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THE IMPACT OF THE COMPUTER-ASSISTED FLIPPED LEARNING MODEL ON TEACHER CANDIDATES' RESEARCH SELF-EFFICACY

Abstract. This study examines the impact of the Computer-Assisted Flipped Learning Model (CAFLM) on the research self-efficacy (RSE) of pre-service teacher candidates, particularly in pre-school and special education departments. Utilizing a two-group pretest-posttest experimental design, 61 participants (31 pre-school and 30 special education teacher candidates) were assessed over a 16-week scientific research methods course. The Scientific Research Self-Efficacy Scale (SRSES), consisting of six components and 37 items, was used as the data collection instrument. The key findings reveal a significant improvement in participants' RSE, with no considerable differences observed between the two departments. In this study, the CAFLM, which involves engaging with instructional content (e.g., educational videos, digital materials, and online resources) before class and applying that knowledge through interactive classroom activities played a central role. The use of digital tools not only enabled flexible and self-paced learning but also supported independent problem-solving and collaborative learning processes, both of which are crucial for fostering mastery experiences that enhance self-efficacy. Participants engaged in watching preparatory videos, participating in in-class discussions, and writing research reports, all supported through computer-assisted platforms. The results showed considerable improvement in overall RSE and in most of the sub-dimensions. Although no statistically significant differences were found in the post-test results of the "definition of the problem" (DP) and "identification of the hypothesis" (IH) subscales, increases in scores were observed. Ultimately, both groups demonstrated improved research self-efficacy following various computer-supported research tasks. The findings suggest that while the field of study does not significantly influence the effectiveness of FLM, the integration of computer assistance within the FLM framework can significantly enhance research skills and self-efficacy among teacher candidates.

Keywords: Flipped learning model; self efficacy; research self efficacy; teacher candidates.

1. INTRODUCTION

The rapid development of digital technologies in education has led to radical changes in teaching methods. In particular, the Flipped Learning Model (FLM) stands out as an innovative approach that allows students to review course materials in advance through online platforms and evaluate in-class time with more interactive and practical activities [1]. The flipped learning model has emerged as a transformative approach in educational settings, particularly within the framework of information technology and media research. This pedagogical strategy, which inverts traditional teaching methods by delivering instructional content outside of the classroom and engaging students in interactive activities during class time, has shown significant potential in enhancing various educational outcomes [2]. Research indicates that the flipped classroom model can positively impact pre-service teacher students' learning achievements, self-efficacy, and motivation, as demonstrated in a study involving a modern educational technology course [3]. Furthermore, the integration of technology in flipped classrooms has been linked to improved digital literacy self-efficacy and techno-pedagogical competence among prospective teachers, suggesting that this model effectively prepares them for the demands of 21st-century education [4]. Additionally, a meta-analysis highlights the flipped classroom's ability to enhance self-efficacy across diverse educational contexts, underscoring the importance of careful course design to maximize its benefits [5].

Computer-assisted FLM plays a significant role in enriching the learning process, enhancing students' research skills, self-efficacy perceptions, and critical thinking abilities. Information and computer technologies (ICT) such as access to digital resources, interactive learning materials, and instant feedback systems enable students to manage their own learning processes more effectively. These technologies not only help students gain a deeper understanding of the subjects but also make their learning experiences more engaging and interactive [2], [4]. Thus, the effectiveness of FLM significantly increases when supported by computer technologies. Therefore, the use of ICT in FLM applications should be considered a fundamental element and integrated into educational processes. The proper and effective use of ICT will not only improve students' academic achievements but also better prepare them for the digital world of the 21st century. These technologies will contribute to creating an innovative and sustainable learning environment in education. However, challenges such as negative attitudes towards scientific research courses in flipped learning environments have also been reported, indicating the need for ongoing refinement and adaptation of this model to suit different learning cultures [6]. Overall, the flipped learning model presents a promising avenue for improving teacher candidates' research self-efficacy, warranting further exploration and cross-departmental studies to fully understand its impact.

In the millennium, education is rapidly transforming and significant changes are occurring in the roles of teachers and students. This transformation requires teachers to be particularly proficient in research methods [4]. To cultivate teachers who are capable researchers, it is essential to provide them with applied research training [7]. In this regard, utilizing teaching methods and techniques that foster interaction in research methods courses is recommended. Additionally, enhancing the accessibility of resources, increasing the number of course-related activities, and creating dedicated study areas for students are essential [8]. This educational shift has led to the exploration of innovative and contemporary approaches that prioritize learners' interests and abilities, with a significant emphasis on the integration of information technologies into education. The rise of online programs, particularly in the aftermath of the COVID-19 pandemic, has further accelerated the adoption of these technologies. In this context, FLM has gained prominence as an effective pedagogical approach [9], [10]. FLM is characterized by students acquiring theoretical knowledge, typically through videos, prior to class, and engaging in activities and practical exercises during class sessions to reinforce and apply the learned material [11]. By encouraging students to investigate problems independently, FLM promotes active learning and supports the development of a collaborative learning environment [12]. In the relevant literature, there is evidence suggesting that FLM enhances learning outcomes [13]. Thus, the effectiveness of FLM across different contexts and variables remains a subject worthy of further investigation.

