tehnološkog znanja. Na 29 tvrdnji odgovaralo se primjenom Likertove skale od sedam stupnjeva: uopće se ne slažem, ne slažem se, donekle se ne slažem, niti se slažem niti se ne slažem, donekle se slažem, slažem se i potpuno se slažem. Napravljene su i druge manje promjene – „prvi nastavni predmet koji predajem" promijenjen je u „nastavni predmet koji predajem" u 3 slučaja koja nemaju važnost za pouzdanost i valjanost instrumenta. Te promjene napravljene su u tri dijela: CK, PCK i TCK. Nije proveden test o valjanosti i pouzdanosti sadržaja jer su ga već prije proveli istraživači koji su se koristili istim instrumentom. Analiza je provedena s pomoću statističkog paketa IBM SPSS Statistics verzija 20. SPSS znači Statistički paket za društvena istraživanja. U ovom je istraživanju proveden neparametrijski test jer veći dio skupina podataka nije bio normalno distribuiran i narušena je homogenost pretpostavke varijance. Utvrđene su srednja vrijednost, standardna devijacija, postotak, frekvencija, a neparametrijski testovi (Mann-Whitneyev U test i Kruskal-Wallis test) primijenjeni su kako bi se utvrdila razlika između grupa. U istraživanju je određena vrijednost stupnja značajnosti (p) od 0,05.

Rezultati

Rezultati procjene predavača s obzirom na pedagoško i predmetno tehnološko znanje

Prikaz 2

Što se tiče prvog istraživačkog pitanja, „Kako predavači procjenjuju svoje pedagoško i predmetno tehnološko znanje?", Prikaz 2. pokazuje srednju distribuciju kroz svih 7 dimenzija pedagoškog i predmetnog tehnološkog znanja. Prema samoizvještajima predavača odgovori na sve dimenzije bili su iznad razine „slažem se". Može se zaključiti da su svi bili značajno visoki. To je razvidno iz Tablice 2.

Tablica 2

Kada je analizirana dobivena procjena znanja predavača o dimenziji tehnološkog znanja (M=5,56, SD=1,05) u Tablici 2., pokazalo se da većina predavača smatra da je njihovo tehnološko znanje na razini „donekle se slažem". Utvrđeno je da je od ukupno 6 TK tvrdnji 4. tvrdnja bila ispod razine „slažem se", što upućuje na to da predavači trebaju više prilika za korištenje već stečenog tehnološkog znanja u rješavanju vlastitih tehničkih problema. To također implicira da predavači trebaju imati dovoljno znanja o svojem predmetu da bi mogli razviti strategije primjene tehnologije jer je ona danas već postala sastavni dio učenja.

Analiza procjene predavača o dimenziji predmetnog znanja CK (M=6,55, SD=,695) u Tablici 2. pokazala je da većina predavača smatra da je razina njihova predmetnog znanja, tj. njihovo znanje o specifičnom predmetnom sadržaju, na razini „potpuno se slažem". Od 3 CK pitanja utvrđeno je da su predavači uvjereni da imaju dostatno znanje o svojem nastavnom predmetu – CK1 (M=6,62, SD=,66) i da imaju dostatno znanje o svom nastavnom predmetu kao stručnjaci u tom području – CK2 (M=6,55, SD=,67), na razini „potpuno se slažem". Sposobnost dubljeg shvaćanja sadržaja njihova nastavnog predmeta CK3 (M=6,49, SD=,91) bila je na razini „slažem se". To upućuje na činjenicu da predavači smatraju kako imaju potpunu kontrolu nad sadržajem svojih nastavnih sati i da smatraju kako imaju visok stupanj znanja. Iz mišljenja predavača o vlastitim specifičnim predmetnim područjima može se zaključiti da je njihovo predmetno znanje zadovoljavajuće.

Uočeno je da su mišljenja predavača o njihovu pedagoškom znanju PK (M=6,47, SD=,56) bila na razini „slažem se". Analiza PK dimenzije u Tablici 2. upućuje na to da predavači znaju kako ocijeniti rad studenata u svojem predmetu, prilagoditi svoj stil poučavanja radu studenata, izraditi različite aktivnosti učenja prema onome što su studenti razumjeli ili nisu razumjeli, uklopiti različite nastavne pristupe kao što su učenje utemeljeno na projektu, ispitivačko učenje, suradničko učenje, usmjeravano učenje itd. Može se zaključiti da je procijenjeno pedagoško znanje predavača zadovoljavajuće s obzirom na tehnike učenja i poučavanja, metodiku, praksu i upravljanje razredom.

