

## **The Effect of the Flipped Classroom Model on Pre-Service Teachers' Digital Literacy and Digital Pedagogical Competencies**

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### **Abstract**

This study aims to analyze the effect of the flipped classroom model on the pre-service social studies teachers' digital literacy and digital pedagogical competencies. The study employed one group pretest-posttest design, one of the weak experimental models. The working group of the study consisted of 28 sophomore studying at the department of social studies teaching in a Turkish state university during the 2019-2020 academic year. This study employed "Digital Literacy and Digital Pedagogic Competency Scales" as data collection tools. Descriptive statistics and multivariate variance analysis (MANOVA) were used during data analysis. The study results revealed that the flipped classroom model based activities had a significant impact upon the digital literacy and digital pedagogical competences of the participants. The study also examined whether there was a significant difference in pre-service teachers' pre-test and post-test scores with regards to gender. A significant difference was identified across the pre-service teachers' digital literacy post-test scores in favor of females. Based on the results, various recommendations were provided.

**Keywords:** Digital Literacy, Digital Pedagogical Competence, Flipped Classroom Model, Pre-Service Teachers

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## Introduction

In the twenty-first century, great advances have been made in science and technology. Developments in science and technology have affected people's lives and technology has gained a significant place in human life. Technology, which has such an important place in human life, has also affected educational research. Especially technological developments have made it necessary to organize technology-based teaching-learning environments. Scientists have developed student-centered teaching-learning approaches by considering students' interests and needs based upon the technological developments and changes. One of them is the flipped classroom model.

The flipped classroom model differs greatly from the traditional classroom model. Demiralay and Karataş (2014) defined the flipped classroom model as a "blended learning model" carried out with the guidance of the teacher, in which the knowledge provided by the teacher in the traditional classroom environment is moved to the online platform and the tasks expected to be done outside the school are transferred into the classroom. Bishop and Verleger (2013) underlined that flipped classroom model is a teaching-learning model that offers students the opportunity to do classroom activities individually or group activities with the guidance of the teacher, and to find solutions to their problems. The flipped classroom model has various contributions such as the effective use of time in the classroom, enabling students to learn at their own pace, increasing the interaction between student and teacher, taking responsibility for the student's own learning, increasing students' academic achievement, motivation and interest in the lesson (Ayçiçek, 2019). In the flipped classroom model, the teacher shares videos or documents s/he has prepared on the subject with the students via Web 2.0 tools or teaching management systems. Before coming to the classroom, students watch these videos and examine the documents and thus become ready for prior knowledge of the subject. The teacher makes various practices related to the subject to be taught in the lesson. Teachers were spending a lot of time in transferring knowledge in the traditional classroom environment. Since the teachers attached more importance to the transfer of knowledge in the classroom, they could not make enough practices for the subjects they taught. In the flipped classroom model, since students come to the class with prior knowledge, teachers find opportunities to practice during the lesson (Bergmann & Sams, 2012; Chilingaryan & Zvereva, 2017; Debbağ, 2019).

Technology-based teaching-learning approaches, as in the flipped classroom model, should be used in all educational levels from primary school to university because individuals in this age take an eager interest in technology. The generation, called the Z generation, uses technology quite frequently in their daily lives (Prensky, 2001). The students' characteristics and needs should be taken into consideration while organizing the teaching-learning process. Providing a teaching environment organized in this way, students' learning gets easier and permanent learning can be achieved. It is also important to apply contemporary technology-based teaching-learning approaches especially in teacher

training programs. Pre-service teachers' knowledge about how technology-based teaching-learning approaches should be applied and learning by doing these approaches can contribute to their implementation of these approaches when they start their teaching profession. Applying technology-based teaching-learning approaches in teacher training programs can also improve pre-service teachers' digital literacy and their digital pedagogical competences.

Digital literacy requires having skills to reach, produce and share accurate information, and to use technology in learning-teaching processes together with the appropriate use of different technologies (Hamutoğlu, Canan-Güngören, Kaya-Uyanık & Gür-Erdoğan, 2017). A digital literate individual is an individual who is creative, innovative, able to collaborate, communicate, think critically, solve problems, develop decision-making skills, know what technological concepts mean and use these concepts accordingly, and who can do what is required as a digital citizen (Ocak & Karakuş, 2018a). Teachers are expected to be digital literate as the age we live in is called the digital age, and therefore, teachers must have the skills to use digital tools.