Given the contemporary expectation that teachers cultivate individuals with high research competencies and advanced critical thinking skills, it is imperative that pre-service teachers those who will train future generations also possess these qualifications. Previous research indicates a positive correlation between critical thinking skills and self-efficacy beliefs. Therefore, to equip teacher candidates with these skills, it is crucial to foster their self-efficacy beliefs [14]. The FLM, as an instructional approach, facilitates communication and provides opportunities to develop both higher-order thinking skills and self-efficacy [2]. This suggests that FLM can potentially enhance students’ responsibility for their own learning, their self-efficacy beliefs, and consequently, their ability to engage in higher-order thinking [15].

Recent studies have demonstrated that the Flipped Learning Model (FLM) has a positive impact on students' academic achievement and self-efficacy perceptions. For instance, a study conducted by Namaziandost et al. [16] in Iran found that FLM practices enhanced students' self-efficacy levels, with this effect varying across gender. Similarly, research by Kızkapan [17] revealed that FLM significantly improved the research self-efficacy of pre-service science

teachers, and this enhanced self-efficacy was identified as a significant predictor of academic achievement. In addition, research shows that this model can significantly affect the ability of teachers and students to use and utilize digital tools effectively. For example, according to Yanuarto et al. [18]., teachers perceive the flipped classroom model positively because it allows them to facilitate higher-order thinking and digital literacy among students. At the same time, this model encourages both teachers and students to interact with new technologies, improving their digital competence. Additionally, for teacher candidates, the flipped classroom model has been shown to significantly improve digital literacy and pedagogical competencies [4].

Teacher candidates' self-efficacy beliefs related to their profession may vary depending on the department they are enrolled in [19]. Affective factors such as student achievement and self-efficacy [17] are influenced by personal circumstances, yet this variation is often overlooked within the Turkish education system. In Turkey, the Research Methods in Education course is uniformly taught across all departments despite significant differences between departments in terms of scope and student profiles. In this context, the original contribution of this study is to comparatively examine the impact of the FLM on the research self-efficacy of pre-service teachers across different departments (pre-school and special education). The literature contains a limited number of studies comparing the effects of FLM across different disciplines. Therefore, this research aims to contribute significantly to the literature by highlighting the impact of FLM on different groups of pre-service teachers, thereby providing insights into the model's generalizability and applicability.

Additionally, this study seeks to address a gap in the literature by investigating the integration of digital learning environments and online educational technologies and their impact on pre-service teachers' research skills and self-efficacy. In this regard, the research will serve as a guide for integrating educational technologies into teacher education programs.

In conclusion, this study provides a comparative analysis of the effects of FLM on different groups of pre-service teachers, offering a deeper examination of the role of digital learning environments and online educational technologies in teacher education processes and making a unique contribution to the literature in this field.

The research goal

This study aims to investigate the impact of the CAFLM on the research self-efficacy of pre-service teachers and to determine whether this effect varies across different academic disciplines (preschool and special education). Based on the main goal, the study has a couple of objectives. The first is figuring out how FLM affects the RSE of teacher candidates, and the second purpose is to test whether the RSE varies depending on the field of study/department. In order to meet these aims the following research questions were determined.

1)What is the effect of CAFLM on pre-school and special education teacher candidates' RSE?

2)Does the impact of CAFLM on research self-efficacy differ between pre-school and special education teacher candidates?

By examining these questions, this study aims to provide insights into the applicability and effectiveness of FLM in developing research competencies in teacher education programs.

2. THE THEORETICAL BACKGROUNDS

2.1. ICT in the context of FLM

Flipped learning is an instructional model in which educators deliver new content to students through pre-class videos, while activities traditionally assigned as homework are instead completed during class time [20]. FLM offers a more interactive and student-centered approach compared to traditional learning methods. However, it should not be forgotten that

the success of this model largely depends on the support of ICT. ICT is a critical factor that facilitates the implementation of FLM and makes learning processes more accessible and interactive. It should be emphasized that without computer-assisted tools, digital resources, and online education platforms, many of the advantages offered by FLM would be lacking [21]. This study highlights the critical role of computer technologies in research self-efficacy within the context of FLM. Several key features of computer-assisted FLM, as used in the study, can be outlined as follows:

Accessibility and flexibility: Computer-assisted FLM provides students with the opportunity to study anytime and anywhere through e-learning platforms, online course materials, and video content. This enables students to manage their learning processes more effectively [13]. In line with these reasons in the current study, after a brief introduction of FLM, theoretical information and discussions on the subject were provided to students outside the classroom in the form of online videos, while homework control and practical applications were carried out in the classroom. In this regard, a screenshot of the course where information is shared via distance education using ICT is presented below (Figure 1).

