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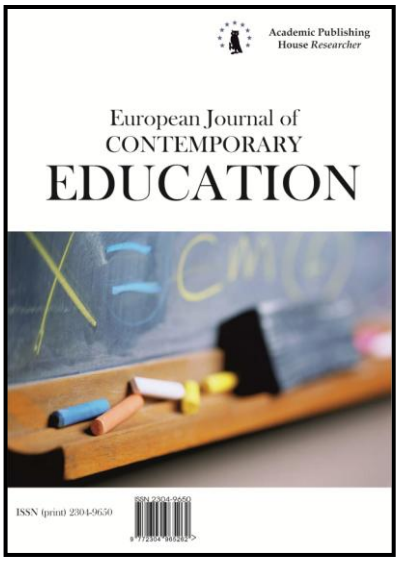

Online Case-based Learning Design for Facilitating Classroom Teachers' Development of Technological, Pedagogical, and Content Knowledge

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Abstract

The aim of this study is to investigate whether, and if so how, online case-based learning influence pre-service classroom teachers' self-confidence on technological pedagogical content knowledge (TPACK). To achieve the goal, a control group pretest–posttest quasi experimental design was used. Participants of the study consisted of 160 pre-service classroom teachers studying in a public university. There were two classes which were randomly assigned to experimental (n=78) and control (n=82) groups. The eight video cases were developed by the researchers based on an analysis of relevant learning content and real stories. During 10 weeks only pre-service teachers in the treatment group were participated in an online case-based learning environment and investigate video cases. An "Academic Motivation Scale" consisting of 20 Likert-type questions was used to measure pre-service teachers' academic motivation. The data were analyzed using two-way ANOVA statistical analysis with SPSS 20 packet program. The results showed that using online case-method significantly improved TCK and TK subdomains. However, pre-service classroom teachers' self-confidence on technological pedagogical content knowledge did not improve significantly.

Keywords: pedagogical issues, teaching/learning strategies, Technologic pedagogic, case-based learning, teacher education.

1. Introduction

Modern education system requires the use of current technologies and methods which provide students with activities that allow them to play active role in learning. In order to facilitate teaching and learning, the use of instructional tools and technologies began to play an important role (Clements, 2002). Surely, innovations and changes in social disciplines bring about complete

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integration between novelty and society. For the last twenty years, technology integration in schools has gained a big emphasis in the whole world (Chen, & Jang, 2014). Teachers are expected to use educational technologies and methods in lessons more effectively. However many studies show that policy makers and governments have been investing in instructional technologies, including computers, mobile devices and Interactive boards, but both pre-service and in-service teachers are not sufficiently prepared to integrate these technologies into their classrooms (Agyei, Voogt, 2012).

Even recently graduated teacher who are digital natives may not have a clear idea of how to integrate technology into teaching and learning and use current methods effectively (Uygun, 2013). ICT have been used as a tool that provide teachers with saving time and expanding classes rather than provide to transfer information in a most authentic way (McCormick, Scrimshaw, 2001). The expected teachers' perspective on technology integration differ depending on culture and context (Correa et al., 2008). Usually the important skill which is expected from teachers is that not only the use of current technologies and the knowledge, but also to integrate them into the given context (Pamuk, 2012). In this regard, some methods and approaches were developed in the field of teacher education.

