Evaluation of Digital Storytelling in terms of Pre-Service ICT Teachers' Perceived TPACK Levels and Teaching Proficiency Self-Efficacy Levels: A Mixed-Method Study

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Article Info	Abstract
	Today, the point where technology has come has revealed the need for individuals to be equipped with different skills. Teachers play an essential role in the development of these skills. Teachers should be able to use and master the methods that enable students to participate in the learning environment actively and gain the technological competencies they need today. In this direction, this study aims to examine the effect of digital storytelling on pre-service teachers' TPACK skills and teaching self-efficacy. An explanatory sequential research design is conducted with 29 pre-service ICT teachers. In the quantitative part of the study experimental research design and, in the qualitative part of the study case study is used. According to the results, digital storytelling is significantly affecting both TPACK and teaching proficiency self-efficacy levels of pre-service teachers. The results and future recommendations of the study are reported in detail.

Introduction

Today, the point where technology has come has revealed the need for individuals to be equipped with different skills. Teachers play an essential role in the development of these skills. Teachers should be able to use and master the methods that enable students to participate in the learning environment actively and gain the technological competencies they need today. In other words, it will be possible for them to train individuals equipped with skills that can keep up with today's society by effectively integrating technology into educational environments.

One of the frameworks developed for the integration of technology into the educational environment is TPACK (Mishra & Kohler, 2006). With TPACK, it is stated that teachers need perfect content knowledge, technological knowledge, and pedagogical knowledge. Before starting the teaching profession, pre-service teachers need to encounter practices and methods to improve their TPACK skills and receive training to improve these skills. At this point, digital storytelling can be considered as an alternative, where learners can be active in the learning environment and use Web 2.0 tools that can be called new media (Condy et al., 2012; Robin, 2008; Yang & Wu, 2012).

Digital storytelling can be defined as animating or digitalizing stories as texts using today's digital technologies.

It can be said that it is an application that is becoming widespread in educational environments as it is easier to apply with internet-based applications thanks to today's new media. The contribution to the learners' variables such as motivation, engagement, and academic success plays an essential role in the widespread use of digital storytelling (Chun-Ming Hung, Hwang, & Huang, 2012; Nam, 2017; Sadik, 2008; Gocen Kabaran, & Duman, 2021; Walters et al., 2018). In addition to the contributions it makes to students, it can be said that it also contributes to teachers' technology integration skills (Sancar-Tokmak, Surmeli, & Ozgelen, 2014; Sancar-Tokmak & Yanpar-Yelken, 2015).

In addition to cognitive skills, affective beliefs such as belief and self-confidence also play an essential role for teachers to integrate technology into the classroom environment (Joo, Park, & Lim, 2018). Although their technological, pedagogical, and field knowledge is sufficient, their belief in themselves plays an important role in turning this into performance. It is crucial to examine the concept of self-efficacy introduced by Bandura (1977), which is defined as the confidence individuals have in themselves to perform performance or task.

The first purpose of measuring self-efficacy is to predict whether individuals will perform a performance rather than revealing their characteristics (Zimmerman, 2000). Although self-efficacy alone is not enough to predict success; As self-efficacy increases, their success increases (Akkoyunlu ve Kurbanoğlu, 2003). One of the four critical components for increasing self-efficacy is experiences (Bandura, 2001). In other words, as the experience of individuals increases, their self-efficacy increases. Thus, pre-service teachers' realization of applications where they can integrate technology will gain experience. This experience will ensure a successful technology integration in future classes.

