Education and Information Technologies
https://doi.org/10.1007/s10639-024-13305-7

Exploring the impact of blended learning instruction on preservice teachers' self-efficacy beliefs in organizing educational field trips to out-of-school learning environment

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Received: 20 May 2024 / Accepted: 26 December 2024
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Abstract
The integration of the flipped classroom model, self-efficacy theory, and the value of out-of-school learning environments forms the foundation for this study. By employing the flipped classroom model, preservice teachers can develop their instructional skills and build self-efficacy in organizing educational field trips. The active, student-centered learning experiences facilitated by the flipped classroom model can enhance preservice teachers' self-efficacy beliefs, preparing them to effectively utilize out-of-school learning environments in their future teaching careers. This study aims to explore the impact of the flipped classroom model on preservice teachers' self-efficacy beliefs, specifically in the context of organizing and conducting educational field trips. By understanding the theoretical underpinnings and practical implications, the study seeks to contribute to the development of effective teacher education practices that promote innovative and confident teaching professionals. The study's participants were 57 preservice teachers in the science teacher education program. It was undertaken employing a sequential, explanatory mixed-methods study. The preservice teachers in the experimental group were educated using the flipped classroom model, while the control group was instructed through the conventional classroom model. The "Self-Efficacy Belief Scale for Organizing Educational Field Trips to Out-of-School Environments" and a semi-structured interview form were used to gather data. Results indicate that the flipped classroom implemented in the course has positive effect on the self-efficacy beliefs of preservice teachers towards organizing trips to out of school learning environments. Furthermore, it was concluded that the use of this model was encouraging for pre-service teachers to use it in their teaching professions.

Keywords Blended learning · Flipped classroom · Out-of-school learning · Science Education

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Published online: 14 January 2025

1 Introduction

Today's educational system is currently encountering challenges in effectively involving the technology-savvy youth who seamlessly incorporate technology into their daily routines. In the current educational environment, there is an increasing acknowledgment of the significance of offering students valuable learning opportunities beyond conventional classroom settings. (Long et al., 2019). It is now an acceptable approach to take learning experiences beyond the confines of the classroom. At this point, out-of-school learning environments (OOSLEs) gain great importance. Innovative technologies contribute to the revolutionisation of out-of-school education, improve the teaching and learning process, and engage and interact with students beyond the traditional learning environment (Shevchenko et al., 2020). Furthermore, as educators strive to enhance the overall learning experience for their students, the use of blended learning has gained traction as an effective approach. (Herbert et al., 2017). Considering the benefits of both approaches, it can be quite insightful to determine the contribution to education of the process in which these two processes are carried out jointly.

The science curriculum aims to develop science-literate individuals who possess not only content knowledge but also the skills necessary to apply this knowledge effectively. This encompasses the ability to investigate and research issues, engage in critical discussions, solve complex problems, work collaboratively with others, and utilize technology proficiently. Creating learning environments that facilitate the development of these competencies involves integrating real-world experiences, engaging pedagogical strategies, and technology. For example, OOSLEs, such as field trips or real-world investigations, offer opportunities for students to connect scientific concepts with daily life (Demirtaş & Akkocaoğlu Çayır, 2021). Studies indicate that the training received by pre service teachers during their university education on organizing excursions to out of school settings produced positive outcomes (Bozdoğan, 2018, Arik, 2022). Tal and Morag (2009) stated that teacher education programs should include experiential education, and field trip preparation and implementation for all preservice teachers, who need to understand their responsibilities and role before, during and after a field trip. It is argued that practices such as planning for OOSLE implementations, creating the necessary conditions, providing trainings that will increase teachers' professional knowledge and experience related to OOSLEs will increase the use of these environments (Kubat, 2018).

Teachers' preliminary preparations and efforts to identify deficiencies, enrich field knowledge and increase motivation positively affect the activities in out-of-school learning environment (Çiçek & Saraç, 2017). The teachers need understand how to prepare and teach the students to learn out of the classroom, because the novelty of informal learning is a distraction to students who are unaccustomed to attending field trips or non-classroom settings (Behrendt & Franklin, 2014). In Laçin- Şimşek and Öztuna- Kaplan's (2022) study, teachers were trained on organizing trips to OOSLEs. Teachers actively participated in the

training, prepared, implemented and evaluated the activities themselves. The aim of this training was to determine the effect of this training on teachers' self-efficacy beliefs about organizing trips OOSLEs. The term "self-efficacy" is used to describe an individual's belief in their ability to succeed in a given task or performance. It was seen that the activities carried out during the project had a positive effect on teachers' self-efficacy beliefs about organizing trips to OOSLEs. In addition, preservice teachers, who will be the teachers of the future, should have acquired the necessary skills to plan educational trips to out-of-school settings before they enter their profession too. However, the implementation of these skills in professional life is highly dependent on individuals' self-efficacy beliefs. Because self-efficacy can influence choice of activities (Schunk, 1995). Kubat (2018) examined pre-service teachers' views on out-of-school learning environments and their self-efficacy beliefs about using these environments. The study showed that pre-service teachers' practice in such experiences significantly increased their self-efficacy beliefs. There are studies in the related literature in which teachers' and pre-service teachers' self-efficacy perceptions towards organizing trips to out-of-school learning environments are determined. Yurtdakal and Karakaş (2021) conducted a study to determine the self-efficacy of classroom teachers in organizing educational trips to OOSLEs and their views on the trips organized. Teachers' self-efficacy beliefs were found to be high; however, teachers stated that they encountered problems in managing the group, finding financial funding, and legal procedures. They stated these problems also have an effect that reduces the self-efficacy beliefs of classroom teachers for organizing trips to out-of-school learning settings. As seen in the related studies in the literature, individuals with high self-efficacy beliefs towards organizing these trips are more likely to organize these trips. Therefore, in order to benefit from the pedagogical benefits of out-of-school learning environments, it will be effective to take initiatives to increase the self-efficacy beliefs towards organizing trips to these environments and thus the possibility of organizing these trips. However, no study was found to develop pre-service teachers' self-efficacy beliefs by linking flipped classroom (FC) with OOSLEs. Only two study was found to associate OOSLEs with the FC, and their participants are secondary school students, not teachers or pre service teachers. In their first study with secondary school students, Ünlütürk and Bakioğlu (2023) prepared videos for preliminary information before organizing trips to OOSLEs and then gave feedback to the students about the OOSLEs. They concluded that the students had positive ideas and thoughts about science education supported by out-of-school learning structured with flipped learning and found the method enjoyable. In their second study, Ünlütürk and Bakioğlu (2024) used the flipped learning model in out-of-school learning environment activities of the acquisitions within the scope of the 8th grade "simple machines" unit. They aimed to determine the effect of structured teaching on students' academic achievement. They created an informative video content and shared it with the students before the trip to the playground. They concluded that the academic achievement of the students increased significantly after the implementation. However, the in-class process and effects of the FC were not explored in both studies.

