

Examination of Relationships between Preservice Teachers' Confidence in Technological Pedagogical Content Knowledge and Learning Strategies

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Abstract: The purpose of this study was to investigate the relationships between pre-service teachers' confidence in technological pedagogical content knowledge and learning strategies. Moreover, the present study also analyzed the effect of gender on confidence in technological pedagogical content knowledge. The study was conducted with correlational research design. The study group of this study was comprised of 82 preservice teachers attending the Faculty of Education in a public university during the spring semester of the 2015-2016 academic years. In the study, the Motivated Strategies for Learning Questionnaire (MSLQ) and Technological Pedagogical Content Knowledge Confidence Survey were used as data collection tools. Data were analyzed using Pearson product-moment correlation and independent samples t-test. At the end of the study, the results of independent samples t-test demonstrated that there was a significant difference in technological knowledge scores for males ($M=4.24$, $SD=.65$) and females [$M=3.81$, $SD=.63$; $t(80)=-2.97$, $p=.004$]. Besides, the results of this study revealed that there were various positive and significant correlations between variables of the study.

Keywords: confidence, critical thinking, elaboration, metacognitive self-Regulation, organization, technological pedagogical content knowledge

Öğretmen Adaylarının Teknolojik Pedagojik Alan Bilgisi Özgüvenleri ile Öğrenme Stratejileri arasındaki İlişkinin İncelenmesi

Öz: Bu çalışmanın amacı öğretmen adaylarının teknolojik pedagojik alan bilgisi özgüvenleri ile öğrenme stratejileri arasındaki ilişkinin incelenmesidir. Ayrıca bu çalışmada cinsiyetin teknolojik pedagojik alan bilgisi özgüveni üzerinde bir etkisi olup olmadığı da analiz edilmiştir. Çalışma, ilişkisel araştırma deseniyle yürütülmüştür. Çalışma grubunu 2015-2016 bahar yarısında bir devlet üniversitesinin eğitim fakültesinde okumakta olan 82 öğretmen adayı oluşturmaktadır. Çalışmada Öğrenme Güdül Stratejiler Anketi (ÖGSA) ve Teknolojik Pedagojik Alan Bilgisi Öz Güven Ölçeği veri toplama aracı olarak kullanılmıştır. Veri analizi Pearson Momentler Çarpımı Korelasyon Katsayısı ve bağımsız örneklem t-testi ile analiz edilmiştir. Çalışmanın sonunda, bağımsız örneklem t-testi sonuçlarına göre teknoloji bilgisi özgüveni puanları açısından kadın [$M=3.81$, $SD=.63$] ve erkek öğretmen adayları arasında anlamlı bir farklılık olduğu bulunmuştur [$M=4.24$, $SD=.65$; $t(80)=-2.97$, $p=.004$]. Ayrıca, çalışmanın sonuçları çalışmaya dahil edilen değişkenler arasında çeşitli anlamlı ve pozitif ilişkilerin olduğunu ortaya koymuştur.

Anahtar Sözcükler: özgüven, eleştirel düşünme, açıklama, metabilşsel özdüzenleme, düzenleme, teknolojik pedagojik alan bilgisi.

Pedagogical content knowledge (PCK) is the type of knowledge which is as important as content knowledge and occupational knowledge that teachers should have. PCK may be defined as expert knowledge acquired in a certain discipline (for instance in chemistry, biology) in terms of teaching and learning processes. Shulman (1986) defines PCK as the knowledge assuring that analogies, examples, explanations, methods of presentation and demonstration which represent the concepts in the best way are used in facilitating comprehension. Technological pedagogical content knowledge (TPACK) model was generated by adding the component of technology to Shulman's (1986) model of

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pedagogical content knowledge (Koehler & Mishra, 2005; Koehler, Mishra, & Yahya, 2007; Mishra & Koehler, 2006). A teachers should have a good command of teaching methods and content knowledge so that he or she can make use of technology and integrate technology into the classroom settings. TPACK is also defined as the knowledge of selecting the appropriate pedagogical methods and technological instruments while teaching a subject, eliminating the difficulties students are to encounter while learning a subject, and of supporting students' knowledge and comprehension with technology in the right way (Mishra & Koehler, 2006).