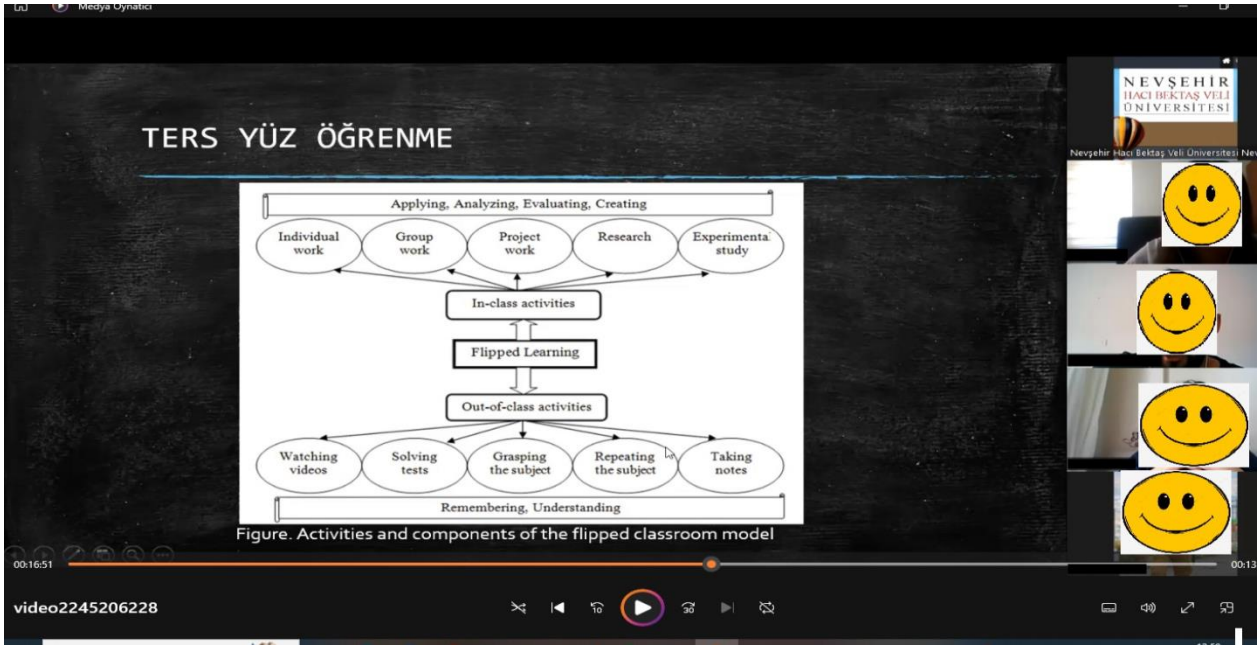

Figure 1. Screenshot of an online course

Interactive and self-learning opportunities: Computer technologies support active participation in FLM by offering interactive simulations, digital laboratory applications, and online discussion platforms. As a result, students develop more analytical and critical thinking skills while conducting research [2], [22]. In the study, online discussions were conducted, allowing students to actively engage with the subject matter. Through these discussions, they enhanced their analytical and critical thinking skills while exploring different perspectives. A screenshot of one of these lessons is presented in Figure 2.

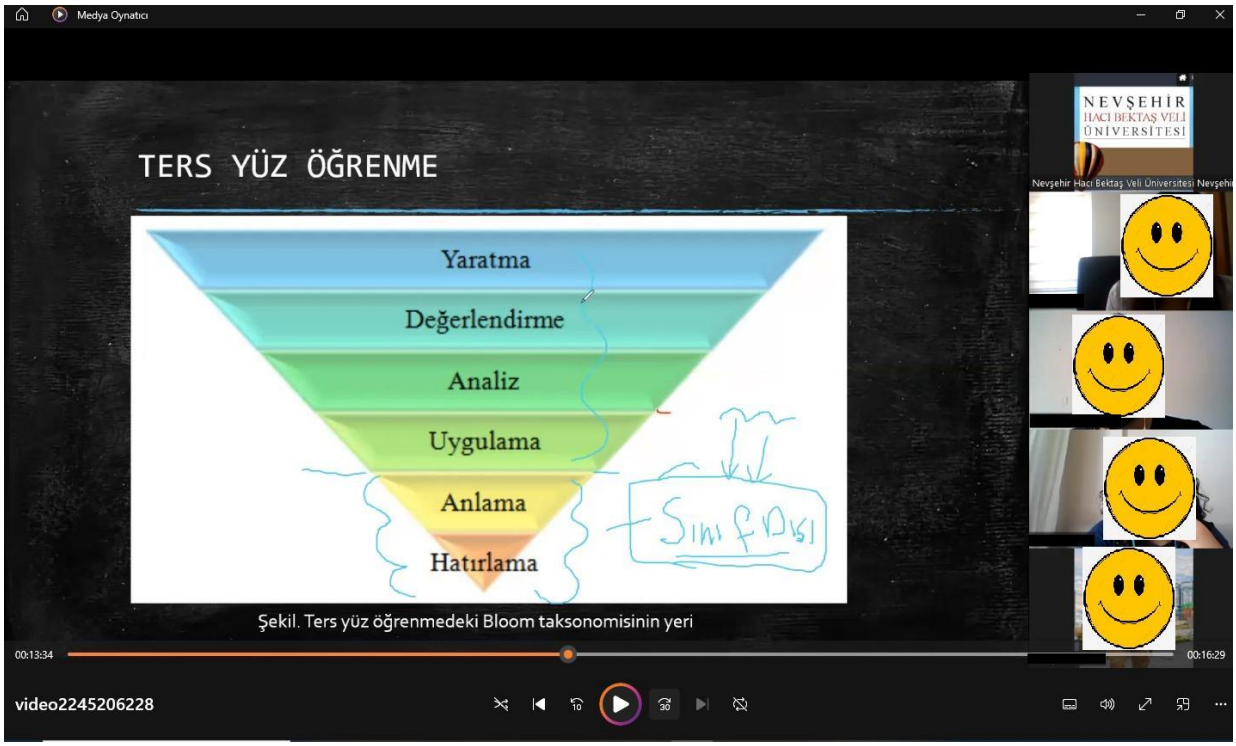

Figure 2. Screenshot of an interactive discussion platform

Instant feedback and assessment: Computer-supported learning environments enhance the learning process by providing instant feedback to students. Online quizzes, automated assessment systems, and analytical data tracking allow detailed monitoring of student progress [12].