Pokazalo se da je procijenjeno pedagoško predmetno znanje PCK (M=5,57, SD=1,28) predavača u Tablici 2. na razini „slažem se". Od 3 PCK pitanja predavači su dali odgovore na razini „slažem se" za pitanja PCK2 (M=5,68, SD=1,48) i PCK3 (M=5,53, SD=1,51). S druge strane, predavači znaju kako razjasniti krive predodžbe studenata bez upotrebe tehnologije – PCK1 (M=5,49, SD=1,40), što su pokazali odgovorima na razini „donekle se slažem", no samo s M=0,1 vrijednošću na razini „slažem se". Stoga se čini da je znanje predavača o pedagoškom predmetnom znanju odgovarajuće. Može se zaključiti da predavači mogu predavati svoje specifične nastavne predmete i da zasigurno posjeduju visoko procijenjeno znanje o svojim predmetnim područjima, što mogu iskoristiti u vođenju nastavnog procesa.

Kada se ispitivalo tehnološko predmetno znanje TCK (M=5,86, SD=,93), rezultati u Tablici 2. pokazali su da je procijenjeno znanje predavača o tehnološkom predmetnom znanju na razini „slažem se". Od 3 TCK pitanja predavači su dali svoje mišljenje o vlastitom znanju o tehnologijama koje se koriste u istraživanju i o svojem razumijevanju sadržaja predmeta koje predaju TCK2 (M=5,34, SD=1,73). Također su procijenili vlastitu upotrebu odgovarajućih tehnologija (npr. multimedijalnih izvora, simulacija) u prezentiranju sadržaja svojih nastavnih predmeta TCK3 (M=6,15, SD=,82). Njihovi odgovori na sve tri tvrdnje bili su na „slažem se" razini. Nadalje, predavači smatraju da je upotreba softvera koji je izrađen eksplicitno za njihov nastavni predmet (oblikovanje nastavnih materijala) TCK3 (M=6,08, SD=,94) bila na razini „donekle se slažem". Ti rezultati pokazuju da predavači imaju visok stupanj procijenjenog znanja, da posjeduju potrebno znanje te da razumiju tehnologiju kojom se koriste kada studentima prezentiraju pojmove specifične za svoje predmetno područje.

Pri ispitivanju tehnološkog predmetnog znanja TPK (M=5,80, SD=,97) utvrđeno je da je procijenjeno znanje predavača na razini „slažem se" (Tablica 2.). Odgovori na svih 5 pitanja u TPK dimenziji bili su na razini „slažem se". Predavači su mogli pomoći studentima da se koriste tehnologijom za pronalaženje mnogih informacija, olakšati upotrebu tehnologije u planiranju i praćenju procesa učenja, koristiti se tehnologijom za različite načine prezentiranja gradiva i surađivati sa studentima da se samostalno koriste tehnologijom. Ti rezultati govore o tome da predavači imaju veliko znanje kada se radi o izboru nastavnih metoda i nastavne tehnologije kojima će se koristiti, no upućuju i na to da nastavnici dobro promišljaju i o mogućim posljedicama takve nastave.

Na kraju, procijenjeno pedagoško i predmetno tehnološko znanje predavača TPACK (M=5,91, SD=,84) bilo je na razini „slažem se" (Tablica 2.). Njihovo procijenjeno znanje o toj dimenziji pokazuje da predavači mogu održavati nastavne sate u kojima se na odgovarajući način kombiniraju predmetni sadržaj, tehnologije i nastavni pristupi – TPACK1 (M=5,98, SD=1,10) te da mogu odabrati tehnologiju kojom će se koristiti u nastavnom procesu, a kojom će pojačati učinak gradiva o kojem poučavaju, kako poučavaju i onoga što studenti uče – TPACK2 (M=6,06; SD=,79). Također se koriste i strategije koje kombiniraju sadržaj, tehnologije i nastavne pristupe o kojima su učili na nastavi – TPACK3 (M=6,00, SD=,89) te su spremni preuzeti vodstvo u pomaganju drugima u školi i/ili okruženju pri koordiniranju upotrebe predmetnog sadržaja, tehnologija i nastavnih pristupa – TPACK4 (M=5,73, SD=1,16). To može upućivati i na činjenicu da predavači imaju visok stupanj pouzdanja u svoje pedagoško i predmetno tehnološko znanje i da mogu dovoljno dobro integrirati tehnologiju u nastavni proces.