When the literature is examined, it is seen that TPACK and Self-efficacy are related. It is known that TPACK affects self-efficacy, as seen in Figure 1, and it also affects behavior (Joo et al., 2018). Therefore, evaluating these two variables together will provide a more accurate interpretation of the results.
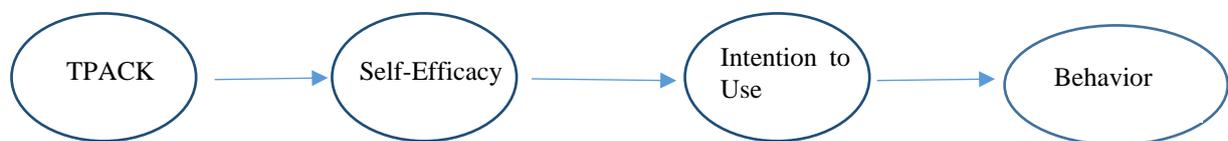
Figure 1. Relationship between TPACK and Self- Efficacy (Adapted from (Joo et al., 2018))

In this direction, this study aims to examine the effect of digital storytelling on pre-service teachers' TPACK skills and teaching self-efficacy. For this purpose, the following questions will be answered:

- Do pre-service teachers' TPACK levels differ significantly before and after the application of digital storytelling?
- Do pre-service teachers' teaching self-efficacy levels differ significantly before and after digital storytelling practice?
- How do pre-service teachers evaluate the digital storytelling process within the framework of TPACK and teaching self-efficacy?

Methodology

In the research, one of the mixed-method approach Explanatory Sequential Design is used. This design is the most commonly used version of mixed methods in educational research. In the explanatory research design, firstly, quantitative data is collected and analyzed. Thus, the general framework of the research question is determined. Furthermore, qualitative data is collected and analyzed for investigating the research question deeply (Creswell, 2012). The symbolic representation of the design is as in Figure 2.
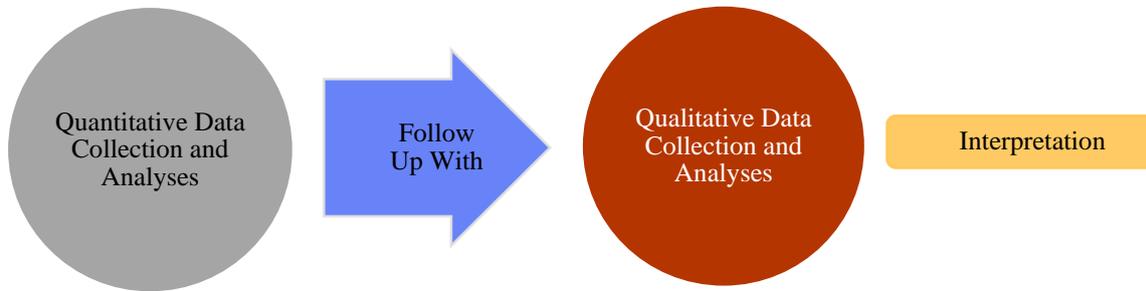

Figure 2. The Symbolic Representation of Explanatory Research Design (Creswell, 2012, pp. 534)

In the quantitative part of the research, the one group pre-test post-test design (Büyüköztürk, Kılıç Çakmak, Akgün, Karadeniz ve Demirel, 2012), in other words, repeated-measures design (Creswell, 2012) is used. The symbolic representation of the design is as in Figure 3.

Figure 3. The Symbolic Representation of The Quantitative Research Design

The qualitative part of the research is planned as a case study. The purpose of the case studies is deeply investigating a case (Yıldırım ve Şimşek, 2011, s.77.).

Participants

Convenience sampling is used in this research. This sampling type is used, where the participant group's participation status is easier or more accessible (Ekiz, 2009). The quantitative data is collected from 29 third grade pre-service ICT Teachers. 15 (%51.72) of the participants were female, and 14 (%48.28) were male. The qualitative data is collected from 9 participants as three focus groups. The participants are selected according to their scores taken from the rubric. The scores separated into three levels as low, medium, and high. In each group, there are participants from all levels.

Procedure

The research was carried out in the history of science courses in the Computer Education and Instructional Technologies (CEIT) department. The research took eight weeks without the data collection process. The process started with the implementation of the pre-tests and with giving information about digital storytelling, about the process of creating digital stories, and showing digital story examples. Pre-service teachers were first asked to be a group of 2 or 3 people, then to select one of the world-renowned Turkish scientists (like Gazi Yaşargil, Oktay Sinanoğlu, etc.) and to create stories about them. Assuming they know the video editing programs, the video editing programs are not described for being a CEIT department student. Post-tests are implemented to the group at the end of the process, and the digital stories are evaluated with a rubric for selecting the focus group interview participants.