The present study was conducted with pre-service teachers who are future teachers. And, in-class process of the flipped classroom model was actively used. It was aimed to discover that pre-service teachers' preparation of trip plans to be organized to OOSLEs with the FC had an effect on their self-efficacy beliefs. It is therefore anticipated that the study will contribute to the existing body of literature in the context of pre-trip preparations for OOSLEs, pre-service teachers' self-efficacy beliefs about organizing these trips and the effect of the FC model. Trips to OOSLEs enrich students' learning experiences by providing them with rich learning opportunities outside the classroom. The findings of this study can provide guidance for more effective planning and implementation of such trips.

Recognizing the pivotal role of preservice teacher self-efficacy in planning and executing educational trips, this study aims to explore the impact of integrating the FC with OOSLE activities on preservice teachers' self-efficacy beliefs in organizing field trips. By combining technology-supported education with hands-on learning experiences in out-of-school settings, this research seeks to enhance the efficiency of information acquisition and implementation among preservice teachers, preparing them to effectively plan and execute educational trips in their future teaching careers.

2 Conceptual background

2.1 Blended learning and flipped classroom

Blended learning, which emerged as a promising approach to address the evolving needs of today's learners is acknowledged for its ability to combine online educational materials and opportunities for interaction online with traditional place-based classroom methods, allowing for a more personalized and often more engaging educational experience (Graham, 2006; Hoic-Bozic et al., 2008; Picciano, 2006).

Blended learning refers to the combination of traditional face-to-face instruction with online learning activities (Lo & Hew, 2017; Picciano, 2006; Stubbs et al., 2006). By integrating technology and interactive online resources into the learning process, educators can create dynamic and engaging learning experiences that extend beyond the confines of the traditional classroom (Aljermawi et al., 2024; Garrison & Kanuka, 2004). This approach allows students to have a more personalized and flexible learning experience, as they can access course materials and complete assignments online. Flipped classroom is also a specific type of blended learning that involves flipping the conventional teaching model (Lo & Hew, 2017; Brewer & Movahedazarhouligh, 2018; Roehl et al., 2013; Flores et al., 2016). FC redefines the conventional classroom dynamic by encouraging students to prepare for lessons independently before class (Bergmann & Sams, 2014), enabling teachers to provide personalized feedback and support rather than conventional lectures. It is based on the transfer of theoretical information in the course content in the form of short videos, usually with digital learning platforms, at home, and the practices and activities are carried out in the classroom under the guidance of the teacher (Lee & Yeung, 2021). FC enables teachers to speak the language of their students, who

are now proficient in utilizing online resources and social networking platforms for both learning and communication (Bergmann & Sams, 2012). Students possess the capability to participate in preliminary preparation before class in a selected environment outside the limitations of the conventional classroom, thus entering the class equipped with an understanding of the material related to the topic at hand. By allowing additional time for hands-on activities in the classroom, sustained learning also encouraged. This ensures that the students spend more time in the class, interact with learning materials and get involved in the knowledge construction (Samaila et al., 2024).

Learning activities in flipped science classes at the college level may motivate students to participate in class, resulting in a more effective course (Sletten, 2017) and students are more effective in an environment where they are active and take responsibility for their own learning (Fulton, 2012). The role of students in the FC model is to use self-directed learning methods to access lessons at home or outside of school using flipped education tools such as YouTube, Google Apps, Dropbox, Educreation, Edpuzzle, GlogsterEdu Screencast, Teaching Channel, and Twitter (X). At this point, the main difference lies in the role taken on by the instructor, it shifts the role of the educator from being the "sage on the stage" to a "guide on the side," facilitating active learning and peer-to-peer collaboration (Say & Yildirim, 2020; Rotellar & Cain, 2016). Students can receive feedback from their classmates on the tasks they have completed and the concepts they still need to grasp (Willey & Gardner, 2013). FC also provides opportunities for students to engage in active and experiential learning, such as organizing educational trips to OOSLEs where students can bridge theoretical knowledge with real-world implementations (Bozdoğan, 2018).

2.2 Out- of-school learning environments (OOSLEs)

Out-of-school learning environments are non-formal learning environments. As it is known; learning is divided into three as informal, formal and non-formal (Eshach, 2007). The term 'formal learning' is used to describe the planned and programmed learning experiences provided in educational institutions in accordance with the objectives set out in the guidelines published in line with the outcomes specified in the curricula. Informal education is a continuous process by which individuals develop certain behaviors, skills and knowledge through their daily interactions with various social groups and environments, including family, neighbors, friends, the workplace, the media and cultural institutions such as the theatre. Non-formal education is education that is outside the environments where formal education is carried out and is carried out within a certain plan. Salmi (1993) defined the approach of using informal environments for formal learning as "out-of-school learning". Out-of-school learning environments are defined as activities and trips that allow people to benefit from different opportunities in the learning process and are organized by establishing relationships with the achievements in the course (Laçin Şimşek, 2020). Educational trips to OOSLEs play a crucial role in enriching students' educational experiences. These environments

provide hands-on learning opportunities that cannot always be replicated within the confines of a classroom. Students are able to observe real-life implementations of the concepts they learn in school, fostering a deeper understanding and appreciation for the subject matter (Arik, 2022). Moreover, out-of-school educational trips are also seen as beneficial for the professional development of teachers, helping them improve their self-efficacy in organizing such activities (Scarinci & Pearce, 2012). Therefore, it is thought that it would be useful to start the development of their competences on this subject in the pre-service period.

The outcome of OOSLEs for preservice teachers is to learn by experiencing course objectives in settings where first-hand learning opportunities are provided as part of a plan (Bolu, 2021). By incorporating innovative methods such as the FC approach, educators can empower preservice teachers to become more confident and capable in planning and executing educational trips outside the traditional classroom setting. The organization and implementation of educational trips to OOSLEs is an important aspect of the teaching profession, especially for science teachers (Bozdoğan, 2018). Organizing educational trips to OOSLEs requires a detailed preparation process. Teachers must plan and execute trips to OOSLEs effectively (Arik, 2022; Bolat & Köroğlu, 2020). Numerous studies have revealed that for educational trips to OOSLEs to achieve their intended purpose, they must be well planned, implemented, and evaluated and should be linked to the curriculum (Kisiel, 2005; Tal et al., 2005; Anderson et al., 2000; Bozdoğan, 2007; Bowker & Tearle, 2007; Tatar & Bağriyanik, 2012; Laçin Şimşek, 2020).