Quick and easy access to information: Through digital libraries, academic databases, and online resources, students can conduct more comprehensive and in-depth research within the scope of FLM. Computer technologies facilitate the research process by providing direct access to scientific information [23].

This technology-supported teaching model places a strong emphasis on peer-assisted learning and collaborative problem-solving during face-to-face sessions [8]. Before attending class, students engage with educational videos and conduct preliminary research. During the in-class portion, they participate in active learning activities such as discussions, projects, and other interactive tasks. Following the class, formative assessments are employed to gauge their understanding and provide further opportunities for feedback [5].

Given these characteristics, educators in a flipped learning environment assume several key responsibilities. They are expected to provide continuous feedback, guide students through the learning process, and address any uncertainties to ensure a deeper understanding and mastery of the material [15]. By facilitating this dynamic learning process, FLM encourages students to engage more actively in cognitive tasks, interact with content more effectively, and fosters opportunities for meaningful knowledge construction. Additionally, this model has the potential to enhance students' self-efficacy by promoting greater autonomy and accountability in their learning journey [24].

2.2. The effect of ICT on research self-efficacy

Self-efficacy refers to an individual's belief in their ability to perform a specific task [25]. In academic contexts, self-efficacy is a central component of Bandura's social-cognitive theory,

as it plays a crucial role in learning, motivation, and academic achievement [26]. Woodcock et al. [14] suggest that educators with high levels of teacher self-efficacy are more likely to embrace and implement change. Moreover, these educators are able to reflect such changes in their teaching practices, making their influence on students both more permanent and more effective than those with lower self-efficacy. This highlights the importance of teacher candidates developing strong self-efficacy beliefs, as it has significant implications for their future teaching performance. Enhancing the self-efficacy of teacher candidates is particularly important, as their confidence in their abilities is a reliable predictor of their future professional success [27].

Research self-efficacy (RSE), on the other hand, refers to an individual's belief in their competence to perform tasks related to research [26]. Livinţi, Gunnesch-Luca, and Iliescu [28] define RSE as the adaptation of self-efficacy to the field of research activities and the belief in one's ability to conceptualize, plan, execute, and report research projects. It is a strong predictor of a student's interest in research and their engagement in research-related activities. Similarly, Akçöltekin [7] defines RSE as self-perceived competence in various stages of research, including problem identification, literature review, hypothesis formulation, method selection, data analysis, and reporting. Research indicates that students with high levels of research competence exhibit greater curiosity and motivation to engage in research [26]. This trend is particularly relevant for teacher candidates, as studies show that enhanced research skills lead to improved academic performance. For example, Kızkapan [17] found that as the research skills of pre-service science teachers increased, their academic success also improved, indicating that research competence is a significant predictor of academic achievement.

CAFLM enriches the learning process by making it multifaceted, thereby enhancing students' research skills and self-efficacy perceptions. Through access to digital resources, interactive learning materials, and instant feedback systems, students can better manage their academic progress and develop their critical thinking skills [3], [10]. ICT has played a significant role in enhancing research self-efficacy across various contexts. ICT usage has been shown to have a strong direct influence on self-efficacy. For instance, in the context of women micro-entrepreneurs, ICT usage decisions were influenced by perceptions of ease of use and usefulness, which in turn directly impacted self-efficacy and empowerment [29]. Similarly, in educational settings, ICT self-efficacy is crucial for teachers to effectively integrate digital technology into their teaching practices, which enhances their overall teaching efficacy [30].

In the relevant literature, the use of ICT for learning purposes has been associated with higher levels of self-efficacy and persistence among students. For example, students who frequently used ICT for out-of-school learning activities, such as school projects, exhibited significantly higher self-efficacy and persistence [31]. This suggests that ICT can motivate learners by providing continuous learning opportunities both in and out of school. Additionally, ICT contributes to self-efficacy by enhancing digital learning environments. In higher education, factors such as computer self-efficacy, perceived enjoyment, and acceptance of digital learning significantly influence students' satisfaction and continued use of ICT for learning [32]. This indicates that ICT not only supports learning but also boosts students' confidence in their ability to use technology effectively. Research also shows that teachers' self-efficacy in using ICT is linked to their digital competence and strategies for evaluating information, which is essential for effective teaching practices [30]. Moreover, collegial collaboration among teachers can further enhance their ICT self-efficacy and usage in teaching [33]. In summary, ICT significantly contributes to improvements in research self-efficacy by providing tools and environments that enhance learning, teaching, and personal empowerment [34]. These improvements are facilitated through increased access to technology, supportive learning environments, and the development of digital competencies.

2.3. Research self-efficacy in the context of flipped learning

The teaching profession requires a strong foundation in research competencies to support its ongoing development. Consequently, undergraduate teacher education programs are responsible for equipping students with the skills necessary to conduct research and effectively report their findings [10]. Given the importance of self-efficacy in shaping students' learning behaviors and outcomes, it is essential to explore factors that influence this belief [35]. According to AlJaser [15], the flipped learning model (FLM) aims to meet students' needs for skills development and enhanced self-efficacy by encouraging their active participation in both virtual and in-person learning environments. By providing meaningful and interactive learning experiences, FLM creates an optimal environment for fostering self-efficacy and positive attitudes toward learning [36]. In this context, it is hypothesized that teacher candidates' research self-efficacy can be significantly enhanced through the application of FLM.