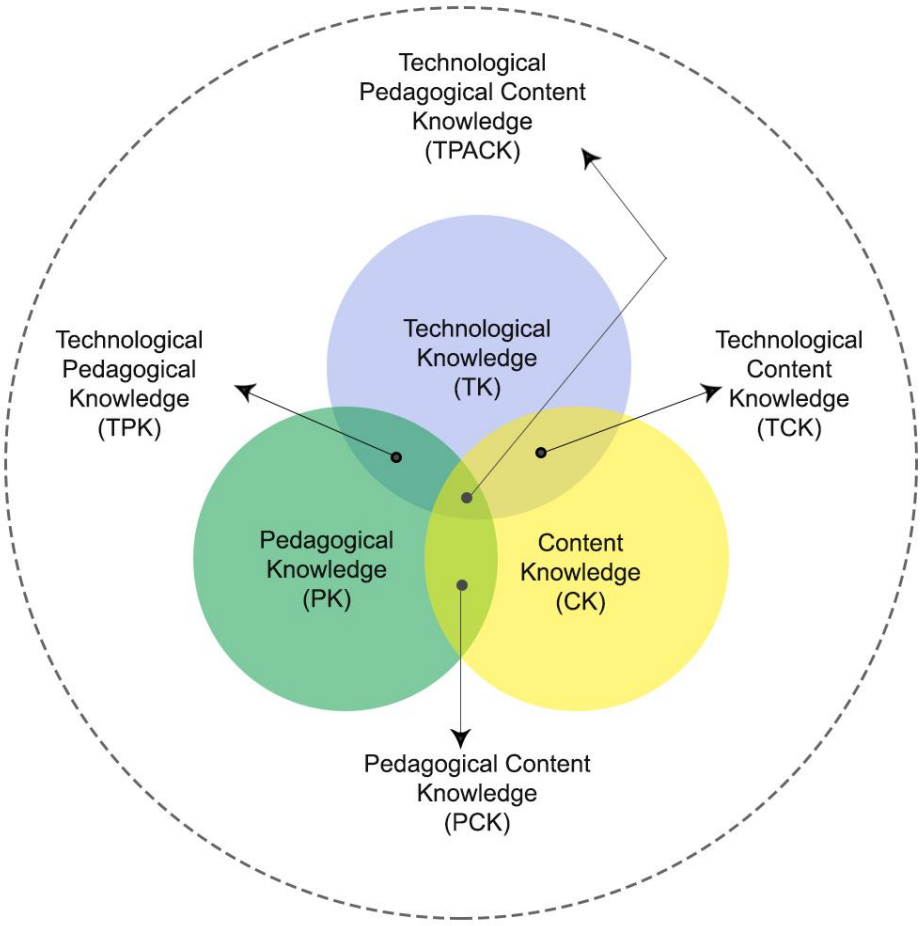

Fig. 1.1 Technological Pedagogical Content Knowledge

One of them is technological pedagogical content knowledge (TPACK) approach. TPACK emphasizes the integration of teachers' pedagogical content knowledge (PCK) and technology knowledge (TK). PCK was first mentioned by Shulman (1986) who focused the integration of content and pedagogic knowledge in teacher certification programs. In the following two decades, technological improvement in the field of education has been increased surprisingly. Thus, technology knowledge added next to the content and pedagogic knowledge. TPACK has been defined as complex, innovative, contextual and integrative knowledge of pedagogy, content and technology (Koehler, Mishra, 2009; Harris et al., 2010). Koehler and Mishra (2009) described seven subscales under the TPACK framework which are content knowledge (CK), pedagogical

knowledge (PK), pedagogical content knowledge (PCK), technology knowledge (TK), technological content knowledge (TCK), technological pedagogical knowledge (TPK), and technological pedagogical content knowledge (TPACK). The relationships of these subscales can be seen in Figure 1.1. There are several studies conducted to investigate the relationship between the subscales. For instance, in their study, Chai and his colleagues (2010) indicated that pedagogical knowledge domain have the largest effect on pre-service teachers' TPACK level. On the other hand, teacher educators have utilized different practices to improve technological pedagogical content knowledge. Some of these practices were summarized in Table 1.1.

Table 1.1 Practice for improvement of TPACK

Practice	**Stage(s)**
Introduction of TPACK	Workshop
Demonstration of example lessons and discussion	Workshop/ discussion
Micro-teaching	Workshop/implementation
Developed lesson plan and materials	Workshop/design/implementation

Case-based learning method is one of the current approaches utilized in different subject areas of education to fill the gap between theory and practice. Case-based method can be helpful development of teachers' TPACK because this method offers learners real life experience by involving real life situations. In this way, learners enable to apply previously learned concepts and principles (Sönmez, 2004). Case-based method provides students with the opportunity of participatory education by facilitating active and reflective learning (Tomey, 2003). However, there are few studies that explore the effectiveness of current practices on TPACK domains. In a recent study, Agyei and Voogt (2012) created design groups consisting of pre-service teachers to develop technology supported instructions. Jang (2008) indicated that teachers become more successful when they work together to apply new technologies. More comprehensive studies were needed to investigate how case-based learning and technological practices affect teachers' technological pedagogical content knowledge.