Rezultati procjene pedagoškog i predmetnog tehnološkog znanja predavača s obzirom na spol

U Tablici 3. prikazani su rezultati Mann-Whitneyeva U testa koji je proveden da bi se odredilo procijenjeno pedagoško i predmetno tehnološko znanje predavača s obzirom na varijablu spola.

Tablica 3

Naši rezultati pokazuju da postoji značajna razlika u dimenzijama tehnološkog znanja (MWU=229,50, $p<0,05$) i pedagoškog predmetnog znanja (MWU=212,000, $p<0,05$) predavača s obzirom na spol. Kod muškaraca (M=30,94) je utvrđena viša srednja vrijednost nego kod žena (M=22,70). Dakle, to je neobična razlika u korist predavača muškog spola. To je daljnje potvrđeno velikom razlikom koja je otkrivena između njihovih srednjih vrijednosti u deskriptivnoj analizi, što je upućivalo na činjenicu da predavači muškog spola, za razliku od predavačica, sebe smatraju kompetentnijima u domenama tehnološkog znanja i pedagoškog predmetnog znanja. Prema prikazanim rezultatima može se zaključiti da je procijenjeno znanje muških predavača bilo na visokom stupnju s obzirom na upotrebu tehnologije u nastavnom procesu i nastavne metode, kao i s obzirom na vođenje nastavnog procesa i primjenu metodike.

Prikaz 3

Iz podataka prezentiranih u Prikazu 3. može se zaključiti da su vrijednosti za skupinu muškog spola bile statistički značajno više od onih za skupinu ženskog spola u srednjoj vrijednosti za tehnološko znanje (M=5,89, F=5,29) i u srednjoj vrijednosti za pedagoško predmetno znanje (M=5,97, F=5,19).

Rezultati procjene pedagoškog i predmetnog tehnološkog znanja predavača s obzirom na vrstu zaposlenja

U Tablici 4. prikazani su rezultati Mann-Whitneyeva U testa koji je proveden da bi se odredilo procijenjeno pedagoško i predmetno tehnološko znanje predavača s obzirom na vrstu zaposlenja.

Tablica 4

Prema rezultatima u Tablici 4. utvrđena je značajna razlika između procijenjenog znanja predavača koji su zaposleni na puno radno vrijeme i onih koji su zaposleni honorarno, u domenama tehnološkog znanja TK (*MWU*=167,000, $p<0,05$) i predmetnog tehnološkog znanja TPK (*MWU*=157,500, $p<0,05$). Te su se dvije domene značajno razlikovale prema vrsti zaposlenja kao varijabli, a ta je razlika išla u korist honorarno zaposlenih predavača. Provedena je daljnja analiza s pomoću reprezentacije srednje vrijednosti, kako je pokazano u Prikazu 4.

Prikaz 4

Prema Prikazu 4. utvrđeno je da je svaka usporedba srednjih vrijednosti u sklopu vrste zaposlenja kao varijable upućivala na to da predavači zaposleni honorarno daju višu vrijednost procjeni svojeg tehnološkog znanja (M=6,04) i tehnološkog pedagoškog znanja (M=6,07) u odnosu na predavače zaposlene na puno radno vrijeme, kod kojih navedene domene imaju ovakve vrijednosti – tehnološko znanje (M=5,37), tehnološko pedagoško znanje (M=5,70). To može upućivati na to da svi predavači imaju visok stupanj pedagoškog i predmetnog tehnološkog znanja i njegovih subdimenzija, no predavači zaposleni honorarno imaju višu razinu procijenjenog znanja. Razlog tomu vjerojatno je taj što provode više vremena u proučavanju novih tehnologija i pronalaze nove načine uključivanja studenata u nastavni proces te tako učenje čine uspješnim.