The majority of research on FLM suggests that it improves student engagement and overall educational outcomes [5]. Additionally, numerous studies have shown that FLM increases student achievement, enhances students' self-efficacy, and positively influences teachers' behaviors in supporting learner autonomy [37], [38], [17]. Furthermore, FLM has been found to positively affect the pedagogical competencies of graduate students [9] and improve teacher-student communication within the learning environment [37]. Despite these promising findings, there is limited research specifically addressing the impact of FLM on the research self-efficacy of teacher candidates. Moreover, no studies have explored whether the research self-efficacy of pre-service teachers varies according to their academic discipline in the context of FLM.

The research literature suggests that teachers' beliefs regarding their research self-efficacy differ across disciplines, which in turn affects their attitudes and behaviors during the teaching and learning process [7]. This highlights the critical role of pre-service education and the influence of departmental specialization on the development of research self-efficacy. Thus, investigating whether research self-efficacy differs according to academic discipline, in addition to examining the effects of FLM on research self-efficacy, will address a gap in the current literature. This study aims to contribute to the fields of teacher education and instructional design by providing insights into how research skills can be effectively developed in teacher candidates during their pre-service training.

3. RESEARCH METHODS

3.1. Design of research

This research was conducted using a two-group pretest-posttest experimental design, one of the quantitative research methods. The effect of FLM on RSE and across groups was tested using a two-group pretest-posttest strategy in order to address the research objectives of this study. In the two-group pretest-posttest experimental design, an independent variable is applied to both groups, and measurements are made before and after the application [39].

3.2. Study group

The sample of the research consisted of 31 teacher candidates in the pre-school teaching group and 30 teacher candidates in the special education teacher group. A total of 61 teacher candidates formed the study group of the research for both the pre-test and post-test. The participants were selected by convenience sampling. All of the participants are second-year teacher candidates, and none of them have prior training in scientific research methods.

3.3. Data collection tools

The Scientific Research Self-Efficacy Scale (SRSES), created by Akçöltekin [7], was utilized in this study as an instrument for gathering data. The scale has six components and 37 items. The factors are as follows: Definition of the problem (DP), literature review (LR), method (M), identification of the hypothesis (IH), data analysis (DA) and reporting (RE). Akçöltekin [7] stated that the reliability coefficient for the overall scale is .92. In this study, the Cronbach's alpha coefficient of the SRSES was calculated as .93 for the general scale. According to this result, it can be said that the reliability coefficient of the study is high.

3.4. Procedure for collecting data

The research data was gathered during the course of the 16-week scientific research methodologies course. The first week of the training began with an introduction to FLM, and the departments that would participate in the research were determined. After the study group was formed, a pre-test was administered to the participants. Starting from the second week, the practitioner uploaded a video on the subject to the system for each week and asked the students to watch these videos, and in-class activities and discussions were held the following week regarding the watched videos. The duration of the videos varies between 25 minutes and 39 minutes on average. For example, during the problem definition phase of the second-week course, the practitioner uploaded a video (39.18 min.) about positivism, post-positivism and constructivism, which form the basis of qualitative and quantitative research, to the system, and the next week, the subject was discussed and the teacher candidates were asked to write an article from the databases introduced by the practitioner in their field. The selected articles were reviewed and approved by the practitioner. In the following weeks, teacher candidates prepared a weekly report by examining the relevant part of the article they had chosen after watching the video on that week's topic. From the start of the third week, teacher candidates, respectively, examined the following topics: Literature review, research questions and hypotheses, quantitative and qualitative research designs, sampling, data collection, quantitative and qualitative data analyses, validity and reliability, discussions of findings, literature and recommendations, and references. Post-test was applied in the week following the end of the application (16th week) and teacher candidates submitted their written reports.

3.5. Analyse of data

The SPSS-22 package program was utilized to examine the data using both descriptive and inferential statistics. The assumption of normality was checked using the Shapiro-Wilk normality test since the number of participant groups was less than 50. The effect of FLM on the RSEs of teacher candidates in the same department was tested using a dependent samples t-test in inferential statistics, while the effect on the RSEs of teacher candidates for pre-school (PRS) and special education (SE) was tested using an independent samples t-test.

4. THE RESULTS AND DISCUSSION

4.1. Descriptive statistics

The pre-implementation (Pre_SRSES) and post-implementation (Post_SRSES) research self-efficacy scores were tested for normality in the study by using the Shapiro-Wilk normality test. According to the results obtained, the p values of the pre-test post-test results of the groups are greater than 05. With this result, a t-test, one of the parametric statistics, was used to analyze the data. The results obtained are presented in Table 1.

Table 1

Descriptive results for the pre-SRSES and post-SRSES

	Pre_PRS	Pre_SE	Post_PRS	Post_SE
N	31	31	30	30
Mean	131.42	127.27	143.23	143.90
Std.	7.826	14.472	12.465	8.155
Shapiro-Wilk	.183	.138	.117	.122

4.2. Inferential statistics

To determine if RSE increased in the scientific research methodologies course through FLM, a dependent samples t-test was employed, within the context of inferential statistics. The results are presented in Tables 2 and 3.

Table 2

Comparison of pre-school teacher candidates' results of the pre and post-tests for the overall SRSES and the subdimensions.