Teachers also need to possess digital pedagogical competences as well as being digital literates. Digital pedagogical competence is defined as the basic knowledge and skills of the teachers about digital tools and their effective usage in teaching process (Yaman, Demirtaş & Aydemir, 2013). Digital pedagogical competence can also be defined as having knowledge about digital technologies, having the skills to use these technologies, employing these technologies by considering student development characteristics while organizing the teaching-learning process, and considering themselves as competent in this regard. Teachers' technological competences play a significant role in identifying their effectiveness in the teaching-learning process. Odabaşı and Kabakçı (2007) noted that teachers' technological competences include not only the ability to have knowledge, skills and attitudes regarding computer or internet technologies, but also to adapt different information and communication technologies to the learning-teaching process. Hence, it is not adequate for teachers to use technology merely by following technological developments; that is, it becomes a necessity for them to use technology while organizing learning activities (Durmaz, 2017). In this regard, it is highly essential that teachers have high digital literacy and digital pedagogical competences. Only if teachers have high digital literacy and digital pedagogical competence, will they be able to organize the teaching environment by taking digital technologies into account. In this case, individuals with 21st century skills can be raised. It is paramount in employing technology-based teaching-learning approaches to develop this literacy and competence in undergraduate education in order to improve teachers' digital literacy and their digital pedagogical competence.

When the national and international literature are examined, researches on flipped classroom model and digital literacy have been found. In the study conducted by Gyeong-Geon, Young-Eun, and Hun-Gi (2021), it was concluded that the collaborative flipped classroom model significantly affected

the motivation of higher education students. On the other hand, Liu-Jie, Sheng-Quan & Shi-Deng (2021) revealed in their research that the flipped classroom model improves student participation and interaction outside of the classroom through peer coaching of students studying in higher education. In the study conducted by Elian and Hamaidi (2018), it was concluded that the flipped classroom model significantly affected the academic achievement of students. Besides, Phoeun and Sengsri (2021), concluded in their research that the flipped classroom model improved students' attitudes towards speaking English in a positive way. In the study conducted by Tyger (2011) it was determined that the digital literacy levels of teacher candidates were low. In the research conducted by Tang and Chaw (2016), it was concluded that the hybrid learning model affects students' digital literacy.

Upon examining the related literature in Turkey, various studies were conducted to examine the effect of the flipped classroom model on pre-service teachers' attitudes towards geometry (Özdemir, 2019), on their academic achievement and the learning motivations (Duman, 2019), on their motivation, self-efficacy and attitudes toward lessons (Debbağ, 2019), their further reading and writing skills, self-regulation skills in learning, and classroom interactions (Aydemir, 2019). There are also studies examining the pre-service teachers' digital literacy (Aslan, 2021; Boyacı, 2019; Ocak & Karakuş, 2018a) and their digital pedagogical competences (Yaman, Demirtaş & Aydemir, 2013) in terms of several variables. Considering the relevant literature in Turkey, there is no such a study specifically published on analyzing the effect of the flipped classroom model on pre-service teachers' digital literacy and their digital pedagogical competence. Thus, it clearly reveals the gap in the literature.

Studies revealed that using technology-based approaches in the teaching-learning process has numerous benefits (Debbağ, 2019; Özdemir, 2019). In this respect, it is fundamental to use technology-based teaching-learning approaches in teacher training programs and to conduct research in this line. Providing education to pre-service teachers who will raise new generations based on contemporary and technology-based approaches may contribute to the development of their digital literacy and digital pedagogical competences. Thus, pre-service teachers can acquire the 21st century skills and equip students with these skills when they begin their teaching. In this respect, the results of this study are expected to contribute to the relevant literature. Especially the activities based on the flipped classroom model will shed light on the faculty instructors working in teacher training programs. Besides, this study is thought to guide scientists who are willing to work in this field.

According to the previous studies' findings, it can be said that some socio-demographic variables are effective on digital literacy and digital pedagogical competence. One of these variables is the gender variable. It can be stated that especially gender roles affect individuals' access to digital technology. As a matter of fact, it can be stated that the patriarchal nature of the social structure in

Turkey causes men to use digital technology more. When the studies conducted in Turkey were examined, it was found that there was a significant difference in favor of men in terms of digital literacy levels (Aslan & Aybek, 2020; Aslan, 2021; Bayrakcı & Narmanlıođlu, 2021; Glđađ, 2021; Yazıcıođlu, Yaylak & Gen, 2020). Likewise, in the study conducted by Bilge and Kılcan (2021), there was a significant difference in favor of males in terms of students' attitudes towards e-literacy. Based on these results, it was examined whether the digital literacy and digital pedagogical competencies of pre-service teachers differed significantly in terms of gender in this study.