Data Collection Tools

There are three different scales used for quantitative data collection. For evaluating the digital stories, a rubric is used. Moreover, for the qualitative data collection, open-ended interview questions are used.

Teaching Profession Self-Efficacy Scale

The original form of the scale is developed by Tschannen-Moran & Woolfolk-Hoy (2001) and first adapted into Turkish by Baloğlu ve Karadağ (2008). The adapted version of the scale is adapted for pre-service teachers by Tuluk (2014). The scale's adapted form involves 19 5 points Likert-type (1= strongly disagree to 5 = strongly agree) items under three dimensions. The scale explains % 54 of the total variance, and the alpha coefficient is .86 for Efficacy in Student Engagement dimension (9 items), .84 for Efficacy in Instructional Practices (7 items), .93 for Efficacy in Classroom Management (3 items).

Perceived TPC Knowledge Scale

For determining the effect of digital storytelling on pre-service teachers' perceived TPC Knowledge levels, the Perceived TPCK scale developed by Kuşkaya-Mumcu (2011), is used. The scale has 15 items under four dimensions; Technological Knowledge (4 Items), Technological Content Knowledge (4 Items), Technological Pedagogical Knowledge (4 items), Technological Pedagogical Content Knowledge (3 Items). The items are 10 points Likert-type, starts from 1=" strongly disagree" to 10 = "strongly agree."

Digital Story Rubric

The rubric used in this study is developed by Özcan, Kukul and Karataş (2016). The rubric involves three main categories; Planning, Production, and Presenting/Sharing/FeedBack. There are four criteria under the planning category: under the product category, there are nine criteria, and under the presenting/sharing/feedback, there is one criterion for evaluating the digital stories. The rubric is developed according to the digital storytelling process

and the elements of digital stories. There are 4 different points for each criteria; 1= "Poor", 2= "Low", 3= "Good", 4= "Excellent".

Interview Questions

In the qualitative part of the study, semi-structured focus group interviews are held. Interview questions are prepared according to the results of the quantitative analysis. Furthermore, it is asked the pre-service ICT teachers to think about all digital storytelling processes for different field teachers because pre-service ICT teachers' digital competencies may be better than those of other fields. For this reason, https://tureng.com/tr/turkce-ingilizce/spontaneousinstant questions are asked during the interview, like, *"When you think of the other fields' teachers, how digital storytelling affects their teaching profession differently from ICT teachers?"* The interview questions are seen below;

- How can digital storytelling affect the teaching profession?
- When you think of digital storytelling in the framework of student engagement, how does it affect student engagement?
- How can digital storytelling affect teachers' technological pedagogical content knowledge?

Data Analysis

According to the explanatory sequential mixed method research design, the data analysis starts with analyzing the quantitative data. Firstly, it was checked whether the quantitative data met the parametric test assumptions. The study's quantitative data analysis was started by checking whether the parametric test assumptions were met. One of the parametric tests' assumptions is the normal distribution of data (Delice, 2010; Kraska-Miller, 2013). One of the most commonly used methods to determine whether the data shows normal distribution is the coefficient of skewness and kurtosis. Some researchers interpret this coefficient to be within ± one range (Başol, 2015; Çokluk, Şekercioğlu, & Büyüköztürk, 2012; Büyüköztürk, 2007) and some researchers emphasize that this value can be within the range of ± 2 (George and Mallery, 2003).

When Table 1 is examined, it is seen that the Skewness and Kurtosis values of the tests other than readiness pre-test are between +1 and -1. That means all the data of the tests show normal distribution.