When the studies conducted in this field are analyzed, it is seen that teachers have insufficient knowledge, skills and experience in out-of-school learning activities (Smith-Sebasto & Smith, 1997; Thomas, 2010), and they face challenges in organizing and maximizing the educational potential of such trips. Issues such as inadequate teacher knowledge and skills (Smith-Sebasto & Smith, 1997; Thomas, 2010), difficulty in maintaining student authority (Doldur & Ertas Kilic, 2023). and connecting OOSLEs to curriculum (McComas, 2006; Clarke-Vivier & Lee, 2018), and the lack of effective trip planning strategies hinder the full realization of the educational benefits of OOSLEs (Carrier et al., 2013; Garrity et al., 2010; Griffin & Symington, 1997; Tal & Morag, 2009). According to Sidars (2008) and Aydoğdu et al. (2023), among the difficulties teachers encounter while organizing field trips do not know how to use them successfully, the time-consuming and complex nature of planning, and the pressure to justify field trips in terms of academic standards. Among these challenges, the lack of self-efficacy stands out as particularly significant because it directly affects teachers' willingness and ability to address other issues, such as planning skills and logistical organization (Bozdoğan, 2016). Teachers with low self-efficacy may feel overwhelmed and less capable of overcoming these challenges, leading to reduced motivation to undertake trips and less effective execution when they do (Bandura, 1997). Highlighting self-efficacy is crucial because it acts as a foundational factor influencing other competencies and behaviors. A teacher with strong self-efficacy beliefs is more likely to seek solutions to logistical challenges, invest time in learning effective planning strategies, and take initiative in aligning trips with curricular goals (Laçin-Şimşek & Öztuna-Kaplan, 2022).

This study addresses the challenge of low self-efficacy by exploring how technological integration can enhance teachers' confidence and competence in organizing educational trips to OOSLEs. The adoption of tools such as video tutorials, interactive platforms, and digital planning resources not only streamlines the planning process but also provides teachers with a structured and accessible way to build their skills. And, the utilization of online platforms and mobile applications in the out-of-school education system provides expedient access to an array of learning resources (Bykovska et al., 2024). By offering pre-service teachers opportunities to practice using these technologies within the framework of the Flipped Classroom (FC) model, this research demonstrates how self-efficacy can be improved alongside practical planning competencies. Thus, technological integration serves as both a tool for enhancing efficiency and a mechanism for fostering the self-efficacy necessary to effectively plan and implement educational trips.

2.3 Self-efficacy

One of the most important indicators of instructors' future behavior is their self-efficacy beliefs. (Demir & Çetin, 2022). According to Bandura (1997), self-efficacy is an individual's belief that he or she is able to coordinate the activities needed to demonstrate a performance situation and that he or she can fully perform those activities. For self-efficacy beliefs to develop, it is important that the individual has a good command of the subject and has developed practice in its use. It is imperative that teachers possess a robust sense of self-efficacy with regard to the organization of educational excursions to external settings, which often necessitate meticulous preparation and practice. Teachers' knowledge of OOSLE, their attitudes, and self-efficacy play an important role in carrying OOSL activities (Temel, 2023). Teachers who exhibit apprehension and hesitancy towards such endeavors, coupled with a perception of inadequacy in the organization and facilitation of the requisite activities, are likely to eschew the undertaking of these trips. (Laçin-Şimşek & Öztuna-Kaplan, 2022). Overall, early attention to teacher self-efficacy beliefs helps educators make informed decisions, improve their skills, and enhance their effectiveness in teaching outdoor education (Schumann, 2013). The objective of this study is to provide insight into how FC might influence the self-efficacy beliefs of pre-service teachers regarding the organization of educational field trips to OOSLEs. This will contribute to the optimization of technology integration in science education, with the aim of enhancing learning outcomes.

2.4 Purpose of the study

This study endeavors to shed light on the synergistic effects of the FC and OOSLEs, offering insights into how technology-enhanced education can optimize the educational benefits of OOSLEs and empower future educators to create meaningful and impactful learning experiences for their students. It is believed that technology-supported education can enhance the effectiveness of visits to OOSLEs,

which can have an undeniable impact. The study is expected to encourage the efficient use of OOSLEs and provide feedback to teacher training programs.

The purpose of this study was to determine how the implementation of the FC, an approach to blended learning, affects preservice teachers' perceptions of self-efficacy beliefs in organizing field trips to OOSLEs and their views on this practice. Specifically, the following research questions were addressed.

1. How pre-service teachers' self-efficacy beliefs in organizing field trips to OOSLEs differ between the groups
2. What are the views of pre-service teachers on the use of the FC to prepare trip plans for OOSLEs?

3 Method

In this study, which aims to examine the effect of FC to self-efficacy beliefs of pre-service teachers towards organizing trips to OOSLEs, mixed method was used. Mixed method is the use of qualitative and quantitative approach components together by the researcher in order to determine the breadth and depth of the research (Johnson & Onwuegbuzie, 2004). An explanatory sequential design was used in accordance with the order of data collection and analysis. Qualitative data in explanatory sequential designs, explain and elaborate quantitative data (Teddlie & Tashakkori, 2015). First, quantitative data were collected and analyzed. Then, quantitative findings were interpreted with the qualitative data obtained. The research design is presented in Fig. 1

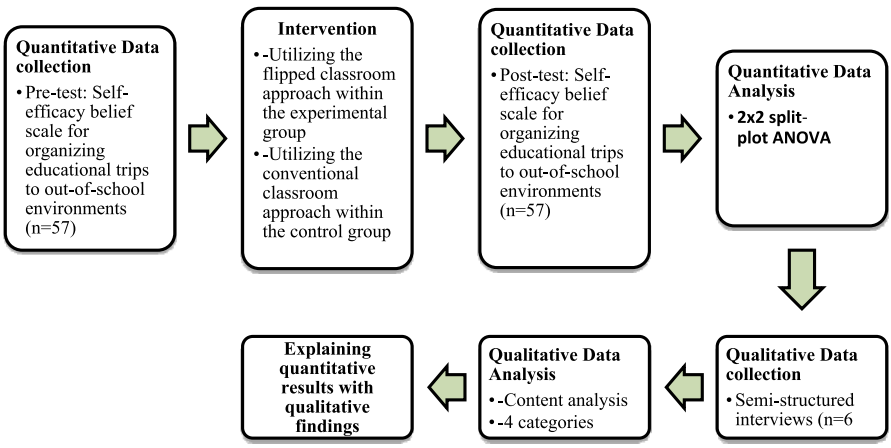


Fig. 1 Research design

3.1 Participants

The participants in the study were preservice teachers who attended the science teacher education program and took the OOSLEs course during the spring 2021–22 semesters at a state university located in the Mediterranean Region of Türkiye. The education system in Turkey is managed by the Ministry of National Education (MoNE). Compulsory education lasts 12 years and consists of primary, secondary and high school levels. During this period, students receive basic education, while at the high school level they take courses in various fields to prepare them for university or professional life. The education system in Turkey is shaped by a national curriculum and is subject to continuous reforms to improve the quality of education.