Rezultati procjene pedagoškog i predmetnog tehnološkog znanja predavača s obzirom na odsjek na kojem su zaposleni

Proveden je Kruskal-Wallis test da bi se odredila razlika između procijenjenog pedagoškog i predmetnog tehnološkog znanja predavača s obzirom na različite odsjeke na kojima predaju. Kruskal-Wallis test pokazao je da postoje značajne razlike u trima domenama: tehnološkom znanju TK ($p<0,05$), tehnološkom pedagoškom znanju TPK ($p<0,05$) i pedagoškom i predmetnom tehnološkom znanju TPACK ($p<0,05$). Dolje je dan grafički prikaz srednjih vrijednosti, za svaku domenu posebno.

Prikaz 5

Na temelju Prikaza 5. provedena je usporedba srednjih vrijednosti za svaku subdimenziju mišljenja predavača o procijenjenom znanju. U tim dimenzijama pojavile su se značajne razlike. Odsjek za računalno obrazovanje i nastavne tehnologije imao je najvišu srednju vrijednost tehnološkog znanja TK (M=6,70), tehnološkog predmetnog znanja TPK (M=6,56) i pedagoškog i predmetnog tehnološkog znanja TPACK (M=6,53). To može značiti da predavači na Odsjeku za računalno obrazovanje i nastavne tehnologije imaju viši stupanj procijenjenog znanja o upotrebi tehnologije, prihvaćanju različitih nastavnih metoda koje zahtijevaju upotrebu tehnologije i različitim vrstama predmetnog sadržaja. Njihova poslovna i privatna upotreba tehnologije je veća u usporedbi s ostalim predavačima.

Rezultati procjene pedagoškog i predmetnog tehnološkog znanja predavača s obzirom na stručno usavršavanje na radu koje je orijentirano na upotrebu tehnologije

U Tablici 5. prikazani su rezultati Mann-Whitneyeva U testa koji je proveden da bi se odredilo procijenjeno pedagoško i predmetno tehnološko znanje predavača s obzirom na varijablu stručnog usavršavanja na radu koje je orijentirano na upotrebu tehnologija kao što su računala, pametne ploče, programski softver, digitalne kamere/video itd.

Tablica 5

Prema Tablici 5., koja prikazuje podatke o stručnom usavršavanju na radu orijentiranom na upotrebu tehnologije koju su predavači pohađali, utvrđena je značajna razlika u procijenjenom pedagoškom predmetnom znanju (*MWU*=77,500, *p*<0,05) predavača. Razlika u toj subdimenziji išla je u korist predavača čiji je odgovor bio „Ne". To može značiti da, iako je stručno usavršavanje na radu orijentirano na upotrebu tehnologije bilo organizirano, ono nije bilo dovoljno usmjereno na način koji bi utjecao na ostale subdimenzije. Provedene su daljnje usporedbe koristeći se deskriptivnim srednjim vrijednostima iz Prikaza 6.

Prikaz *6*

Prema Prikazu 6. broj predavača koji su dali odgovor „da" na pitanje o pružanju oblika stručnog usavršavanja na radu orijentiranog na upotrebu tehnologije bio je veći od broja onih koji nisu pohađali takvo stručno usavršavanje, osim u slučaju pedagoškog predmetnog znanja. Broj predavača koji su izjavili da nisu imali priliku pohađati stručno usavršavanje na radu (M=6,48) bio je veći od broja onih koji su imali takvo stručno usavršavanje (M=5,43). To upućuje na činjenicu da iako je stručno usavršavanje na radu orijentirano na upotrebu tehnologije povećalo procijenjeno znanje predavača o domenama TK, CK, PK, TPK, TCK, TPACK, ono nije utjecalo na PCK. Razlog tomu može biti da organizirano stručno usavršavanja na radu nije bilo dostatno da bi se povećao stupanj procijenjenog znanja. Kada se razmotri srednja vrijednost, može se vidjeti da je bilo pozitivnih utjecaja na dimenzije PK, TCK, TPK i TPACK, iako one nisu u broju koji bi bio značajno velik.

Rasprava

Rezultati prikazani u ovom istraživanju pokazuju procijenjeno pedagoško i predmetno tehnološko znanje predavača u svih sedam ispitivanih komponenti: TK, CK, PK, PCK, TCK, TPK i TPACK. Pokazalo se da je stupanj procjene znanja na razini „slažem se", što pokazuje da predavači imaju visok stupanj procijenjenog znanja.