Table 1. The Skewness and Kurtosis Values of the Scales

Scale	Test	N	$\overline{X}$	Sd	Skewness	Skewness Std Error	Kurtosis	Kurtosis Std. Error
Self-Efficacy	Pre-Test	29	72.59	1.779	.099		-.852	
	Post-Test	29	77.17	1.321	.366	.434	-.008	.845
TPCK	Pre-Test	29	112.03	3.964	-.364		.030	
	Post-Test	29	123.14	2.993	-.139		-.955	

The digital story rubric is used for evaluating the digital stories developed by the pre-service teachers. Two researchers evaluated the stories separately, and then the scores given by the researchers were compared for reliability analysis. According to the results, the participants are separated into three different groups by their scores. From each group, three participants selected randomly for focus group interviews. Each participant of focus group interviews is given a nickname, as seen in Table 2.

Table 2. Nicknames of the Participants

Focus Group	Nickname	Score
Focus Group 1	P_ 1L	Low
	P_2M	Medium
	P_3H	High
Focus Group 2	P_ 4L	Low
	P_5M	Medium
	P_6H	High
Focus Group 3	P_ 7L	Low
	P_8M	Medium
	P_9H	High

Students with different scores are selected for groups; it is the assumption that pre-service teachers who have low scores may not be satisfied with the process. Thus, it was tried to show why they were also not satisfied with the process and the weaknesses of the process.

Findings

Teaching Profession Self-Efficacy Scale

Paired Samples t-Test is used for determining the effect of digital storytelling on pre-service teachers' teaching profession self-efficacy levels. The results are shown in Table 3.

Table 3. Paired Samples t-Test Results of Teaching Profession Self-Efficacy Scale

Scale	Test	N	$\bar{X}$	Std.	df	t	p	Cohen's d
Self-Efficacy Scale	Pre-Test	29	72.59	9.58	28	-3.13	0.004*	0.54
	Post-Test	29	77.17	7.11				
Efficacy in Student Engagement	Pre-Test	29	35.24	4.70	28	-2.30	0.029*	0.44
	Post-Test	29	37.03	3.38				
Efficacy in Instructional Practices	Pre-Test	29	27.03	3.84	28	-3.19	0.004*	0.57
	Post-Test	29	29.03	3.10				
Efficacy in Classroom Management	Pre-Test	29	10.31	1.98	28	-2.09	0.046*	0.44
	Post-Test	29	11.10	1.61				

p<0.05 significant

According to the results of paired samples t-test, there is a significant difference between pre-test and post-test scores (t(28)=-3.13; p<0.05). It is determined that the mean of post-test scores ($\bar{X}$=77.17) is higher than pre-test

scores ($\bar{X}$=72.59). In other words, digital storytelling has a positive effect on pre-service teachers' self-efficacy levels towards teaching. As a result of the analysis made to determine the effect size, the value of 0.54 revealed that this effect size is medium. According to Cohen, the effect size higher than 0.5 is large enough for the researcher to see, even with his observations (Cohen, 1988). When the sub-factors are examined, the same effect is seen for all the sub-factors too. Digital storytelling positively affects pre-service teachers' efficacy in Student Engagement, Instructional Practices, and Classroom Management. The efficacy in Instructional Practices is the most effected sub-category with .57 effect size (t(28)=-3.19; p<0.05).

Perceived TPACK Scale

Paired Samples t-Test is used for determining the effect of digital storytelling on pre-service teachers' perceived technologic pedagogical content knowledge levels. The results are shown in Table 4.

Table 4. Paired Samples t-Test Results of Perceived TPC Knowledge Scale

Scale	Test	N	$\bar{X}$	Std.	df	t	p	Cohen's d
TPACK	Pre-Test	29	112.03	21.35	28	-3.67	.001*	0.59
	Post-Test	29	123.14	16.12				
Technological Knowledge	Pre-Test	29	29.52	6.85	28	-2.05	.049*	0.34
	Post-Test	29	31.52	4.74				
Technological Content	Pre-Test	29	29.48	6.59	28	-3.81	.001*	0.59
	Post-Test	29	33.00	5.29				
Technological Pedagogy	Pre-Test	29	31.17	5.59	28	-3.06	.005*	0.58
	Post-Test	29	34.10	4.49				
Technological Pedagogical Content	Pre-Test	29	21.86	4.64	28	-3.42	.002*	0.63
	Post-Test	29	24.52	3.72				