1.2 Purposes of the study

The aim of this study is to investigate effects of usage of online case-based learning on pre-service classroom teachers' perceived technological knowledge, pedagogical knowledge (TPACK). This study compared the perceived TPACK of pre-service classroom teachers who were participated in online case-based learning activities taking classroom management course with the pre-service teachers in control group who were not participated the online activities but take the classroom management course. In this regard, the following research questions were addressed:

- Is there a significant difference between the TPACK scores of pre-service teachers who were participated in online case-based learning activities and who did not?
- Is there a significant difference between female and male pre-service teachers' perceived TPACK scores taught by using online case-based learning method in classroom management course?

2. Method

The aim of this study is to determine whether pre-service teachers who have participated online case-based learning activities taking classroom management course show a greater performance on TPACK scores than the pre-service teachers in control group who do not participate in the online activities but take the same classroom management course. The methodology of the study was quasi-experimental design with pretest-posttest and control

group. Experimental design enables researchers to observe effects of systematic manipulations on one or more variables (Fraenkel and Wallen, 2006). Therefore this method was appropriate for the study.

2.2 Learning environment

The study was conducted with pre-service classroom teachers who were enrolled in a mandatory course namely "Classroom Management". The aim of the course is to improve pre-service teachers' pedagogic knowledge. They were taking classes in four groups. Two groups were randomly selected as experimental and two groups were control group. The same teacher educator was conducted lesson in both group using same methods. Pre-service teachers in experimental group were also participated in online case-based learning activities. These activities were conducted on a webpage (http://ornekolay.amasya.edu.tr/). Pre-service teachers used this webpage by logging in with their user name and password. For 10 weeks, they watched 10 video-cases and investigated them using eight-step problem solving approach (Saltan, Özden, 2010). The teacher educator also had an account to monitor and facilitate pre-service teachers while they were investigating the cases. A screenshot of the web page is seen below in Figure 2.1.

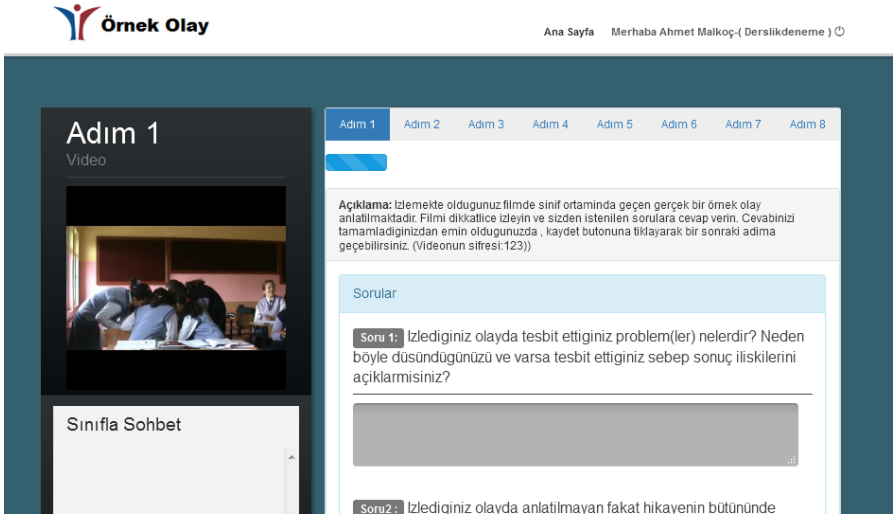

Figure 2.1 A view from online learning environment

2.3 Participants

The participants of the study consisted of 160 pre-service classroom teachers who were taking the classroom management course. There were two classes which were randomly assigned to experimental (n=78) and control (n=82) groups. In the experimental group there were 47 females and 31 males. The control group consisted of 48 females and 34 males. The participant of the study was shown in the Table 2.1 below.

Table 2.1 Distribution of the participants for experimental and comparison group

Group	Gender		Total
	Male	Female	
Experimental	31	47	78
Control	34	48	82
Total	65	95	160

2.4 Data Collection and Instruments

Data was collected through "Technological, Pedagogical, and Content Knowledge Self-Confidence" scale developed by Graham, Burgoyne, Cantrell, Smith, and Harris (2009). Timur and Taşar (2011) translated the survey into Turkish and Cronbach Alpha was calculated as .92. Technological, Pedagogical, and Content Knowledge Self-Confidence scale consists of 31 5-point

Likert type questions under TK, TCK, TPK, and TPACK factors. The Table 2.2 shows data collection process of the study.