Teacher education takes place largely through undergraduate programs offered at university faculties of education. These faculties aim to enhance the pedagogical competencies of their graduates by providing pre-service teachers with both theoretical knowledge and practical teaching experiences. Teacher education programs usually cover four years of study and graduates have to take centralized examinations, in order to be appointed as teachers. All of the pre-service teacher participants are in their fourth year of training. These pre-service teachers were going to become science teachers specialize to teach secondary school which includes 10–14 years old students. Table 1 displays descriptive data about the participants. The study employed a purposive sampling method to increase the transferability of the data during sampling. Because, in this study, the effect of the flipped classroom model on pre-service teachers' self-efficacy beliefs in organizing educational trips to out-of-school learning environments was tried to be determined with the current course. Therefore, the participants of the study were the pre-service teachers attending this course. When the pre-test results of the self-efficacy belief levels of pre-service teachers were analyzed, it was determined that there was no significant difference between the groups and the experimental and control groups were determined randomly. The practices were designed in accordance with the content of the curriculum of the out-of-school learning environments in science teaching course. Therefore, all pre-service teachers enrolled in the course were included in the study and verbal informed consent was obtained from all participants. The background for data transferability was provided through detailed descriptions for external judgment and assessment.

Table 1 Descriptive ınformation about the participants

		Gender		Total
		Female	Male	
Group	Experimental	23	5	28
	Control	20	9	29
Total		43	14	57

3.2 Data collection

3.2.1 Self-efficacy belief scale for organizing educational trips to out-of-school environments

The scale was developed by Bozdoğan (2016). The Cronbach's alpha reliability coefficient of the scale was calculated as 0.93, the Guttmann split-half value was 0.89, and the Spearman Brown reliability coefficient was 0.89. The Cronbach's alpha reliability coefficient of the scale for this study was calculated as 0.89. The scale is a 5-point Likert scale. There are 17 positive and 13 negative items on the scale and consists of one factor. The average score was determined by flipping the values of the scale's negative elements.

Sample items for the Self-Efficacy Belief Scale for Organizing Educational Trips to Out-of-School Environments are as follows;

(20) I think I will have difficulty in preparing a pre-trip plan (route, duration, means of transport, departure times, number of students, trip fees, etc.).
(25) I believe that I can organize trips to out-of-school environments very easily.

3.2.2 Semi structured interview form

A semi-structured interview protocol was conducted by the researcher. To ensure credibility, a draft interview form of 12 questions composed for this study was reviewed by two experts who are experienced in qualitative research, science education and instructional technologies. After revision of the draft, the final form consisted of 9 interview questions related to revealing the opinions of the participants about the OOSLEs course, flipping classroom and how they benefit from it.

In both the experimental and control groups, pre-service teachers were administered the Self-Efficacy Belief Scale for Organizing Educational Trips to OOSLEs as a pretest prior to intervention and as a posttest following intervention. Four weeks after the intervention, online semi structured interviews were conducted with 6 preservice teachers who were randomly selected from among the preservice teachers in the experimental group to obtain more in-depth information. Probe questions were also asked during the interview if needed. All participants provided consent to participate in the research study. Participants who accepted the online interview were informed prior to the interview about some topics. The interviews would be recorded if permitted, the recordings would be subject to their consent for confirmation purposes, they would be presented, that their identities would never be shared with third parties, and they would be referred to in the study with codes such as S1, S2. And consents were obtained.

3.3 Data analysis

To analyze the data, a 2 × 2 split plot design, one of the ANOVA designs for mixed measures, was employed. The design comprises two factors: the first defines the teaching method (FC and traditional teaching), and the second defines the pre- and post-experiment measurements (pretest–posttest). Prior to conducting a split plot ANOVA for mixed measures analysis, it is essential to verify a number of underlying assumptions. These assumptions are that the pretest scores are normally distributed in all subgroups ($p > 0.05$), that the variances are equal ($p > 0.05$), and that the covariance are equal ($p > 0.05$). To ascertain the variance homogeneity of the groups, Levene' s test was employed ($p = 0.926$), while to determine the equality of the covariance, Box's M statistic was utilized (Box's $M = 2.032$, $p = 0.582$). As all assumptions were deemed to be valid, the analysis was then conducted. And the semi structured interviews were content analyzed. Researcher took extensive notes and categorized them accordingly. Direct quotes from the preservice teachers' utterances were used to highlight the obtained categories in the findings. Anonymized participant names were used throughout the presentation of the expressions in the findings (e.g., S1, S2).

3.4 Intervention

The "out-of-school learning environments in science education" course is an 4th year course and consists of 2 theoretical course hours per week a total of 14 weeks. This course was offered in 2 different parallel groups. One of the group was randomly assigned as a control and the other one is experimental group. In the experimental group, the FC model was used, while in the control group, the conventional classroom model was used. The interventions of the course in both groups are presented below.

3.4.1 The experimental group

During the first five weeks of the course, topics related to out-of-school learning and their places in science education were taught by the instructor. In doing so, the instructor used power point presentations and classroom discussions. From the 5th week onward, the FC was used to explore in detail the OOSLEs in which field trips can be organized and to develop trip plans. First, preservice teachers were informed