TPACK is composed of four types of knowledge in addition to technological, pedagogical and content knowledge that teachers need to have. They are technological pedagogical content knowledge (TPACK), technological pedagogical knowledge (TPK), technological content knowledge (TCK), and technological knowledge (TK) (See Figure 1). Content knowledge (CK) is the knowledge of domain which is taught and to be learnt; pedagogical knowledge (PK) is the knowledge of learning and teaching process and implementation of it such as students' learning process, classroom management, developing lesson plans, application and assessment; and technological knowledge (TK) is the knowledge of information technologies, hardware, software and using equipment. Pedagogical content knowledge (PCK) is the pedagogical knowledge concerning the process of learning and teaching certain content. Technological pedagogical knowledge (TPK) is the knowledge of how learning and teaching change when a certain technology is used - that is to say, it is the knowledge of using pedagogical designs and strategies suitable to the technological instruments used. TCK is the knowledge of how to use technology in developing the course content, in displaying the content or researching into the field, and it is the knowledge of what the technologies are specific to the field. Technological pedagogical content knowledge (TPACK) is the type of knowledge arising in consequence of interactions between content knowledge, pedagogical knowledge and technological knowledge, and is the knowledge of integrating the knowledge of a certain field into pedagogical strategies, methods and techniques with appropriate technology for the teaching of a subject (Karadeniz & Vatanartiran, 2015; Koehler & Mishra, 2008).

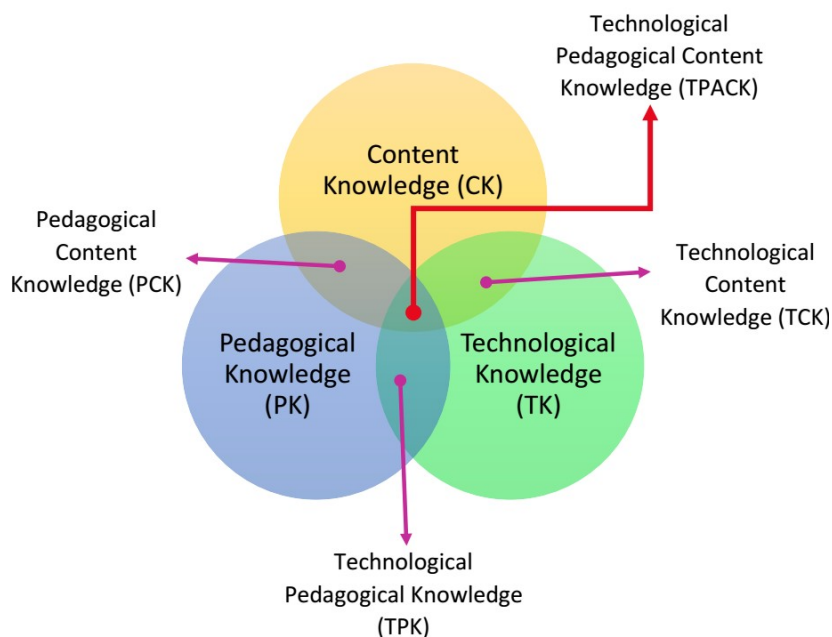


Fig. 1. TPACK Framework

Studies available in the literature demonstrate that teachers cannot integrate technology successfully into the learning/teaching process (Angeli & Valanides, 2009; Niess, 2005; Yeşil, 2009; Yılmaz, 2007). One of the reasons for this is that teachers do not have the pedagogical content knowledge and technological pedagogical content knowledge to enable the integration. At this point, the properties that teachers should have, become apparent. One of the properties is that they should be self-regulated individuals. Self-regulated individuals affect, guide and control their own behaviours. Such individuals are the individuals who think on, inquire and criticise the knowledge they have learnt, who search for knowledge, who have problem solving skills, who can take on responsibilities in the society in which they live, and who can contribute to the development of the society (Pintrich, 2000; Zimmerman, 2000). Self-regulated individuals do not lose their interest in a challenging activity they are to encounter, nor their motivation decreases, and they set their own target, they prepare their plans and implement them. They display the behaviours necessary for performing the activities and they do not escape from problems they encounter. In all these processes they observe their behaviours and the consequences, and they motivate themselves to achieve success in front of any type of difficulty, they modify and try to develop their strategies (Sakız & Yetkin Özdemir, 2014). Setting out from this point, this study make an attempt at investigating whether or not there are any correlations between deep cognitive and metacognitive learning strategies self-regulated learners frequently used and confidence in TPACK scores. The study also aims to investigate the effects of gender on TPACK and on other types of knowledge. Some of the studies in the relevant literature have found that men find themselves more competent in using information technologies than women (Koppi et al., 2010; Lasen, 2010). It was also found in the literature that female teachers considered themselves more adequate than male teachers in PK and in CK (Baylor, Shen, & Huang, 2003; Einarsson & Granström, 2002). Therefore, researching the effects of gender on TPACK would contribute considerably to the literature. Therefore, according to the purpose of the study, the following research questions were determined:

1. Is there any statistically significant correlation between the pre-service teachers' deep learning strategies, metacognitive learning strategies and confidence in technological pedagogical content knowledge?
2. Is there a significant difference in the mean TPACK, TPK, TCK and TK scores for males and females?

Method

Research Model

The study was conducted with correlational research design which is one of the quantitative research methods and examines the relationships between two or more variables (Fraenkel & Wallen, 2006).

Study Group

The study group of this study was comprised of 82 preservice teachers attending the Faculty of Education in a public university during the spring semester of the 2015-2016 academic year. Participants voluntarily completed the both questionnaires in the study. Purposive sampling which is one of the non-random sampling approach was used to identify participants. Among the preservice teachers, 49 were male and 33 were female. The mean of age of them was 25.59 (SD = 4.46) years.

Data Collection Tools

Motivated Strategies for Learning Questionnaire (MSLQ) developed by Pintrich, Smith, Garcia and McKeachie (1991) and adapted into Turkish by Büyüköztürk, Akgün, Kahveci, & Demirel (2004) was used to determine preservice teachers' deep learning and metacognitive learning strategies. The MSLQ is composed of two parts named motivation and learning strategies. There are nine subscales in the learning strategies part. In this current study, elaboration, organisation, and critical thinking that belong to deep learning strategies and metacognitive self-regulation subscales were used.

Technological Pedagogical Content Knowledge Confidence Survey (TPCKCS) developed by Graham et al., (2009) and adapted into Turkish by Timur and Taşar (2011) was applied to determine preservice teachers' confidence in technological pedagogical content knowledge. The TPCKCS has four subscales named technological pedagogical content knowledge (TPACK), technological pedagogical knowledge (TPK), technological content knowledge (TCK), and technological knowledge (TK).

Data Analysis

The obtained data was analysed using SPSS 15.0 software package. The relationships between confidence in technological pedagogical content knowledge and learning strategies were investigated using Pearson product-moment correlation coefficient. The effect of gender was analysed using independent-samples t-test.

Findings

An effort was made in the first part of this study to determine whether gender have effects on preservice teachers' TPACK, TPK, TK and TCK scores. For these purposes, the data obtained in the study were analysed through independent samples t-test. Table 1 shows the analysis results.

Table 1
Results of Independent Samples t-Test

		Levene's Test for Equality of Variances		t-test for Equality of Means					95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2- tailed)	Mean Difference	Std. Error Difference	Upper	Lower
TPACK	Equal variances assumed	1,782	,186	,252	80	,801	,03776	,14965	-,26005	,33556
TPK	Equal variances assumed	1,460	,230	-,137	80	,892	-,02808	,20538	-,43679	,38063
TCK	Equal variances assumed	,001	,978	-,208	80	,836	-,05009	,24139	-,53048	,43030
TK	Equal variances assumed	1,068	,305	-2,965	80	,004	-,42737	,14414	-,71422	-,14052

According to the results of independent samples t-test, there was a significant difference in TK scores for males ($M=4.24$, $SD=.65$) and females [$M=3.81$, $SD=.63$; $t(80)=-2.97$, $p=.004$]. The magnitude of the differences in the means (mean difference = $-.43$, 95% CI: $-.14$ to $-.71$) was large (eta squared = $.10$). 10% of the variance in TK scores was explained by gender. Also, the differences in TPACK, TPK, and

TCK scores were not statistically significant between females and males. The results of correlation analysis are given in Table 2.