Table 2.2 Data collection Process

Group	Before Treatment	Treatment	After Treatment
Experimental	• Technological, Pedagogical, and Content Knowledge (TPACK)	• Instruction with additional activities based on online-case based learning	• Technological, Pedagogical, and Content Knowledge (TPACK)
Control	• Technological, Pedagogical, and Content Knowledge (TPACK)	• Instruction without the activities	• Technological, Pedagogical, and Content Knowledge (TPACK)

2.5 Data Analysis

For this study data includes one independent variable and eight dependent variables, which are pre and post test scores of TPACK including sub-scales of technological, pedagogical and content knowledge. Firstly, pre and post test scores in technology, pedagogy, and content knowledge were taken directly from TPACK's scores. And then, total scores of each sub-scale of the instrument for pre and post tests were calculated.

Data gained from TPACK scale were analyzed through descriptive and inferential statistics for each sub scale of the instruments by using the SPSS statistical package. The level of significance for the statistical tests was set at.05. The study investigated two research questions aiming to explore the difference between experimental and control group participants' scores in TPACK scale. The questions were analyzed by examining the sub-questions in the main questions. Table 2.3 shows the main questions and sub questions, and also applied statistical tests for them.

Table 2.3 Research Questions

Research question 1. Is there a significant difference between the TPACK scores of participants who take case-based learning activities and who do not take in classroom management course?	
Sub-questions	**Applied Statistical Test**
• Is there a significant difference between experimental and control group students' pre-test scores of TPACK?	• Independent samples t-test
• Is there a significant difference between pre and post- test' scores of both groups?	• Paired samples t-test
Research Question 2. Is there a significant difference between female and male pre-service teachers' perceived TPACK taught by using online case-based learning method in classroom management course?	
Sub-questions	**Applied Statistical Test**
• Is there a significant difference between female and male pre-service teachers' perceived TPACK taught by using online case-based learning method in classroom management course?	• One-way ANOVA

3. Results

Before conducting statistical analysis, assumptions of t-test were checked. There are three most frequently cited assumptions, which are outliers, normality, and homogeneity of variance. First, outlier analysis was performed by using explore procedure in SPSS to remove extreme scores

from the data, and no significant outliers was found. Second assumption is to check dependent variables –pre and post test scores- is normally distributed or not. One of the ways for checking normality is to apply Kolmogorov-Smirnov test. Test result showed that distribution of dependent variables is not significantly difference than normal distribution (p>.05). Lastly, Levene's test was used to check homogeneity of variances and the test indicated non-significant result.

3.2 Is there a significant difference between experimental and control group students' pre-test scores of TPACK?

Independent sample t-test was performed to compare TPACK mean score of pre-service teachers in experimental with pre-service teachers in control group. As shown in table 2.4 below, scores of experimental and control group students on pre-test were 4.05 and 4.03 respectively. Independent sample t-test result showed no statistical significant difference at a significance level of .05 (t(158)= .26, p> .05). Based on this result, there was not a significant difference between groups in pretest TPACK scores, so it can be said that before conducting the study two groups had same level in terms of TPACK scores.

Table 2.4 The Results of Independent Samples t-test for Pre- Test Scores

Group	N	Mean	SD	df	t	p
Experimental	78	4.05	.68	158	.26	.79
Control	82	4.03	.57			

In addition, the sub-factors of TPACK, technological pedagogical content knowledge (TPCK), technological pedagogical knowledge (TPK), technological content knowledge (TCK), technological knowledge (TK), were also analyzed to see mean difference among groups on pre test scores and no statistical significance was found for each factor (p>.05).

3.3 Is there a significant difference between pre and post- test' scores of both groups?

Second sub-question was formulated to test whether there is a significant difference between pre and post test scores of experimental group and control group students. Paired sample t-test was used. For experimental group, t-test result showed that means of the students post test scores ($\bar{X}$=4.08) was not significantly higher than the mean of their pre test scores ($\bar{X}$=4.05) (t(77)=.76, p>.05). On the other hand, in TCK and TK sub-domains of TPACK there were statistical significant difference between pre and post test scores (t(77)=2.35, p<.05 and (t(77)=3.6, p<.05). In table 2.5 below, TPACK scores of experimental group's pre and post test with sub-factors are shown. On the other hand, in control group, for the main and sub domains of TPACK, no statistical significant difference was found between pre and post test scores.