Pre-School	Mean	t	df	Sig. (2-tailed)	Mean Difference
Pre_DP	22.74	-1.836	30	.076	-.774
Post_DP	23.52				
Pre_LR	23.06	-5.333	30	.000	-3.548
Post_LR	26.61				
Pre_IH	19.58	-2.034	30	.051	-.839
Post_IH	20.42				
Pre_M	21.65	-2.778	30	.009	-1.323
Post_M	22.97				
Pre_DA	19.90	-4.879	30	.000	-3.097
Post_DA	23.00				
Pre_RE	24.35	-3.900	30	.001	-2.355
Post_RE	26.71				
Pre_Total-SRSES	131.42	-9.363	30	.000	-11.806
Post_Total-SRSES	143.23				

When the scores obtained by pre-school teacher candidates from SRSES are examined, there is a significant difference ($p < .05$) between the pre-test and post-test scores in the general and LR, M, DA and RE sub-dimensions of the scale. In simple terms, research results indicated that FLM considerably increased pre-service preschool teachers' RSE in general and in the sub-dimensions in question. However, although an increase was noted in the DP ($p = .076$, $p > .05$) and IH ($p = .051$, $p > .05$) sub-dimensions, it was determined that this difference was not significant.

Table 3

Comparison of special education teacher candidates' results of the pre and post-tests for the overall SRSES and the subdimensions.

Special Education	Mean	t	df	Sig. (2-tailed)	Mean Difference
Pre_DP	22,50	-2.066	29	.048	-1.067
Post_DP	23,57				
Pre_LR	22,73	-7.128	29	.000	-4.000
Post_LR	26,73				
Pre_IH	19,10	-1.385	29	.177	-.733

Post_IH	19,83				
Pre_M	20,23	-5.009	29	.000	-2.767
Post_M	23,00				
Pre_DA	19,20	-6.599	29	.000	-4.033
Post_DA	23,23				
Pre_RE	23,50	-5.032	29	.000	-4.033
Post_RE	27,53				
Pre_Total-SRSES	127,27	-10.472	29	.000	-16.633
Post_Total-SRSES	143,90				

As seen in Table 3, except for the IH sub-dimension (p=177, p>.05) the overall and the other sub-dimensions of the SRSES show a substantial difference between the pre-test and post-test scores (p <.05). In other words, it was determined that there was a significant increase in the post-test scores of special education teacher candidates' research self-efficacy, except for the sub-dimension of determining hypotheses.

Secondly, in the context of inferential statistics, an independent samples t-test was employed to test whether the development of RSE in the scientific research methods course taught through FLM constitutes a significant difference according to the departments in question. The results are presented in Tables 4 and 5.

Table 4

Comparison of pre-tests of pre-school and special education teacher candidates' results for the overall SRSES and the subdimensions

	Mean	t	df	Sig. (2-tailed)	Mean Difference
Pre_DP-Pre School	22.74	.469	59	.641	.242
Pre_DP-Special Education	22.50				
Pre_LR-Pre School	23.06	.398	59	.692	.331
Pre_LR-Special Education	22.73				
Pre_IH-Pre School	19.58	.801	59	.427	.481
Pre_IH-Special Education	19.10				
Pre_M-Pre School	21.65	1.916	59	.60	1.412
Pre_M-Special Education	20.23				
Pre_DA-Pre School	19.90	.751	59	.456	.703
Pre_DA-Special Education	19.20				
Pre_RE-Pre School	24.35	.897	59	.373	.855
Pre_RE-Special Education	23.50				
Pre_Total-Pre School	131.42	1.388	59	.172	4.153
Pre_Total-Special Education	127.27				

When Table 4 is examined, there is no significant difference between the scores of the pre-test in the overall and sub-dimensions of the SRSES between the departments.

Table 5

Comparison of post-tests of pre-school and special education teacher candidates' results for the sub dimension and overall SRSES

	Mean	t	df	Sig. (2-tailed)	Mean Difference
Post_DP-Pre School	23.52	-.096	59	.924	-.051
Post_DP-Special Education	23.57				
Post_LR-Pre School	26.61	-.180	59	.858	-.120
Post_LR-Special Education	26.73				
Post_IH-Pre School	20.42	1.357	59	.180	586
Post_IH-Special Education	19.83				
Post_M-Pre School	22.97	-.060	59	.953	-.032
Post_M-Special Education	23.00				
Post_DA-Pre School	23.00	-.304	59	.763	-.233
Post_DA-Special Education	23.23				
Post_RE-Pre School	26.71	-1.390	59	.170	-824

Post_RE-Special Education	27.53				
Post_Total-Pre School	143.23	-.249	59	.804	-.674
Post_Total-Special Education	143.90				

As seen in Table 5, it was determined that there was no significant difference between the post-test scores of pre-school and special education teacher candidates from the general and sub-dimensions of the scale (p>.05). According to this result, it was determined that the field of study did not have an effect on the development of RSE in the context of the scientific research methods course taught through FLM.