p<0.05 significant

According to the results of paired samples t-test, there is a significant difference between pre-test and post-test scores (t(28)=-3.67; p<0.05). It is determined that the mean of post-test scores ($\bar{X}$=123.14) is higher than pre-test scores ($\bar{X}$=112.03). In other words, digital storytelling has a positive effect on pre-service teachers' perceived TPC knowledge levels. As a result of the analysis made to determine the effect size, the value of 0.59 revealed that this effect size is medium (Cohen, 1988). When the sub-factors are examined, it can be said that digital storytelling has a significant positive effect on all sub-factors of the TPACK Scale. Technological Pedagogical Content sub-factor is the most effected factor with .63 effect size (t(28)=-3.42; p<0.05).

Findings of the Focus Group Interviews

In the framework of the study, three focus group interviews are organized. In this section, all the interviews will be analyzed together. In the first question directed to the pre-service teachers, digital storytelling's effect on teaching competencies was asked. Although the pre-service teachers generally emphasized the positive effects,

they also stated that it did not contribute much because they were ICT pre-service teachers, considering that their technological skills were already sufficient. When asked to think about pre-service teachers in other fields; they stated that they found it positive in developing technological skills, enriching the learning environment, following the new technologies. It is seen that the pre-service teachers' thoughts below:

> P_3H: *"With digital storytelling, teachers may need to use different web 2.0 tools. Therefore, the teacher needs to be aware of these tools."*

> P_5M: *"A teacher who will have this application must know web 2.0 technologies and follow new technologies. In doing so, their technological skills will improve, and I think today's teachers should use technology well."*

> P_8M: *"I think it is easy to use digital storytelling for the teachers in our department. After all, using and making web 2.0 tools available is part of our field. However, teachers in other departments may find it difficult."*

> P_1L: *"Yes, it is a different activity for students, but I do not think that teachers in other departments will implement it. It is a difficult process for them; they will both learn and teach new technologies."*

When the pre-service teachers were asked to evaluate digital storytelling in terms of student engagement, enrichment of the learning environment, and classroom management, it was stated that digital storytelling generally contributed positively to the learning environment. However, digital storytelling is thought to positively affect students, such as attracting students' attention, developing students' creativity, and developing their students' technological skills.

> P_6H: *"I think digital storytelling is an important activity to enrich my class. The history of science is a subject that we can teach in secondary schools, and I would not have thought of using digital storytelling while dealing with this topic."*

> P_4L: *"I think it can make the lesson fun for children. In doing so, it is ensured that they both learn the subject and develop their technological competence."*

> P_7L: *"Although I cannot create a creative story, I think students will develop more creative things. Maybe if we did digital stories at the secondary school, I would be creative too :)"*

When the pre-service teachers are asked to evaluate digital storytelling within the framework of TPACK, it is seen that they think it contributes especially pedagogically. As seen in the previous questions, it is seen that they consider the course as a method that can enrich the course, and while doing this, they consider using technology to work as an advantage. Although digital storytelling works technology, it is not considered a technological innovation for ICT teachers. However, they state that they will contribute positively to their technological knowledge when they think in terms of teachers in other fields. Some of the opinions of pre-service teachers about the effect of digital storytelling on TPACK skills are given below:

> P_2M: *"I do not think it gives a technological competence for our department. We are already using new vehicles due to our branch. However, it will make a positive contribution to friends' technological competencies in other branches, of course. "*

> P_7L: *"I think it is a useful method because it is a method where teachers can both put students at the center and make technology use in the subjects they will cover in their lessons. After all, at this age, all*

individuals need to use technology actively."

P_9H: "I think it will be very beneficial for students to use these activities in different lessons. Because they both have fun and learn, for this, we, as pre-service teachers, need to learn how to use these methods and technologies in our lessons at university."