This study aims to analyze the effect of the flipped classroom model on the pre-service social studies teachers' digital literacy and their digital pedagogical competences. In this regard, answers to the following questions were sought:

Is there a significant difference between the pre-test and post-test scores of the experimental group regarding digital literacy and digital pedagogical competence scales?

Do the pre-test and post-test scores of the experimental group regarding digital literacy and digital pedagogical competence scales significantly differ across gender?

## **Method**

### **Research Model**

This study utilized an experimental research model. Experimental research is a systematic model used by researchers to manipulate one or more variables and to control the rest of the variables (zdemir & Dođruz, 2020). A weak experimental design was used in the present study. In weak experimental designs, external variables or situations that may threaten the internal validity of the study cannot be controlled (Őahin, 2019). Weak experimental designs are used in situations in which the conditions in the field of education are unfavorable and the number of participants is low (Őahin, 2019). This study employed a weak experimental design since the number of participants was insufficient. The one-group pretest-posttest design is usually the one in which the experimental process is carried out on a single group and the group is measured twice (Őata, 2020). One group pretest-posttest design is used when a control group cannot be formed (Tuncer, 2020). As the number of participants was low in this study, a control group could not be formed and therefore one group pretest-posttest design was used. Table 1 depicts the experimental design of the study.

**Table 1.** Experimental Design of the Research

Group	Pre-test	Experimental process	Processing time	Post-test
Experimental	Digital literacy Digital pedagogical competence	Flipped classroom model	14 weeks	Digital literacy Digital pedagogical competence

### Participants

The participants consisted of 28 sophomore pre-service teachers studying at the department of social studies teaching in a Turkish state university during the 2019-2020 academic year. Convenience sampling method was used while determining the sample. In this sampling method, the researcher includes the participants in the immediate surroundings that s/he can reach (Özkan, 2019). This study used the convenience sampling method as the pre-service teachers studying at the department of social studies teaching, which could be easily reached by the researcher, participated in the study. The working group held 17 female and 11 male pre-service teachers. Necessary permissions were obtained before the study was conducted. During data collection process, participant consent forms were distributed and signed to the teachers. The decision of the ethics committee was also taken (Number: E-87432956-050.99-173705).

### Experimental Process

Experimental procedures related to the study were executed in a total of 14 weeks. Activities were conducted with the experimental group in the computer laboratory of the university.

#### *Activities Used with the Experimental Group*

Within the scope of the study, the activities based on the flipped classroom model were administered to the experimental group. Pretests were applied to the experimental group before the activities were carried out. A flipped classroom model was applied to the experimental group via the teaching management system (Blackboard). Prior to applying the flipped classroom model-based activities to the experimental group, the pre-service teachers were informed about the teaching management system and the necessary information was presented. After the teaching management system was announced by the researcher, the experimental application was initiated. The experimental process was conducted by the researcher within the context of “Instructional Technologies” course. When teacher training programs are examined, it is recommended to teach theoretical information about "information technologies in education, teaching process and classification of instructional technologies, theoretical approaches to instructional technologies, new trends in learning approaches, current literacy, design principles of instructional materials, evaluation criteria of instructional

materials" in instructional technologies course (Council of Higher Education [YOK], 2018). Apart from this content, different information was given to the students and different applications were made within the scope of the course in this research. The researcher observed that the pre-service teachers did not have sufficient knowledge about digital technologies, and their digital literacy as well as digital pedagogical competences were low. The starting point of the study was grounded on these observations. Within the scope of the research, in the out-of-class dimension of the flipped classroom model, pre-service teachers were taught theoretical information on subjects such as animation, simulation, augmented reality, and digital story. For this, videos were shot and shared with teacher candidates before they came to the lesson. In addition, programs that can be used for animation, simulation and digital story development are also mentioned in these videos. Thus, the pre-service teachers were informed about the topics of that week before coming to the class. Within the scope of in-class activities dimension of the flipped classroom model, activities were organized in the computer laboratory by using these programs for the acquisitions in the social studies curriculum in the classroom for pre-service teachers. Within the scope of the instructional technologies course, the pre-service teachers were ensured to prepare presentations in various programs by introducing presentation tools; moreover, animations, digital stories, simulations, and lecture videos were developed and prepared through some programs. In addition, some of the augmented reality applications were exemplified for the pre-service teachers within the framework of social studies curriculum and game-based learning tools were developed. Pre-service teachers were made to prepare samples regarding the use of social media tools (Twitter, Facebook, Instagram) within social studies teaching. They were also urged to prepare web designs for classroom web design. Applications were made for these subjects in the classroom environment. The contents and activities of the videos were presented to five faculty members, who work at the department of educational sciences and who have studies on technology integration in education, in order to receive their opinions. With the faculty members' feedback, the videos and activities were finalized and put into practice. After all subjects were applied in this way, a post-test was implemented to the experimental group.