Table 2
Results of Correlations Analysis

		Elaboration	Organization	Critical Thinking	Metacognitive Self-regulation
TPACK	Pearson Correlation	,387(**)	,536(**)	,362(**)	,257(*)
	Sig. (2-tailed)	,000	,000	,001	,020
TPK	Pearson Correlation	,523(**)	,521(**)	,389(**)	,451(**)
	Sig. (2-tailed)	,000	,000	,000	,000
TCK	Pearson Correlation	,440(**)	,471(**)	,361(**)	,388(**)
	Sig. (2-tailed)	,000	,000	,001	,000
TK	Pearson Correlation	,277(*)	,266(*)	,218(*)	,246(*)
	Sig. (2-tailed)	,012	,016	,049	,026

** Correlation is significant at the 0.01 level (2-tailed).

* Correlation is significant at the 0.05 level (2-tailed).

The results of correlation analysis revealed that there was a positive and significant correlation between variables (Table 2). However, according to Cohen's (1988) criteria, there was only a strong, significant and positive correlation between the TPACK and organization [$r=.54$, $n=82$, $p<.001$], TPK and elaboration [$r=.52$, $n=82$, $p<.001$] and finally TPK and organization [$r=.53$, $n=82$, $p<.001$]. In addition, TCK was statistically significantly correlated with elaboration [$r=.44$, $n=82$, $p<.001$], organization [$r=.47$, $n=82$, $p<.001$], critical thinking [$r=.36$, $n=82$, $p<.001$] and metacognitive self-regulation [$r=.39$, $n=82$, $p<.001$]. Also, the results of the study showed that a small, positive and significant correlation existed between the variables of TPACK and metacognitive self-regulation, TK and elaboration, TK and organization, TK and critical thinking, TK and metacognitive self-regulation at the .05 level.

Conclusions and Discussion

This study analysed the correlations between preservice teachers' confidence in technological pedagogical content knowledge, deep learning and their metacognitive learning strategies. Additionally, whether or not genders have any effects on confidence in technological pedagogical content knowledge was also determined. 82 participants in total were included in the research. At the end of the research, it was found that preservice teachers' confidence in technological knowledge scores differed according to gender. An examination of group averages showed that the difference was in favour of male teachers. Some studies in the literature are also supportive of this finding (Koppi et al, 2010; Lasen, 2010). Because this dimension is rather the knowledge of using information technologies, hardware, software and instruments; having the differences in favour of male teachers was an expected result. Akkoyunlu and Orhan (2003) also found that men and women were the same in terms of basic use of instructional technologies, but that men were more competent in using technologies requiring upper level of skills. It was also found that there were no significant differences between male and female prospective teachers in terms of confidence in technological pedagogical content knowledge, technological pedagogical knowledge and technological content knowledge scores. The studies in the literature also support this finding (Alba & Zubillaga, 2010; Chudgar & Sankar, 2008).

Another conclusion obtained in this study is that there are strong, medium level, positive and significant correlations between preservice teachers' confidence in technological pedagogical content knowledge, technological pedagogical knowledge and technological content knowledge, deep

learning, and their metacognitive learning strategies. The analyses demonstrated that confidence in technological pedagogical content knowledge scores have strong and positive correlations with organisation, medium level correlations with elaboration and critical thinking, and weak correlations with metacognitive self-regulation. In a similar vein, confidence in TPK has strong and positive correlations with organisation and elaboration, and medium level correlations with critical thinking and metacognitive self-regulation. In addition to that, confidence in TCK scores have positive and medium level correlations with organisation, elaboration, critical thinking and metacognitive self-regulation scores. Another finding of importance in the research is that there are positive but weak correlations between confidence in TK scores and learning strategies. Gündoğmuş and Gündüz (2015), on the other hand, found that preservice teachers' technological pedagogical content knowledge had positive and medium level correlations with organisation, elaboration, critical thinking and metacognitive self-regulation.

In conclusion, it was found that gender did not have any effects on preservice teachers' confidence in TPACK scores, which is a finding in parallel to the ones obtained in the literature. Therefore, if inequality in preservice teachers' use of technology is removed, all teachers' self-efficacy in using technology and in integrating technology into their classrooms will increase. Besides, it was also found that preservice teachers' confidence in TPACK scores had significant correlations with deep learning strategies (organisation, elaboration and critical thinking) and metacognitive self-regulation. Hence, studies to be performed in relation to the development of preservice teachers' self-regulation skills will increase preservice teachers' efficacy in technology use.

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