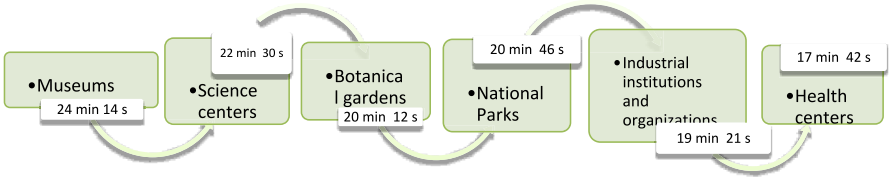


Fig. 2 Lecture videos and durations

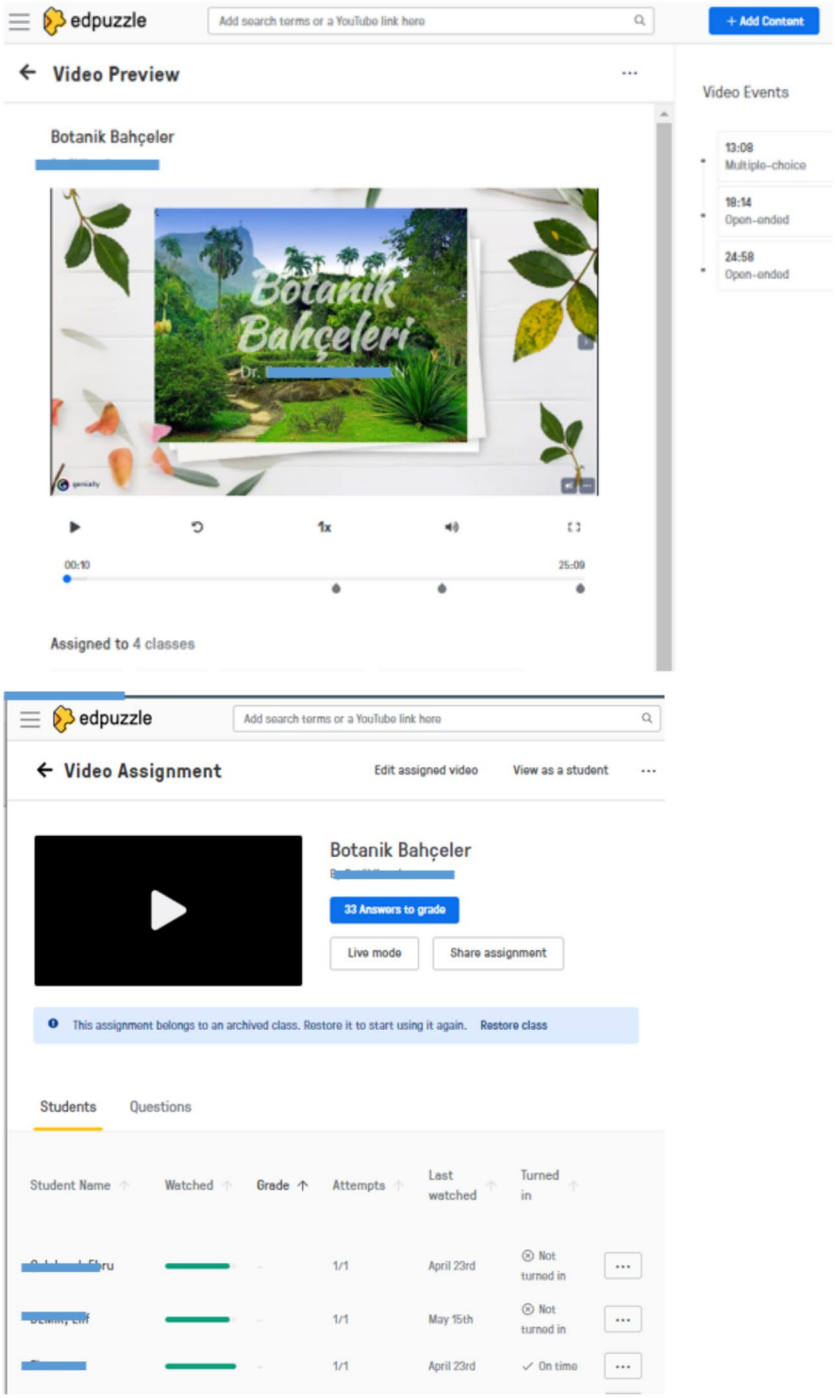


Fig. 3 Examples of screenshots of the virtual classroom (Edpuzzle)

about the FC. The instructor prepared lecture videos on how the selected out-of-school learning environment could be used. The duration of the videos varied from 17–24 min. A total of 6 videos were created. The content and duration of the videos are shown in Fig. 2.

Lecture videos were uploaded to the virtual classroom created with Edpuzzle which is web-based eLearning application allowing users to select a video and customize it by editing, cropping, recording their own audio, and adding quiz questions directly to the video stream. And, made accessible by preservice teachers and researcher to be interactive and to monitor student activity by researcher outside the classroom. Some questions related to the topic were embedded in the videos. In this way, preservice teachers' participation status could be analyzed. Examples of screenshots of the virtual classroom are shown in Fig. 3.

The links to the lecture videos were provided to the course team on Microsoft Teams, the learning management system used by the university where preservice teachers take the course. Other written lecture material, related to the out-of-school learning environment were also made available to preservice teachers. After watching the lecture video and performing the needed activities, the preservice teachers were asked to prepare and share a question related to the topic.

Then, the in-class practices started. A quiz was prepared with the questions sent by the preservice teachers and the questions added by the instructor and applied to the preservice teachers in the classroom part of FC. The quiz was also applied by selecting an assessment tool (Quizizz) from web 2.0 tools. In this way, it was determined which subject the preservice teachers were lacking in and which subject was revisited in the classroom, and guidance was provided to the preservice teachers.

Each group was asked to choose a learning outcome from the 5-8th grade science curriculum in light of their learning outside the classroom and to create a plan for the educational trip to the out-of-school learning environment chosen that week. Guidance was provided by the instructor during preparation of the plans. At the end of the lesson, homework was assigned via Microsoft teams, and each group's lesson plans were asked to be uploaded to the system.

The following week's lesson video was posted, and the preservice teachers were given a new outside-of-school learning setting. The in-class activities for the second week's OOSL environment were implemented as they had been during the first week, and the preservice teachers received feedback regarding the excursion plans they had created in the first week. This process was continued in the same manner for different OOSL environments for 6 weeks.

3.4.2 Control group

Topics related to out-of-school learning and its place in science education was taught in the classroom during the first five weeks of the course. In the subsequent weeks, instruction was given using the conventional instructional model to teach preservice teachers about the relevant OOSLEs and their implementations. In this group, preservice teachers were assigned a trip plan for the relevant out-of-school learning environment as homework and were instructed to complete it before the next lesson. Feedback is generally given on prepared trip plans in other lessons.