Zaključeno je da se procijenjeno pedagoško i predmetno tehnološko znanje predavača promijenilo i u područjima tehnološkog znanja i pedagoškog predmetnog znanja s obzirom na varijablu spola, a da promjene s obzirom na spol nisu uočene u procjeni pedagoškog i predmetnog tehnološkog znanja u područjima predmetnog znanja, pedagoškog znanja, tehnološkog predmetnog znanja, kao i pedagoškog i predmetnog tehnološkog znanja. Dobiveni rezultati pokazali su da predavači muškog spola imaju višu razinu procjene tih dviju dimenzija u kojima su se promjene pojavile, što je u skladu s rezultatima drugih istraživanja (Jang i Tsai, 2013; Koh i sur., 2010; Lin i sur., 2013). Kazu i Erten (2014) su naveli da je razina procijenjenog znanja nastavnika ženskog spola bila viša od razine procijenjenog znanja nastavnika muškog spola. To može značiti da mnogi predavači imaju vještine izvan područja standardnih tehnologija i mogu upotrebljavati određene tehnologije. Također su zabilježili bolje vještine u raznim načinima interakcije unutar predmetnog područja i različite oblike nastavne prakse koji učenicima mogu pomoći da bolje nauče predmetno gradivo. Lin i sur. (2013) su u svojem istraživanju ispitali vezu između pedagoškog i predmetnog tehnološkog znanja nastavnika prirodnih znanosti i spola. Rezultati do kojih su došli pokazuju da nastavnice procjenjuju da je njihovo pedagoško znanje na višoj razini, a tehnološko znanje na nižoj razini, u usporedbi s kolegama muškog spola, što je također u skladu s rezultatima ovog istraživanja.

Rezultati ovog istraživanja također su pokazali da se procijenjeno tehnološko znanje i tehnološko pedagoško znanje predavača promijenilo s obzirom na vrstu zaposlenja, a da promjene s obzirom na vrstu zaposlenja nisu uočene u predmetnom znanju, pedagoškom znanju, pedagoškom predmetnom znanju, tehnološkom predmetnom znanju i pedagoškom i predmetnom tehnološkom znanju. Zaključak je da su predavači zaposleni honorarno procijenili da je njihovo tehnološko znanje i tehnološko pedagoško znanje na višoj razini, u usporedbi s predavačima zaposlenima na puno radno vrijeme. Razlog za to mogla bi biti činjenica da predavači zaposleni honorarno provode više vremena na usavršavanju u području korištenja tehnologijom i da su sposobni izraditi i prihvatiti nastavne metode korištenjem tehnologije. Možda imaju više entuzijazma za praćenje najnovijih tehnologija i vještina, i iz osobne i iz profesionalne perspektive. Predavači koji rade puno radno vrijeme trebali bi biti motivirani za praćenje i korištenje različitim i najnovijim tehnologijama, jer ta dva elementa mogu imati drugačiji utjecaj na proces učenja kod studenata (Shin i sur., 2009).

Na kraju, mišljenja predavača o pedagoškom predmetnom znanju mijenjaju se s obzirom na organizirano stručno usavršavanje na radu orijentirano na upotrebu tehnologije (računala, pametnih ploča, digitalnih kamera, videomaterijala, projektora, programskog softvera itd.). Nisu uočene značajne promjene u tehnološkom znanju, predmetnom znanju, pedagoškom znanju, tehnološkom pedagoškom znanju, tehnološkom predmetnom znanju i pedagoškom i predmetnom tehnološkom znanju, a pozitivan je utjecaj uočen u područjima pedagoškog znanja, tehnološkog predmetnog znanja, tehnološkog pedagoškog znanja, pedagoškog i predmetnog tehnološkog znanja kada se razmatrala razina srednjih vrijednosti. Stručno usavršavanje na radu orijentirano na upotrebu tehnologije poput računala (22,6%), pametnih ploča (46,1%), digitalnih kamera i videomaterijala (7,5%), projektora (17%), programskog softvera

(11,3%), kao idrugih tehnologija koje nisu navedene (9,4%) nije imalo značajan utjecaj na procijenjeno znanje predavača o pedagoškom predmetnom znanju. Kazu i Erten (2014) su istaknuli da je povećano znanje nastavnika o upotrebi tehnologije dovelo do jednakog povećanja u kontroli koju imaju dok obavljaju svoj posao, u nastavnom procesu i u njihovu procijenjenom znanju. To upućuje na činjenicu da ako stručno usavršavanje na radu orijentirano na upotrebu tehnologije ne vodi povećanju pedagoškog predmetnog znanja ili bilo kojeg drugog područja znanja, tada stručno usavršavanje ili nije bilo dovoljno ili nije na najbolji način iskorišteno. Stoga bi se trebala posvetiti primjerena pažnja stručnom usavršavanju na radu da bi se postigao pozitivan učinak na područja znanja.