### **Data Collection Tools**

This study used two data collection tools.

#### *Digital Literacy Scale*

The "Digital Literacy Scale" developed by Sulak (2019) was used in the study. The scale development process was conducted with 424 pre-service teachers. Exploratory and confirmatory factor analyzes were used while developing the scale. The exploratory factor analysis results showed that the scale consists of 3 factors and 44 items. Instructional technologies factor of the scale includes 18 items, and the factor loadings of the items varies between .37 and .81; the information communication factor consists of 15 items and the factor loadings differ across .48 and .68; the

technical factor involves of 11 items in total and the factor loadings of the items vary between .51 and .74 (Sulak, 2019). The factors of the scale explain 49% of the total variance. The Cronbach Alpha coefficient was examined in order to determine the reliability of the scale, and the coefficients of the instructional technologies, the information communication and the technical factors were found to be .92, .90 and .91, respectively (Sulak, 2019). In the confirmatory factor analysis performed by Sulak (2019), some of the fit values were at acceptable levels, while others were below the acceptable level. The scale was developed as a five-point Likert type. In this study, the Cronbach Alpha coefficient of the scale was examined, and the Cronbach Alpha coefficient of the sub-dimension titled as instructional Technologies was found .95, the information communication sub-dimension was found .93; technical sub-dimension was found .95 and the whole scale was found .97. The Cronbach Alpha coefficient of .70 and above indicates that the scale is highly reliable (Fraenkel, Wallen & Hyun, 2014).

#### *Digital Pedagogical Competences Scale*

The “Digital Pedagogical Competences Scale” developed by Yaman, Aydemir-İleri and Demirtaş (2013) was deployed in this study. The scale development process was conducted with 246 pre-service teachers. Exploratory and confirmatory factor analyzes were used while developing the scale. The exploratory factor analysis results suggested that the scale consists of 3 factors and 19 items. The educational digital pedagogical competence factor of the scale includes 7 items and the factor loads vary between .43 and .84; web digital pedagogical competence factor consists of 5 items and the factor loads differ across .48 and .76; the general digital pedagogical competence factor possesses 7 items in total, and the factor loads of the items vary between .55 and .78 (Yaman, Aydemir-İleri & Demirtaş, 2013). The factors of the scale explain 55% of the total variance. The Cronbach Alpha coefficient was examined to determine the reliability of the scale, and accordingly the coefficients of the factors- educational digital pedagogical competence, web digital pedagogical competence and general digital pedagogical competence- were identified as .89, .81 and .76 (Yaman, Aydemir-İleri & Demirtaş, 2013). As a result of the confirmatory factor analysis performed by Yaman, Aydemir-İleri, and Demirtaş (2013), the fit indices were found at an acceptable level. 5 point likert type gradation was used to express agreement level. In this study, the Cronbach Alpha coefficient of the scale was examined and the Cronbach Alpha coefficient of the educational digital pedagogical competence sub-dimension was found .91, the web digital pedagogical competence sub-dimension was found .89, the general digital pedagogical competence sub-dimension was found .93 and the whole scale was found .95. Based on this result, the scale can be said to be reliable. Necessary permissions were obtained for the data collection tools. Confirmatory factor analysis was performed on both scales and a second level validity study was conducted. For this reason, analyses were made over the total score in the study.