4.3 Discussion

First, the study looked into how FLM affected pre-school and special education teacher candidates' research self-efficacy. The study's findings demonstrate that participants' RSE significantly improved across the board and in the majority of the sub-dimensions. Although there was no significant difference in the post-test results of the DP and IH subscales, an increase was noted in the participants' scores after the intervention. As a result, both groups had increased self-efficacy after completing a variety of research-based tasks. The socio-cognitive theory proposed by Bandura [25] is consistent with these findings. The primary factors influencing learners' self-efficacy, according to Bandura [25], are mastery experience, vicarious experience, verbal or social persuasion, and physiological state. Among these sources, Bandura [40] identified mastery experience, which is based on personal performance, as the strongest determinant of self-efficacy. Studies conducted during the FLM pre-lesson and in-class stages enhanced the RSE of pre-service teachers, supporting this viewpoint. In other words, both groups' pre-service teachers arrived at class with the basic understanding they acquired throughout the FLM pre-lesson phase and became more confident via in-person discussions in class and critiques of articles. In a similar vein, research conducted during FLM's classroom phase also raised students' self-efficacy. Because, in FLM's face-to-face sessions, participants examined research articles and prepared a written report in line with the information they gained from the videos. The reports they wrote in this context were a mastery experience for them. Because FLM is a student-centered approach that offers abundant learning opportunities, students voluntarily structure their knowledge in meaningful ways and explore subjects more deeply [41]. Thus, FLM provides students with more autonomy in their learning processes, making them constantly active in constructing their own knowledge [37]. According to these results, it should be noted that one of the key elements that increases the effectiveness of FLM is the integration of ICT. Without technology, the personalized and interactive learning experience offered by FLM will be limited. For example, video lectures, online exam systems, and virtual laboratories support students' independent learning processes and increase their research self-efficacy [42]. In addition, data analytics and feedback mechanisms offered by ICT make learning processes more efficient by identifying the subjects in which students are deficient [43].

Indirect experience, or assessing one's own skills by contrasting them with those of others, is the second source of self-efficacy [40]. In a similar vein, prospective teachers completed their work in groups, observed other groups, and checked on their progress. Thus, one group's efforts inspired the other. If there are similarities between the observed individual and the person making the observation, or if the individual has a previous experience with the behavior he observes, the effect is greater [14]. In this context, interactions between groups during and after class allowed participants to receive vicarious experience. This circumstance arose during the course of the study because FLM allowed the researcher to set up the

classrooms to facilitate group projects. As a result, FLM gave students the chance to experience learning through others and raise their self-efficacy.

Verbal or interpersonal persuasion is the third aspect that raises self-efficacy [40]. In the flipped group, preservice teachers got regular feedback from the practicing instructor and their classmates. Specifically, the instructor consistently supported student teachers by providing examples, engaging in group discussions, and posing insightful questions during in-class sessions of the FLM when they felt like they were failing and could not continue their work. This can be interpreted as the practitioner contributing to the development of the participants' self-efficacy through verbal persuasion. In this context, the person who gives feedback or advice in verbal persuasion is important in terms of the effect of persuasion. In the formation or development of self-efficacy perception, the credibility, expertise and prestige of the persuader affect the persuasion process [25]. In other words, people with high self-efficacy beliefs in a subject area can change the self-efficacy perceptions of those around them on similar topics.

Another basis of self-efficacy belief is a psychological condition [40]. A person's mood, stress, fear and tension can affect his or her self-efficacy perceptions [3]. Studies show that FLM is a flexible approach that lowers stress and anxiety [1]. In this particular situation, it can be argued that FLM enhances participants' self-efficacy by offering a relaxed and adaptable learning environment to students.

In general, it is understood that some applications of FLM come to the fore in the high research self-efficacy of the participants. In prior research, the advantageous aspects of FLM were stated that students come to class by learning the fundamental principles of the subject [9], use new information autonomously and actively [44], achieve difficult assignments with the instructor's assistance [45], can reinforce their learning by doing practices and repetitions and find opportunity to work in groups [38]. Thus, it is believed that these FLM features also raised participants' RSE. Considering that FLM is an ICT-based learning model, the effectiveness of FLM increases to a great extent when supported by computer technologies. Therefore, the use of ICT should be considered as a fundamental element in FLM applications. Our research findings show that ICT not only supports FLM but is also a critical factor in increasing students' research self-efficacy.

The study's findings support earlier empirical research's findings that FLM raises self-efficacy. As an instance, when the experimental groups in which FLM was used as an intervention program were compared with the control groups, it was determined that there were significant increases in the self-efficacy of the participants in the experimental groups [45], [24]. In another study, Aşiroğlu [9] claimed that graduate education sciences students with FLM who attended the Research Methods course noticed an improvement in their research self-efficacy. According to Aşiroğlu [9], because FLM requires self-regulation, assigns responsibility for the course, and fosters higher-order thinking abilities, it increases students' self-efficacy more. Furthermore, FLM promotes a sense of competence in students by allowing them to actively contribute to the sharing of knowledge. Because of this, the flipped classroom approach gives students the capacity to complete the required activities, enhancing their self-confidence and problem-solving abilities [17]. In light of all these reasons, it can be said that the results of the current study are consistent. The results of the current study, as well as the results in the relevant literature, confirm that FLM improves students' research self-efficacy.

The current study's second result is that the fields of study do not have an impact on the development of RSE within the scope of the scientific research methods course taught through FLM. In the relevant literature, no results have been found as to whether the scientific research methods course conducted with FLM varies depending on the department in which students study. In this context, it is thought that the results of the current study will be an important data source in future research. However, although not directly related to the subject of this study,

there are also studies examining the relationships between self-efficacy beliefs, domain-specific cognitive skills [46]; [47] and the department studied [19]. For example, Paunonen and Hong [47] investigated to what extent self-efficacy beliefs predicted task performance in cognitive ability areas (verbal, numerical, spatial, and mechanical). As a result of the research, a moderate level of correlation was found between self-efficacy and numerical, spatial and mechanical domain skills, and a very low correlation with verbal domain skills. Researchers interpreted this as meaning that these variables can be explained by possible connections to general cognitive ability and that the effect of domain-specific self-efficacy beliefs on task performance should be examined independently of cross-domain ability. However, they stated that field-specific self-efficacy differences between departments may result from lack of experience and age-related conditions. In parallel with the findings of the current study, Saracaloğlu et al. [19] concluded that the self-efficacy perception sub-dimension and total scores of Science, Social Studies and Classroom teacher candidates did not show a statistically significant difference according to the department they studied. This result obtained in the current study supports the assumptions that it is difficult to examine the effect of self-efficacy on performance in a specific cognitive domain alone in general and that other variables must also come into play [47] and that domain-specific measurements can better match domain-specific outcomes [46]. Therefore, the reasons why teacher candidates' research self-efficacy does not vary according to the departments they study in should be explained not only on the basis of the departments taken in the sample, but also by examining different departments, gender, class and experience levels, etc., or it would be more accurate to examine each department with competencies specific to their field.