Razmatrajući rezultate silaznim redom, poredak je sljedeći, za svaku dimenziju posebno s obzirom na srednje vrijednosti: predmetno znanje (M=6,55), pedagoško znanje (M=6,47), pedagoško i predmetno tehnološko znanje (M=5,91), tehnološko predmetno znanje (M=5,80), tehnološko pedagoško znanje (M=5,86), pedagoško predmetno znanje (M=5,57) i tehnološko znanje (M=5,56). Predavači su, uz varijacije, imali visok stupanj predmetnog, pedagoškog i koje je variralo zbog shvaćanja i poznavanje boljih načina interakcije s tim vrstama znanja (Jang i Tsai, 2012, 2013). Ti bolji načini nastali su putem transformacije tehnologije, pedagogije i predmetnog sadržaja (Kazu i Erten, 2014). To znači da su predavači usredotočeni na poznavanje predmetnog sadržaja predmeta koji predaju i da znaju kako se to znanje može najbolje prenijeti studentima i omogućiti im interakciju sa sadržajem, što može biti rezultat godina staža u struci, no i nekih drugih čimbenika koji su također ispitani. Općenito analizirajući pedagoško i predmetno tehnološko znanje, došlo se do zaključka da predavači jako dobro razumiju međusobno djelovanje i kompleksne veze između samih sebe, studenata, predmetnog sadržaja, nastavne prakse i tehnologije. Kazu i Erten (2014) se slažu s tim mišljenjem. Predavači posjeduju znanje o strategijama kombiniranja tehnologije i nastavnih pristupa te koordiniraju predmetni sadržaj o kojem poučavaju i razne načine poticanja procesa učenja kod studenata u tehnološkom nastavnom okruženju. K tomu, poboljšanje pedagoškog predmetnog znanja i tehnološkog znanja pomoći će predavačima kako bi se mogli koristiti tehnologijom kao alatom koji će postati dijelom cijelog nastavnog procesa, a neće se smatrati samo alatom koji pomaže u nastavnom procesu.

Zaključak

Razmatrajući prvo istraživačko pitanje, zaključeno je da predavači imaju visok stupanj procijenjenog pedagoškog i predmetnog tehnološkog znanja. Istraživanje je pomoglo u razumijevanju raznolikih načina na koje su predavači procjenjivali svoje pedagoško i predmetno tehnološko znanje. Otkrivene su i razlike u procjeni pedagoškog i predmetnog tehnološkog znanja predavača, kao i u svakoj dimenziji znanja, u procijenjenom znanju predavača u dimenzijama tehnološkog znanja (TK) i pedagoškog predmetnog znanja (PCK) s obzirom na spol, u procijenjenom znanju predavača u dimenzijama tehnološkog znanja (TK) i tehnološkog pedagoškog znanja (TPK), prema vrsti zaposlenja, u procijenjenom znanju predavača u dimenzijama tehnološkog znanja (TK), tehnološkog pedagoškog znanja (TPK) te pedagoškog i predmetnog tehnološkog znanja (TPACK), prema odsjeku na kojem predavači rade kao i u procijenjenom znanju predavača u dimenziji pedagoškog predmetnog znanja (PCK) s obzirom na stručno usavršavanje na radu.

Nakon razmatranja drugog istraživačkog pitanja, došlo se do sljedećih zaključaka:

1. Prema spolu, muški predavači procijenili su da je njihovo pedagoško i predmetno tehnološko znanje na višoj razini nego što je to slučaj kod predavača ženskog spola, sa značajnim razlikama uočenima u dimenzijama TK i PCK.
2. Prema vrsti zaposlenja, honorarni predavači procijenili su da je njihovo pedagoško i predmetno tehnološko znanje na višoj razini nego što je to slučaj kod predavača zaposlenih na puno radno vrijeme, sa značajnim razlikama u dimenzijama TK i TPK.
3. Prema odsjeku na kojem rade, predavači iz Odsjeka za računalno obrazovanje i nastavne tehnologije procijenili su da je njihovo pedagoško i predmetno tehnološko znanje na višoj razini nego što je to slučaj kod predavača s ostalih odsjeka, sa značajnim razlikama u dimenzijama TK, TPK i TPACK.
4. Prema stručnom usavršavanju na radu orijentiranom na upotrebu tehnologija broj predavača čiji je odgovor bio negativan veći je od broja predavača čiji je odgovor bio pozitivan. Predavači koji procjenjuju da je njihovo pedagoško predmetno znanje na višoj razini imali su više negativnih odgovora nego ostali.