### **Data Analysis**

At first, the data were analyzed to determine as to whether the univariate normality assumption was met. The Shapiro-Wilks test was examined in terms of whether the univariate normality assumption was met or not. Seçer (2015) suggested that the sample should be 50 at most to use the Shapiro-Wilks test. As the number of the pre-service teachers in the experimental group was less than 50, the Shapiro-Wilks analysis result was examined in the present study. As a result of the analysis, the digital pedagogical competence pretest score (S-W:.97,  $p>.05$ ) and digital literacy posttest scores (S-W:.97,  $p>.05$ ) of the experimental group demonstrated a normal distribution, while the digital literacy pretest and the digital pedagogical competence posttest scores did not show a normal distribution. Can (2019) suggested that if the Shapiro-Wilks analysis is significant, the skewness and kurtosis coefficients must be examined. As a result of the analysis, the skewness coefficient of the digital literacy pretest score was -1.36 and the standard error was .44, the kurtosis coefficient was 1.45 and the standard error was .85; besides, the digital pedagogical competence posttest score was found to have a skewness coefficient of -1.05 and a standard error of .44, a kurtosis coefficient of 1.45 and a standard error of .85. Can (2019) noted the coefficient of skewness and kurtosis between +1.96 and -1.96 indicates that the data are distributed normally. Based on this reference, the experimental group's digital literacy pretest score and the digital pedagogical competence posttest score showed a normal distribution. Descriptive statistics and MANOVA were used during data analysis. Some assumptions are required to use MANOVA. This study revealed the assumptions that the number of samples were more than the dependent variables, the variance-covariance matrices were homogeneous, the provision of multivariate normality, and the absence of multiple linear connections were met in order to perform MANOVA (Akbulut, 2011; Field, 2009; Pallant, 2005; Tabachnick & Fidell, 2007). Green and Salkind (2013) stated that the effect size value ( $\eta^2$ ) for MANOVA is evaluated as such: .01 small, .06 medium and .14 large. The effect size was also mentioned in relevant tables. This analysis could not be performed because the basic assumptions of MANCOVA could not be provided in the analysis of the data.

### **Results**

This section presents the results of the analyses related to the sub-problems of the study separately.

#### **Findings Regarding the Difference between Pretest and Posttest Scores of the Experimental Group**

Table 2 depicts the one-way repeated MANOVA (Multivariate Analysis of Variance) results related to whether there was a significant difference between pre-test and post-test scores of the pre-service teachers in the experimental group.

**Table 2.** One-Way Repeated MANOVA (Multivariate Analysis of Variance) Results of the Experimental Group's Pretest and Posttests

Variable	Test	n	<i>M</i>	<i>SD</i>	<i>df</i>	<i>F</i>	<i>p</i>	$\eta^2$	<i>Diff.</i>
Digital literacy	Pretest (A)	28	3.17	.64	1-54	11.29	.00*	.17	B>A
	Posttest (B)	28	3.71	.56					
Digital pedagogical competence	Pretest (A)	28	3.20	.64	1-54	25.2	.00.	.31	B>A
	Posttest (B)	28	4.02	.58					

\* $p < .05$

Table 2 suggests one-way repeated MANOVA analysis results in order to examine the difference between the pretest and posttest scores of the experimental group on digital literacy and digital pedagogical competence. In the one-way repeated MANOVA analysis, digital literacy and digital pedagogical competences scales were dependent variables, while the experimental group's pretest and posttest scores were independent variables. Before executing one-way repeated MANOVA MANOVA, the assumptions of normality, univariate and multivariate extreme values, linearity, multiple correlation problem and homogeneity of variance-covariance matrices were examined and it was found that all these assumptions were not violated. Therefore, the Wilks' Lambda test was analyzed. A statistically significant difference was identified across the pre-test and post-test scores of the experimental group in terms of the combined dependent variables ( $F_{(1-54)}=12.6$ ,  $p=.00$ ; Wilks' Lamda=.6;  $\eta^2=.32$ ). Given the ANOVA results presented in Table 2 for the dependent variables, a significant difference was determined between the experimental group's digital literacy ( $F_{(1-54)}=11.29$ ,  $p<.05$ ) and their digital pedagogical competences ( $F_{(1-54)}=25.28$ ,  $p<.05$ ) pretest and posttest scores in favor of posttest scores. The eta square values signified a high level of effect.

#### **Findings Regarding the Difference between the Experimental Group's Pretest-Posttest Scores in Terms of Gender**

Table 3 displays the one-way between groups MANOVA results related to whether there was a significant difference between pretest and posttest scores of the pre-service teachers in the experimental group in terms of their gender.