P_8M: "I agree with P_9H, but unfortunately, even if we take practical courses at the university, they are theoretical. It is always said that our branch can cooperate with other branches, but as a pre-service teacher, we do not work in partnership with other branches. How should we work as a teacher?"

Discussion

In the study, in which the effect of digital storytelling on the TPACK levels and teaching self-efficacy of ICT pre-service teachers was investigated, it was observed that digital storytelling had a significant positive effect on both variables. This finding coincides with the studies of Sancar-Tokmak and Yanpar-Yelken (2015), Sancar-Tokmak, Surmeli, and Ozgelen (2014). However, in this study, it was seen that digital storytelling had the most excellent effect on the Technological Pedagogical Content sub-factor, whereas in Sancar-Tokmak and Yanpar-Yelken (2015) there was no significant difference under this factor. It has been observed that pre-service teachers evaluated digital storytelling as powerful, especially in terms of enriching the learning environment. While expressing this, pre-service teachers who care about integrating technology into the learning environment emphasized the importance of technological pedagogical knowledge. In this respect, it shows that digital storytelling is a strong alternative for integrating technology into the educational environment (Sadik, 2008).

The pre-service teachers emphasize that they can make their lessons more enjoyable with digital storytelling, enable their students to be active in the lessons, and develop their creativity. This finding corresponds exactly to the study findings of Karataş, Kukul and Özcan (2018). It can be thought that students' commitment to the lesson will increase by having fun in the lessons (Nam, 2017). Although ICT pre-service teachers consider it an easy process for them, they think it can be a time consuming and difficult process for other teachers. This finding coincides with the study of Karataş, Kukul and Özcan (2018) and Yiğit (2020). Pre-service teachers generally think that processes other than traditional methods are difficult and time-consuming. Although they think that digital storytelling will be useful in different lessons (Islim, Ozudogru, & Sevim-Cirak, 2018; Kocaman-Karoglu, 2014), they do not believe that it is applicable. There may be different reasons for this:

- First of all, pre-service teachers have not taken any courses other than traditional methods until and after they arrive at the university,
- The implementations of the courses taken in university education,
- Teachers' technological knowledge and skills are not sufficient.

Conclusion

It is seen that digital storytelling has a positive effect on pre-service teachers' TPACK levels and teaching self-efficacy. Many studies in the literature overlap with this study result (Nam, 2017; Sancar-Tokmak et al., 2014; Sancar-Tokmak & Yanpar-Yelken, 2015). Besides, it has positive effects on students (Hung, Hwang, & Huang,

2012; Nam, 2017; Yang & Wu, 2012) and maybe (Islim, Ozudogru, & Sevim-Cirak, 2018; Karataş, Kukul, & Özcan (2018), many studies put forward. However, in some studies, as in this study, it is seen that pre-service teachers perceive digital storytelling as difficult to apply in a classroom environment for different reasons. (Karataş, Kukul, & Özcan, 2018). This finding can be seen as an essential finding that must be overcome for successful technology integration.

Why do pre-service teachers think that digital storytelling is a time consuming and complicated process? Because the pre-service teachers come from the traditional learning environment and unfortunately, as they have stated, this situation does not differ at the university. Thus, pre-service teachers can get rid of this prejudice if they see more lessons conducted with unconventional methods. It can also be ensured that pre-service teachers practice with teaching methods in which new technologies can be used in the lessons included in the teacher training program such as special teaching methods, teaching principles, and methods. Thus, the process can be easier for pre-service teachers who find more practical opportunities.

Another reason behind the pre-service teachers' perception of digital storytelling as a problematic process may be the lack of technological knowledge and skills. It is known that pre-service teachers are mostly limited to the use of social media until they come to university (Islim, Ozudogru, & Sevim-Cirak, 2018). Their inability or fear of not being able to do so when faced with new technologies can also cause them to consider the process difficult. In order to prevent this, increasing the digital literacy of pre-service teachers may be beneficial. In addition, if it is possible to expand the use of technology for different purposes in younger age groups, technology knowledge and skills will increase in future pre-service teachers.

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