Prema Elçiju (2012), „Većina sudionika s učiteljskog fakulteta (83,3%) navela je da žele učiti kako bi studentima olakšali načine rješavanja problema i kritičkog mišljenja" (str. 140). Tijekom ovog istraživanja utvrdili smo da su značajne razlike vrlo visoke, što pokazuje da su predavači zapravo razvili tehnološko znanje u vezi s pedagogijom, kako bi olakšali svojim studentima proces učenja i za vrijeme Elçijeva istraživanja i sada. Zaključeno je da je okvir pedagoškog i predmetnog tehnološkog znanja precizan alat za mjerenje i razvoj znanja predavača o integriranju tehnologije u obrazovni proces.

Preporuke za daljnja istraživanja

U procesima učenja i poučavanja događaju se goleme i brze promjene, kao i u nastavnim planovima i programima na Učiteljskom fakultetu, što se može pripisati sve većoj integraciji tehnologije u nastavu. U svim tim promjenama predavači ženskog spola trebali bi biti motivirani i uključeni u tehnološki razvoj da bi poboljšali svoje pedagoško i predmetno tehnološko znanje. Ovo istraživanje je također utvrdilo važne utjecaje pedagoškog i predmetnog tehnološkog znanja na stručno usavršavanje predavača sa stajališta njihova procijenjenog znanja. To čini pedagoško i predmetno tehnološko znanje odgovarajućim okvirom koji predavaču može pomoći u prevladavanju ograničenja tradicionalnog načina poučavanja i prijeći na poučavanje utemeljeno na tehnologiji, koje uzima u obzir kompleksne veze između tehnologije, predmetnog sadržaja i pedagogije (pedagoških principa i metoda). Međutim, to se može postići jedino ako predavači prihvate raznolike načine poučavanja, poput pristupa „učenje dizajniranjem" (eng. „Learning by Design") (Koehler i Mishra, 2005), kako su predložili i mnogi drugi istraživači.

Osim stručnjaka koji organiziraju tečajeve za buduće nastavnike o tome kako se koristiti tehnologijom za uspješnu pedagogiju, više pažnje trebalo bi posvetiti stručnom usavršavanju predavača zaposlenih na puno radno vrijeme, s temom integriranja tehnoloških i pedagoških pristupa, što će pomoći studentima u boljem razumijevanju kolegije i obrazovne prakse. Treba stvoriti više prilika za praksu i primjenu okvira pedagoškog i predmetnog tehnološkog znanja i na ostalim odsjecima, kako bi se premostio tehnološki jaz koji postoji kada se ti odsjeci usporede s Odsjekom za računalno obrazovanje i nastavne tehnologije.

K tomu, procijenjeno pedagoško i predmetno tehnološko znanje predavača i kompetencije trebale bi se određivati s vremena na vrijeme da bi se predavače motiviralo i potaknulo na razvijanje pedagoškog i predmetnog tehnološkog znanja. U skladu sa zaključkom ovog istraživanja preporuka istraživača je da bi trebalo provesti više istraživanja koja će ići dalje od razumijevanja pedagoškog i predmetnog tehnološkog znanja predavača sa stajališta procijenjenog znanja, a koja će uzeti u obzir promatrane stavove koji mogu pomoći u razumijevanju i određivanju stvarnih kompetencija pedagoškog i predmetnog tehnološkog znanja predavača s Učiteljskog fakulteta Istočnog mediteranskog sveučilišta.

Na kraju, buduća istraživanja trebala bi imati kvalitativan pristup ili kombinirani pristup da bi se detaljnije razumjeli rezultati i da bi se moglo doći do općenitijih zaključaka (Koehler i Mishra, 2005; Shin i sur., 2009). Rezultati ovog istraživanja mogli bi poslužiti kao osnova za druga istraživanja koja će biti provedena na Istočnom mediteranskom sveučilištu, u školama u Cipru i u drugim državama.