**Table 3.** One-way Between Groups MANOVA Results Regarding the Difference between the Pretest and Posttest Scores of the Experimental Group in Terms of Gender

Test	Variable	Gender	n	M	SD	df	F	p	$\eta^2$	Diff.
Pretest	Digital literacy	Female (A)	17	3.32	.43	1-26	2.45	.13	.08	-
		Male (B)	11	2.94	.84					
	Digital pedagogical competence	Female (A)	17	3.24	.67	1-26	.18	.67	.00	-
		Male (B)	11	3.13	.62					
Posttest	Digital literacy	Female (A)	17	3.88	.58	1-26	4.516	.04*	.15	B>A
		Male (B)	11	3.45	.42					
	Digital pedagogical competence	Female (A)	17	4.09	.58	1-26	.553	.46	.02	-
		Male (B)	11	3.92	.59					

\* $p < .05$

As is seen in Table 3, one-way between groups MANOVA analysis was conducted in order to reveal whether there was a difference between the digital literacy and digital pedagogical competences pre-test and post-test scores of the experimental group in terms of their gender. In one-way between groups MANOVA analysis, digital literacy and digital pedagogical competences scales were dependent variables, while the experimental group's gender was an independent variable. Before executing one-way between groups MANOVA, the assumptions of normality, univariate and multivariate extreme values, linearity, multiple correlation problem and homogeneity of variance-covariance matrices were examined and it was found that all these assumptions were not violated. Therefore, the Wilks' Lambda test was analyzed. No statistically significant difference was identified across the digital literacy and digital pedagogical competences pre-test scores of the experimental group in terms of their gender within the context of the combined dependent variables ( $F_{(1-26)}=1.62$ ,  $p=.21$ ; Wilks' Lamda=.89;  $\eta^2=.11$ ). On the other, a statistically significant difference was found between the digital literacy and digital pedagogical competence posttest scores of the experimental group in terms of their gender within the context of the combined dependent variables ( $F_{(1-26)}=4.11$ ,  $p=.02$ ; Wilks' Lamda=.75;  $\eta^2=.24$ ). Considering the ANOVA results presented in Table 3 for dependent variables, the post-test scores of the experimental group's digital literacy ( $F_{(1-26)}=4.52$ ,  $p<.05$ ) was determined to significantly vary across their gender in favor of female pre-service teachers. No significant difference emerged in the posttest score of the experimental group's digital pedagogical competence ( $F_{(1-26)}=.55$ ,  $p>.05$ ) in terms of gender. Taking the eta squared values into consideration, the digital literacy pre-test score had medium effect and the post-test score had high; whereas a low level of effect on digital pedagogical pretest and posttest scores.

## Discussion

The scientific and technological developments in the twenty-first century have made an effect on the field of education along with all areas of life. The need for organizing learning-teaching environments has sprung so that individuals can keep up with technological developments in the field of education. In this fashion, the demands of the Z generation will be met. The most prominent feature of Generation Z is their persistent use of digital technology in their daily lives (Polakova & Klimova, 2019; Pousson & Myers, 2018). Thus, this study attempts to develop the Generation Z pre-service teachers' digital literacy and their digital pedagogical competences.

The first problem of the study was constructed to uncover whether there was a significant difference between the digital literacy and digital pedagogical competence pretest and posttest scores of the experimental group. The analysis results demonstrated a significant difference in favor of the posttest scores of the pre-service teachers in the experimental group. Rested on this result, it may be wise to mention that the flipped classroom model applied in the experimental group had a significant effect on the pre-service teachers' digital literacy and digital pedagogical competences. The flipped classroom model is a student-centered teaching-learning approach based on technology. In student-centered approaches, students are both physically and mentally active during the teaching-learning process. What is more, students are responsible for their own learning in student-centered approaches (Bayrakçeken, Doymuş & Doğan, 2015; Flumerfelt & Green, 2013; Foldnes, 2016). Similarly, student-centered activities based on the flipped model were applied to the pre-service teachers in the experimental group in order to enable them to be active in the process and to be responsible for their own learning in the present study. Also, the flipped classroom model allows students to practice in the classroom. Not only students are more active in the classroom but also time is used effectively by the teacher in the flipped classroom model (Aslan, 2021; Bishop & Verleger, 2013). Hence, this study paved the way for the fact that these activities carried out in this way could significantly affect the pre-service teachers' digital literacy and their digital pedagogical competence. In the study conducted by Özdemir (2019), the flipped classroom model was determined to increase pre-service teachers' attitudes towards geometry. Duman (2019) concluded that the flipped classroom model affects the pre-service teachers' academic achievement and their learning motivations. Likewise, the studies carried out by Gua, Tian, and Liu (2018), Erbil (2019) and Zhang (2018) presented that the flipped classroom model increased the students' academic achievement. Based upon these results, the flipped classroom model can be regarded as an effective teaching-learning approach.