Table 2 Descriptive findings regarding self- efficacy scores which belong to different measurement times of experimental and control groups

		Pretest		Post test	
	N	$\overline{X}$	S	$\overline{X}$	S
Experimental group	**28**	3,79	0,40	4,44	0,38
Control group	**29**	3,97	0,42	4,24	0,30

Table 3 ANOVA results according to the experimental and control group pretest and posttest scores

Source of variation	SS	df	MS	F	p	Partial η^2
Between group	1926.199	56				
Group (experimental-control)	0.001	1	0.001	0.007	0.935	0.000
Error	9.096	55	0.165			
Within group	13.757	57				
Time (pretest- posttest)	6.198	1	6.198	51.853	0.000	0.485
Time *group	**0.985**	**1**	**0.985**	**8.243**	**0.006**	**0.130**
Error	6.574	55	0.120			
Total	1939.956	113				

4 Results

4.1 Preservice teachers' self-efficacy beliefs in organizing educational trips to OOSLEs

In order to assess the efficacy of the FC model in enhancing pre-service teachers' self-efficacy beliefs regarding the organization of field trips to out-of-school learning environments, a 2×2 split plot design, one of the ANOVA designs for mixed measures, was employed. The table below presents the mean scores and standard deviation values of the pre-service teachers' self-efficacy perception scale for organizing field trips to out-of-school learning environments, as measured by the pretest and posttest.

As demonstrated in Table 2, the mean score of the pre-service teachers in the experimental group was 3.79 prior to the experiment. Following the experiment, this value increased to 4.44. The mean scores of the pre-service teachers in the control group were 3.97 and 4.24, respectively. Thus, it can be concluded that both groups exhibited an increase in self-efficacy perception levels. The split plot ANOVA results regarding whether the observed increase before and after the experiment was statistically significant are presented in Table 3.

As demonstrated in Table 3, the outcomes of the ANOVA did not yield a statistically significant main effect for group [$F_{(1,55)} = 0.007$; $p > 0.05$]. However, the results of the within-subject ANOVA indicated a significant main effect for time [$F_{(1-55)} = 51.853$; $p < 0.05$], with an effect size of $\eta^2 = 0.485$, indicating a large effect size (Cohen, 1988). The results demonstrate that the effect of time on the difference between the mean scores obtained in the pre-test and post-test measurements

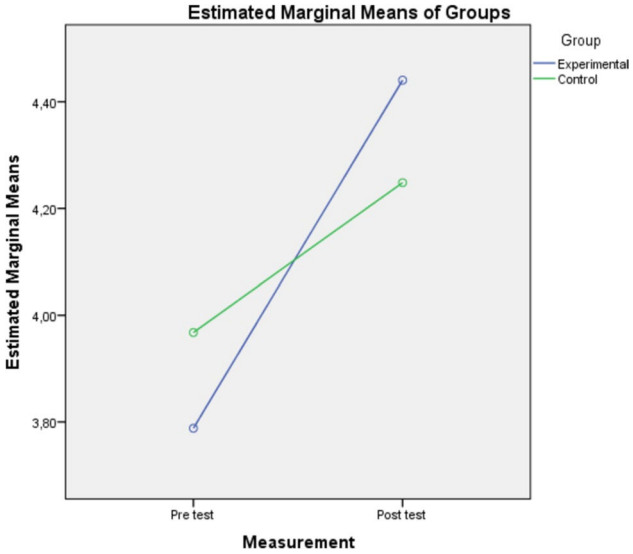


Fig. 4 Comparison of groups' mean scores of self-efficacy beliefs at different time

made at different times without any group distinction is statistically significant. Additionally, the interaction effect (time*group) was found to be statistically significant [$F_{(1-55)} = 8.243$; $p < 0.05$]. Split plot ANOVA revealed a statistically significant difference between the pretest and posttest scores for self-efficacy beliefs regarding the organization of educational field trips to out-of-school environments for both the experimental and control groups. In other words, preservice teachers' pre-test and post-test mean scores differed in favor of the experimental group depending on the group they were in. Namely, the research finding stating that; self-efficacy belief scores of preservice teachers who had the training with FC regarding organizing educational field trips to out-of-school environments were meaningfully higher than the control group. The interaction effect is explained below by using Fig. 4.

When Fig. 4 is examined, it is seen that although the pre-test scores of the control group were higher than the experimental group, the post-test means of the



Fig. 5 Themes which present the preservice teachers' views on the use of the FC in the OOSLES course

experimental group were higher after the FC application. The slope of the lines indicates the rate of improvement observed in the experimental group. This is attributed to the positive effect of FC in the experimental group.

4.2 Pre-service teachers' views on the use of FC in the OOSLEs course

Semi structured interviews were conducted with preservice teachers 4 weeks after implementation. Through these interviews, an attempt was made to determine the opinions of the preservice teachers about teaching the OOSLEs course using the FC. Four themes were identified based on the content analysis of the interviews. Figure 5 shows the themes that were discovered.

As shown in Fig. 5, preservice teachers' opinions about the use of the FC in the OOSLEs course were grouped under four themes: advantages, disadvantages, contributions to the OOSLEs course, and suggestions.

4.2.1 Opinions on the advantages of implementing FC in the OOSLEs course

The first theme that emerged from the analysis of the interviews relates to the advantages of using FC. The categories for this theme are presented in Table 4.

When examining preservice teachers' views on the advantages of using the FC in the OOSLEs course, it appears that preservice teachers most frequently mentioned that the questions the instructor embedded into the videos caught preservice teachers' attention and allowed them to focus (f:8), prepare for class (f:3), feel confident (f:1), and feel encouraged (f:1). Some preservice teachers' opinions about this situation are as follows:

> *"There were also questions in the videos you posted in the lesson, and solving those truly made us listen more carefully and focus on the lesson." (S5).*

Table 4 Categories about advantages of the model

Themes	Categories	Participants
Advantages	Effects of questions in videos	S2, S3, S4, S5, S6
	The advantage of working in a group	S1, S2, S3, S4, S5
	Ensuring preparation for the lesson	S1, S4, S5, S6
	Implementation in the classroom	S1, S2, S3, S4, S6
	Enabling sustained learning	S4, S5, S6
	Positive impact of teacher guidance	S1, S2, S4, S5
	Students take responsibility for learning	S1, S4, S5
	Being fun	S1, S3, S4
	No time limit	S1, S5
	Active participation of students in the course	S1, S3
	The opportunity to explore curiosities	S4
	Individual learning opportunity	S4
	Being independent of space	S5

"The questions in the videos make us listen to the lectures from beginning to end; these questions are very useful. Since we will prepare a plan, it is not possible to come without knowledge... "(S2).

In addition, preservice teachers indicated that the most important advantages of the model were working in groups, preparing for class, having time to practice in the classroom, and providing permanent learning.

"*Sometimes I have trouble coming up with an idea on my own, but since we work with our friends, my friend comes up with an idea that I did not think of. In this way, we contribute to each other's learning.*" (S4)

And, they emphasize the importance of teacher guidance. The opinions of other preservice teachers about the effect of teacher guidance are quoted below.