5. CONCLUSIONS AND PROSPECTS FOR FURTHER RESEARCH

This study demonstrates the effectiveness of the FLM in enhancing the research self-efficacy of pre-service teacher candidates across pre-school and special education departments. Participants' RSE significantly improved following the intervention, aligning with Bandura's socio-cognitive theory, which highlights mastery experience, vicarious experience, verbal persuasion, and physiological state as critical factors influencing self-efficacy. FLM's student-centered approach provided meaningful learning opportunities, fostering autonomy, collaboration, and active engagement, which contributed to participants' increased confidence in conducting research.

Moreover, the integration of ICT within the FLM framework played a crucial role in supporting research skill development. ICT tools facilitated access to diverse resources, enabled interactive learning experiences, and enhanced collaboration, making the research process more efficient and engaging. This suggests that the synergy between FLM and ICT can further strengthen research self-efficacy by offering dynamic and accessible learning environments.

Notably, the field of study did not significantly affect the development of RSE, suggesting that FLM can be broadly effective across different academic disciplines. This finding highlights the importance of FLM as a versatile and inclusive pedagogical approach. Future studies should explore the interplay of additional variables, such as experience, gender, and domain-specific competencies, to gain deeper insights into the factors influencing RSE. Ultimately, this research supports the adoption of FLM as an effective strategy for preparing teacher candidates with essential research skills and self-efficacy to meet the demands of 21st-century education.

This study has some limitations that should be taken into account. One of them is related to the small sample size. While 30-31 volunteers are thought to be adequate for experimental research, it is advisable to repeat the study with higher sample sizes. Another limitation of the study is the lack of a control group. Therefore, future research will yield different findings when examining the impact of FLM on RSE by contrasting it with the control group. In addition, the

study's participants' self-efficacy could only be ascertained using quantitative data. In-depth research on the impact of FLM on self-efficacy requires qualitative investigations that use observation and interview techniques. Lastly, the RSE of pre-school and special education teacher candidates was the main emphasis of this study; future studies may examine the self-efficacy of various groups under various conditions.

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ВПЛИВ КОМП'ЮТЕРИЗОВАНОЇ МОДЕЛІ ПЕРЕВЕРНУТОГО НАВЧАННЯ НА ДОСЛІДНИЦЬКУ САМОЕФЕКТИВНІСТЬ МАЙБУТНІХ УЧИТЕЛІВ

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Анотація. У цьому дослідженні розглядається вплив комп'ютеризованої моделі перевернутого навчання (CAFLM – Computer-Assisted Flipped Learning Model) на дослідницьку самоефективність (RSE – research self-efficacy) майбутніх учителів, зокрема студентів дошкільного та спеціального педагогічного напрямів. Дослідження було проведено за експериментальним дизайном з двома групами з попереднім і підсумковим тестуваннями за участю 61 особи (31 майбутній учитель дошкільної освіти, 30 – спеціальної освіти) протягом 16-тижневого курсу з методів наукового дослідження. Для збору даних було використано Шкалу наукової дослідницької самоефективності (SRSES – Scientific Research Self-Efficacy Scale), що складається з шести компонентів і 37 пунктів. Ключові результати показали суттєве покращення дослідницької самоефективності учасників, без значущих відмінностей між двома навчальними напрямами. У центрі дослідження комп'ютеризована модель FLM, яка передбачає засвоєння нового матеріалу (зокрема за допомогою навчальних відео, цифрових матеріалів та онлайн-ресурсів) до заняття, а під час заняття його практичне застосування. Залучення цифрових технологій сприяло гнучкому індивідуалізованому навчанню, а також підтримувало процеси самостійного розв'язання проблем і спільного навчання ключовим чинникам формування майстерності, що впливають на розвиток самоефективності. Учасники, використовуючи комп'ютеризовані платформи, переглядали підготовчі відео, брали участь в обговореннях на заняттях і писали наукові звіти. Результати показали значне підвищення загального рівня RSE та більшості її підскал. Хоча статистично значущих відмінностей у підшкалах «визначення проблеми» (DP – definition of the problem)

та «ідентифікація гіпотези» (IH – identification of the hypothesis) виявлено не було, спостерігалось зростання балів після втручання. У результаті обидві групи продемонстрували покращення дослідницької самоефективності після виконання різноманітних завдань з використанням комп'ютерної підтримки. Отримані дані свідчать про те, що, хоча спеціальність не має значного впливу на ефективність FLM, інтеграція комп'ютерної підтримки в цю модель істотно сприяє розвитку самоефективності майбутніх учителів та їхніх дослідницьких навичок.

Ключові слова: модель перевернутого навчання; самоефективність; самоефективність дослідницької діяльності; кандидати в учителі.