The second problem of the study attempted to unveil whether there was a significant difference between digital literacy and digital pedagogical competence pretest and posttest scores of the experimental group in terms of gender. In that event, no significant difference was identified between the digital literacy and digital pedagogical competence pretest scores of the experimental

group, while a significant difference existed between the digital literacy scores posttest scores in favor of female pre-service teachers. The flipped learning activities had more effect on the females' digital literacy than males'. This is a significant result of this study. The concept of gender is generally known to be interpreted in favor of males in Turkey. Parents are usually in favor of men in accessing and using technology (Aslan & Aybek, 2020). As a matter of fact, the finding of the study conducted by Aslan and Aybek (2020) supports this situation, emphasizing a significant difference between the digital literacy levels of the secondary school students in favor of male students. That the pre-service teachers' digital literacy pretest scores were free from any significant difference may indicate that their digital literacy levels are close to one another. However, the emergence of a significant difference between digital literacy posttest scores of the pre-service teachers in favor of females can be interpreted as the activities applied within the scope of the experiment affect female pre-service teachers more than male counterparts. As a matter of fact, in the out-of-class dimension of the flipped classroom model, female pre-service teachers used the instructional management system (Blackboard) to watch the videos. In this case, it can be said that female teacher candidates improve their digital literacy and digital pedagogical competencies.

### **Conclusion**

This study examined the effect of using flipped classroom model in "Instructional Technologies" course on the digital literacy levels and digital pedagogical competencies of prospective social studies teachers. As a result of the research, it was concluded that the flipped classroom model was effective on the digital literacy levels and digital pedagogical competencies of prospective teachers. Planning teaching-learning process based on the flipped classroom model in teacher training institutions may improve the digital literacy and digital pedagogical competencies of prospective teachers. In this way, teachers equipped with 21st century skills can be trained. This leads to the conclusion that technology-based teaching-learning models may be more effective in teacher education. It is thought that the results of this research are very important and that they have made an important contribution to the literature.

### **Limitations and Suggestions for Future Research**

This study was conducted according to one group pretest and posttest design, which is one of the weak experimental designs. This design has significant validity problems (Cohen, Manion & Morrison, 2007). For this reason, while reporting the results of the study using this design, one can claim that the experimental process has an effect on a development, still cannot evaluate this development as an alternative to another application (Tuncer, 2020). In this regard, the researcher claimed that the reason for the significant difference might be the activities based on the flipped classroom model applied to the experimental group, yet this significant effect was not considered as an alternative to another application. In order to overcome this limitation, different activities rather

than the content of the instructional technologies course were applied by the researcher. However, this limitation can be eliminated by creating a control group together with the experimental group and performing covariance analysis, in future experimental studies. Another limitation of the study is the disuse of qualitative data collection tools within the study. Qualitative data collection could have made a contribution to the validity and reliability of the study. However, qualitative data collection tools were not used by the researcher as the activities applied during the study process took forever. In later studies, in-depth researches will also be used in the literature by using qualitative data tools.

### Suggestions

Based upon the results, various recommendations were provided:

1. The results showed that the flipped classroom model had a significant effect on the digital literacy and digital pedagogical competence of the pre-service teachers in the experimental group. On this subject, it is recommended to apply the flipped classroom model in teacher training programs. In this way, pre-service teachers' digital literacy and their digital pedagogical competence can be developed, and pre-service teachers appropriate for the 21st century can be raised.
2. Experimental studies may be conducted on the flipped classroom model in different teacher training programs and courses.
3. This study deployed one group pre-test and post-test experimental design. It is advisable that controlled experimental designs be used in the experimental studies.
4. Conducting studies on which different models and designs such as case study, mixed research model, action research will be applied for examining the effect of the flipped classroom model on the pre-service teachers' digital literacy and digital pedagogical competence will contribute to the relevant literature.

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