" We can reach you instantly and get feedback, and this happens instantly. ... Every lesson, you would tell us the missing points, the points we needed to complete and correct, and give us feedback."(S4)
"… you actually get involved in the process. You clarify things in our minds. We feel safe." (S2)
"... We were hesitant at first, but then we asked, and you answered our questions with a very nice approach, giving hints, just hints without explaining them fully... Actually, you made us determine for ourselves. This was very good." (S5)

4.2.2 Opinions on the disadvantages of implementing FC in the OOSLEs course

The second theme that emerged as a result of the interviews concerns the disadvantages of implementing the FC in OOSLEs courses. The categories related to the theme are presented in Table 5.

Regarding the disadvantages of the model, the majority of the preservice teachers (f: 5) mentioned only technical problems such as internet connections, etc., and S5 expressed his internet-related problems as follows: "*The internet can sometimes be a problem. Sometimes, when you answered the question, the answer did not go through or appeared incomplete. The internet can be a disadvantage. Other than that, I do not think there are many disadvantages.*"

Table 5 Categories about the disadvantages of the FC

Themes	Categories	Participants
Disadvantages	Technological challenges	S1, S4, S5
	Absence of disadvantages	S3, S6

Table 6 Categories about the contributions of FC to the OOSLEs course

Themes	Categories	Participants
Contributions to the OOSLES course	Gaining proficiency in lesson plan preparation/ becoming practical	S2, S4,
	Understanding OOSLE trip procedures	S1, S2, S4,
	The effect on self-efficacy beliefs for organizing excursions	S2
	The desire to employ this model when become a teacher	S2
	Increased motivation to organize trips to OOSLE	S5, S6
	To be able to associate activities with goals	S2

4.2.3 Preservice teachers' opinions on the contribution of the model to the OOSLEs course

The categories related to preservice teachers' views on the contributions of the model to the OOSLEs course are given in Table 6.

When Table 6 is examined, the preservice teachers especially stated that it contributed to increasing their trip planning competencies (f: 5), provided them with information about the procedures for organizing a trip to an out-of-school learning environment (f: 3), and increased their self-efficacy beliefs and motivation for organizing an educational trip to an OOSLE (f:2). S4 especially draws attention to the importance of preparing a plan and the effect of practice on learning the procedures. *" … preparing this plan is very different from going to school and preparing a plan to explain the content to my students in class. Since we have to take responsibility for all kinds of needs of the students, we have to think about them in every aspect. … You cannot do without a plan. Especially when it is considered an OOSLEs…" (S4).* Similarly, S1 expresses his views as follows: *" People say, " will I obtain permission from the principal? Or is this something that only the principal can do, or something organized by the MoNE? People get nervous with these thoughts; they give up Willy nilly.. …we have learned everything we need to do by this course, from the permissions to the activities to the recovery part to be done when we return, I would use it with peace of mind. (S1)."*

Table 7 Categories about the model and recommendations for ıts ımplementation

Themes	Categories	Participants
Recommendations	Prepared plans can be implemented	S2, S3
	More time can be devoted to classroom practice	S1
	Groups may change in the process	S6

4.2.4 Preservice teachers' suggestions on FC and its implementation

When the theme of *suggestions* was analyzed, the preservice teachers suggested that the prepared lesson plans be practiced, that more time be allocated for in-class practices, and that group members be changed (Table 7).

4.2.5 Trip plans

By analyzing the trip plans created by the preservice teachers, it can be concluded that the submitted excursion plans generally satisfy every requirement for both groups. Furthermore, more than half of the preservice teachers in the control group (f:21) submitted incomplete trip plans, but there were no late or incomplete submissions in the experimental group. This might be explained by the lack of interest in the topic matter or by the control group students' perceptions of their own inadequacy in terms of planning and managing the trip.

5 Conclusion and discussion

In this study it is researched how the implementation of the FC, an approach to blended learning, affects preservice teachers' perceptions of self-efficacy beliefs in organizing field trips to OOSLEs and their views on this practice. Results about pre service teachers' self-efficacy beliefs in organizing field trips to OOSLEs showed that the mean self-efficacy belief scores of the experimental group, which was taught with the FC, were significantly greater than those of the control group. According to these results, implementing the FC in OOSLEs courses positively affects preservice teachers' self-efficacy beliefs toward organizing educational trips to out-of-school environments. When the opinions of pre-service teachers about the teaching of OOSLEs course using FC approach were analyzed, their opinions were grouped under four themes: advantages, disadvantages, contributions to the OOSLEs course, and suggestions.

According to the related literature (Gürsoy, 2018; Ünlütürk and Bakioğlu, 2023; Debbağ, 2018; Souza & Rodrigues, 2015; Kenna, 2014), similar results have been obtained, that is, this model has a positive effect on students' affective characteristics such as attitude, motivation and self-efficacy. For example, similar to the current study, Ünlütürk (2022), who linked the FC with out-of-school learning, concluded that out-of-school science education activities that were structured with the FC increased motivation compared to the conventional model. Similarly, some studies concluded that the FC model had a positive effect on preservice teachers' self-efficacy beliefs toward the course (Bouwmeester et al., 2019; Chuang et al., 2018; Debbağ, 2018). When the opinions of pre-service teachers about the teaching of OOSLEs course using FC approach were analyzed, similar opinions emerged. They supported this result by stating that their cooperation with peers and the positive effects of teacher guidance affected the in-class phase of the FC model.

The preservice teachers in experimental group reported that they were more inspired to come up with new ideas because they had more time to devote to

applying the material in the classroom and had more opportunities to interact with their peers. The parts that are not understood or missing during work at home are the parts that students need the most from their teachers. Therefore, in FC their reinforcement is saved for the classroom environment (Stone, 2012). As demonstrated in Debbağ and Yıldız's (2021) study, preservice teachers perceived the FC model as facilitating a more effective use of classroom time. Students have ample time to collaborate with peers, delve into the subject matter, and promptly receive feedback from their teacher (Hamden et al., 2013; Aydin, 2016). With the FC model, more time can be allocated to active learning activities in the classroom (Roehl et al., 2013; Tutal & Yazar, 2021; Bishop & Verleger, 2013; Yestrebsky, 2016; Erlinda, 2019). With this model, basic knowledge is acquired outside the classroom with the help of technology, while higher-level skills are acquired in the classroom with friends and the teacher (Herreid & Schiller, 2013). In this way, students can reinforce their subjects by performing more activities in the classroom (Kong, 2014; Tucker, 2012). Similar results were reached at different grade levels. Çukurbaşı (2016), in his study with high school students, and Winter (2018), in his study with middle school students, concluded that the FC model positively affects students' motivation toward the course.