Table 2.5 The Results for Paired Samples t-test for Experimental Group's TPACK Test Scores including sub factors

TPACK's test scores	Mean		sd		df	t	p
	pre.	post	pre	post			
TPACK	4.05	4.08	.68	.63	77	-.30	.76
TPCK	3.85	3.89	.64	.57	77	-.76	.44
TPK	3.89	4.00	.69	.61	77	-1.63	.10
TCK	3.84	3.51	1.08	1.09	77	2.35	.02*
TK	4.64	4.89	.95	.84	77	3.6	.00*

3.4 Is there a significant difference between female and male pre-service teachers' perceived TPACK taught by using online case-based learning method in classroom management course?

This question was formulated to see the gender difference in experimental group. One-way Anova was applied. Table 2.5 below showed that there was no significant difference between male and female students involved in online case-based learning (p>0.05).

Table 2.5 The Results of One-way ANOVA of experimental group on gender difference

Gender	Mean	SD	df	f	p
Male	4.25	.65	77	1.33	.25
Female	3.99	.57			

4. Discussion and conclusion

The purpose of the study was to investigate the effects of online case-based learning on pre-service classroom teachers' perceived technological knowledge, and pedagogical knowledge. The study also compared the perceived TPACK of pre-service classroom teachers who were participated in online case-based learning activities and with those who did not. For experimental group, t-test results showed that post test scores was not significantly higher than the pre test scores. On the other hand, in two sub-domains of TPACK scores, which are TCK and TK, there was a statistical significant difference between pre and post test scores. This result indicated that online case-based activities improved participants' technological knowledge and technological content knowledge significantly. Several studies found that just focusing on the technological knowledge, content knowledge and pedagogical knowledge were necessary up to a certain extent for TPACK development but not enough (Timur, 2011). Lack of experience in understanding of different teaching methods and use of them were important issues in developing pre-service teachers' TPACK (Pamuk, 2012).

On the other hand, in control group, a significant difference in technological pedagogical content knowledge and TPACK sub-domains between pre and post test scores was not found. The result showed that the classroom management course, one of the courses in teacher preparation program, did not significantly improved pre-service teachers' TPACK. Courses in teacher preparation programs which are teaching by using traditional methods may not be enough to improve pre-service teachers' technological pedagogical content knowledge. Fishman and Davis (2006) similarly indicated that improvement of TPACK takes long time and pre-service teachers need to move beyond to teacher preparation programs by having experience in teaching profession to build TPACK. In this respect, teacher preparation programs might need continuous revisions to educate teachers depending on the necessity of the time. Surely new researches will follow these revisions to understand the effect of contemporary methods and teaching strategies.

The analysis showed that although post-test TPACK scores of experimental group students was higher than the control groups students' TPACK scores, there was no statistical significant difference in post-test TPACK scores between groups. This showed that although involvement in online cased-based learning activities improve pre-service teachers' TPACK, it is not statistically significant. The TPACK literature indicated that generation and improvement of new sub-domains like technological content knowledge takes long time and much experience. In this study, it was aimed to provide this experience in an online environment by utilizing case-based learning strategies. However, it seems that one semester was not enough to significantly improve students' TPACK level. Case-based activities should continue one school year or more. Further researches may collect data using intermittent measurement to explore the chance in TPACK scores. By this way, it can be monitored how pre-service teachers' TPACK improve by using technology based teaching strategies. In their study, Canbazoglu-bilici, Guzey and Yamak (2016) assessed pre-service teachers' technological pedagogical content knowledge over one semester. They highlighted that teacher education programs should provide some courses to improve pre-service teachers' TPACK sub-domains.

On the other hand, it was investigated whether there is a significant difference between male and female students' TPACK scores. Analysis showed that there was no significant difference

between male and female students' TPACK who were involved in online case-based learning. In the literature, there are some findings showed that gender have an effect in computer integration. Male teachers might have more self-confidence in technology specifically about computers (Blackmore et al., 1992). Even though it was seen that men are more likely than women regarding computer and ICT technologies, there have been conflicting findings (Teo, 2008; Panteli et al., 1999). Markauskaite (2006) found significant differences between males' and females' ICT abilities and situational sustainability. The findings about gender related ICT activities will be considered with further studies.

To sum up, the study showed that using case-method with technology significantly improved TCK and TK subdomains. However, pre-service classroom teachers' self-confidence on technological pedagogical content knowledge did not improve significantly. This result might be because of content of cases or application time. 10-week application time may have been inadequate. Same study may be conducted during one school year. On the other hand further studies should consider using case-method with various technologies.

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