Preservice teachers also claimed that the questions from the lecture videos helped them prepare for the lesson. The model enables students to come prepared for the lesson (Talbert, 2012) and enhance teacher-student interaction, student–student interaction, as well as collaboration (Bergmann & Sams, 2012; Tutal & Yazar, 2021). At this point, the FC model is considered advantageous because it encourages independent learning, generates new ideas in discussion environments, prepares for the subject (Görü Doğan, 2015), provides flexibility in watching videos, helps individuals understand content, contributes to prior learning, and motivates learning (Ramirez et al., 2014). By combining pre-class and in-class activities, students are forced to take on more duties and responsibilities, which increases their engagement in the classroom and increases their sense of self-efficacy (Namik et al., 2014). In the present study, the fact that the preservice teachers in the control group submitted incomplete trip plans can be shown as evidence of the effect of the model on affective characteristics. The reason why the preservice teachers in the control group lagged behind the experimental group in terms of class participation and responsibility fulfillment may be due to the lack of self-efficacy beliefs and motivation of the preservice teachers who were not in the group where the model was applied. Because FC improves students' accountability, increases students' active participation, and the depth of learning (Koç Akran & Bayrak, 2020; Nelson, 2014).

Preservice teachers stated that the only disadvantage of the model was technical problems. Many studies in the literature state that students mention technical problems related to internet access as the most important disadvantage of the model (Keskin et al., 2021; Nielsen, 2012; Ozudogru & Aksu, 2020). To prevent this problem, evaluating the suitability of the technical infrastructure of students and preparing alternative solutions before its implementation may be recommended in cases of Internet-related problems.

The study revealed that pre-service teachers' concerns about organizing a field trip to an OOSLE decreased as they became familiar with the relevant procedures.

Many researchers (Arabacı & Dönel Akgül, 2020; Ocak & Korkmaz, 2018; Pekin & Bozdoğan, 2021; Topçu, 2017) have stated that science teachers have the most difficulties in the process of organizing educational trips to out-of-school environments, mostly through bureaucratic processes such as obtaining permission from the institution and ensuring the control of students. and disciplinary issues. According to Anderson et al. (2000) and Tal (2012), for the purpose of improving learning outcomes from out of school activities, teachers should meticulously design their plans by establishing connections between out-of-school visits and particular curriculum objectives, and subsequently linking these objectives directly to activities that take place during the visit. At this point, as stated by the preservice teachers who participated in the study, the FC is thought to increase their ability to plan a trip to OOSLEs, which will prevent them from having difficulties in this regard when they start working as teachers and thus become more willing to organize trips.

When the related literature was analyzed, only two study was found to associate OOSLEs with the FC. In their study with secondary school students, Ünlütürk and Bakioğlu (2023; 2024) prepared videos for preliminary information before organizing trips to OOSLEs and then gave feedback to the students about the OOSLEs. However, the in-class process and effects of the FC were not explored in these studies. In the first study, student views were examined, and in the second study, academic achievement was examined. The current study focuses on the preparation processes of the pre-service teachers who carry out these trips rather than the effect of OOSLEs. It presents a model for the development of self-efficacy beliefs, which is considered important in this process. And, in-class processes of the flipped classroom model were actively used. As a result, it was concluded that pre-service teachers' preparation of trip plans to be organized to OOSLEs with the FC had a significant effect on their self-efficacy beliefs. It is therefore anticipated that the study will contribute to the existing body of literature in the context of pre-trip preparations for OOSLEs, pre-service teachers' self-efficacy beliefs about organizing these trips, and the effect of the FC model. Trips to OOSLEs enrich students' learning experiences by providing them with rich learning opportunities outside the classroom. The findings of this study can guide more effective planning and implementation of such trips.

This study's results have important ramifications on teacher education programs. As the FC model improves self-efficacy in planning and executing OOSLEs, the research argues for incorporating FC into the curriculum for the pre-service science teachers. More specifically, the systematic application of some digital tools (Edpuzzle and Quizizz, for example) helps not only theoretical instruction, but also sheds light on practical aspects of real life teaching problems. Moreover, the results obtained from the experimental group, where the quality of preparation as well as the anxiety related to planning the trip was reduced suggest that FC may help the future teachers to use new ways of doing things in their teaching. The integration of FC with OOSLE planning also aligns with contemporary educational goals of fostering active learning and critical thinking. By shifting the focus from instructor-led lectures to student-centered exploration, the FC model supports deeper engagement with the curriculum, preparing pre-service teachers to replicate this dynamic approach in their future classrooms. Moreover, the study's framework could be

adapted to various educational contexts, providing a scalable model for enhancing teacher readiness across disciplines.

6 Limitations and future work

This research has several limitations and still has room for improvement. The present study employed FC as a strategy to enhance the self-efficacy beliefs of preservice teachers regarding OOSLEs trip planning. The findings indicated that FC was an efficacious approach. However, the effectiveness of the trip plans prepared with the assistance of this model could not be evaluated. The effects of OOSLEs trips on students in terms of different variables using trip plans prepared with the FC model can be examined practically. Both preservice teachers/ students and teachers' perspectives on the implementation of the flipped learning model and its effect on OOSLEs trips can be analyzed in detail. This would provide in-depth insights into how the FC is perceived and experienced in practice. The effectiveness of various technological tools (e.g., video lectures, interactive platforms) used in the FC model in preparing excursion plans to OOSLEs and the effect of these tools on self-efficacy beliefs can be examined. This may helps to determine which technological tools are more effective and why.

Funding Open access funding provided by the Scientific and Technological Research Council of Türkiye (TÜBİTAK). No funds, grants, or other support was received.

Data availability The data sets are deposited in repositories located in the public university. The data generated and analyzed during the current study are available anonymized from the corresponding author by request. The datasets generated during and/or analyzed during the current study are available from the corresponding author upon reasonable request.

Declarations

Ethics approval The procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki Declaration and its later amendments or comparable ethical standards.

Consent to participate All participants provided verbal consent to participate in the research study and separate consent to allow for audio recording of interviews.

Participants who accepted the online interview were informed prior to the interview that the interviews would be recorded if permitted, and that the recordings would be subject to their consent for confirmation purposes. that they would be presented, that their identities would never be shared with third parties, and that they would be referred to in the study with codes such as S1, S2. and verbal consents were obtained.

Conflict of interest The authors declare no competing interests.

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