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Improving Pre-Service Social Studies Teachers' Scientific Research Self-Efficacy (SRSE)

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Abstract

In this research, it was aimed to improve the SRSE of pre-service social studies teachers through the educational process designed by the researchers. The study, conducted with a mixed embedded design, spanned four weeks. During the first week, a problem-based learning approach was implemented, followed by 5E and 7E learning activities and mastery learning in subsequent weeks. The participant group of the research consisted of 46 students studying in the second year of the social studies teaching department of a university in Turkey. Data were gathered personal information form, SRSE Scale and semi-structured interview form. T-test for dependent samples and Wilcoxon signed-rank test were used to analyze the data. Findings revealed that the education process applied in the research developed the SRSE of the pre-service social studies teachers both in general and within the scope of the literature, method, result and discussion, suggestion development and reference writing dimensions. Qualitative findings were found to support the quantitative findings. Various suggestions were developed depending on the research findings.

Keywords: Social studies, pre-service teachers, scientific research, scientific research self-efficacy.

Sosyal Bilgiler Öğretmen Adaylarının Bilimsel Araştırma Öz Yeterliklerinin Geliştirilmesi

Öz

Bu araştırmada araştırmacılar tarafından tasarlanan bilimsel araştırma öz yeterliliği kazandırmaya yönelik eğitim süreci aracılığıyla sosyal bilgiler öğretmen adaylarının bilimsel araştırma öz yeterliklerinin geliştirilmesi amaçlanmıştır. Karma gömülü desen ile yürütülen araştırmanın uygulama süreci, dört hafta sürmüştür. Uygulama sürecinin ilk haftasında probleme dayalı öğrenme; ikinci haftasında 5E öğrenme; üçüncü haftasında 7E öğrenme ve dördüncü haftasında tam öğrenme yaklaşımına dayalı geliştirilen etkinlikler uygulanmıştır. Araştırmanın katılımcı grubu, Türkiye'deki bir üniversitenin sosyal bilgiler öğretmenliği bölümünün ikinci sınıflarında öğrenim görmekte olan 46 öğrenci oluşturmaktadır. Araştırmanın verileri; kişisel bilgi formu, Bilimsel Araştırma Öz-Yeterlilik Ölçeği ve yarı yapılandırılmış görüşme formu aracılığıyla toplanmıştır. Araştırmanın verileri çözümlenirken bağımlı örneklemler için t-testi ve Wilcoxon işaretli sıralar testinden yararlanılmıştır. Araştırmada uygulanan eğitim sürecinin sosyal bilgiler öğretmen adaylarının bilimsel araştırma öz yeterliliklerini hem genel olarak hem de alanyazın, yöntem, sonuç ve tartışma ve öneri geliştirme ve referans yazma boyutları kapsamında geliştirdiği belirlenmiştir. Araştırmada ayrıca sosyal bilgiler öğretmen adaylarının bilimsel araştırma öz yeterliği kazandırmaya yönelik eğitimin kendilerine hem genel bilimsel araştırma öz yeterliği hem de alanyazın, yöntem, sonuç ve tartışma ve öneri geliştirme ve referans yazma boyutları temelinde yeterlik kazandırdığı görüşüne sahip oldukları saptanmıştır. Araştırmada ulaşılan sonuçlara bağlı olarak çeşitli önerilerde bulunulmuştur.

Anahtar kelimeler: Sosyal bilgiler, öğretmen adayları, bilimsel araştırma, bilimsel araştırma öz yeterlikleri

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INTRODUCTION

Social studies is a course that aims to equip primary and secondary school students with the knowledge, skills and values they need in daily life (Deveci & Bayram, 2022). In other words, the social studies course aims to provide students with proficiency in daily life. Gaining the competencies that students need in the social studies course is only possible if the teachers who give social studies education to the students are equipped in the aforementioned scope (Evans, 2004). One of the competencies that students need in daily life and that the social studies course aims to develop is scientific research self-efficacy (Russel III & Waters).

SRSE refers to knowing the stages of a scientific research and becoming competent on how to conduct it (Towne & Shavelson, 2002). The stages of scientific research are listed as follows (Cross, Naughton, & Walker, 1981; Gauch & Gauch, 2003):

- Gathering information through observations
- Collecting data from observations and experiments
- Formulating tentative hypotheses
- Making predictions based on hypotheses
- Conducting controlled experiments
- Analyzing data from experiments
- Reporting findings
- Developing general theories and laws explaining the problem

Enhancing students' SRSE in social studies courses is contingent upon the competence of their social studies teachers in this area. Thus, it is imperative that social studies teachers receive training during their educational preparation that equips them with the necessary competencies. Specifically, social studies teachers must be trained not only in how to teach life-relevant variables to primary and secondary school students but also in the methodologies of conducting scientific research (Bayram, 2021). Pre-service social studies teachers, who will become the social studies educators of the future, bear the primary responsibility for designing educational processes aligned with the goals of social studies. Consequently, it is essential to research and enhance the scientific research competencies of these pre-service teachers. This research aims to elevate the SRSE levels of pre-service social studies teachers, particularly addressing the low levels of SRSE observed among these teachers at the university where the study was conducted. The researchers, who are academicians at this university, initiated the study to address this issue.

The literature is replete with studies on the development of scientific research self-efficacy among prospective mathematics and science teachers (Albareda-Tiana et al., 2018; Anisimova et al., 2020; Presnukhina et al., 2020) as well as mathematics teachers (Koichu & Pinto, 2018; Wareerat et al., 2016). Additionally, there are studies focused on assessing the SRSE of pre-service teachers, practicing teachers, and students (Büyüköztürk, 1999; Cortes, 2019; İlhan et al., 2016; Laidlaw et al., 2012; Derling et al., 2018). However, there is a noticeable gap in the literature regarding studies aimed at improving the SRSE of pre-service social studies teachers. Enhancing the SRSE of these pre-service teachers is crucial for achieving the objectives of social studies education, as today's pre-service teachers are tomorrow's social studies educators. The absence of research on this topic is recognized as a deficiency and motivated this study. It is anticipated that this research will contribute original findings to the scientific literature and serve as a resource for similar future studies. Additionally, it is expected to highlight the importance of developing scientific research self-efficacy among pre-service social studies teachers.

Research Questions

This research aimed to enhance the Scientific Research Self-Efficacy (SRSE) of pre-service social studies teachers through a training program specifically designed by the researchers. To achieve this objective, a hypothesis was tested, and a research question was posed. The hypothesis and the corresponding research question are as follows:

- **Hypothesis:** Education designed to enhance SRSE effectively improves the scientific research self-efficacy of pre-service social studies teachers.
- **Research Question:** What are the perspectives of pre-service social studies teachers regarding the impact of education on their scientific research self-efficacy?

METHOD

Research Design

The research employed a mixed research methodology, utilizing a mixed embedded design. This design aims to complement quantitative data with qualitative data collected at one or more stages of the research process (Creswell & Plano Clark, 2020). The rationale for using the mixed embedded design is that the study was conducted in an experimental framework.

Participants

The participants comprised second-year pre-service teachers enrolled in the social studies teaching department at a state university in Turkey. The selection of second-year pre-service teachers was intentional, as the scientific research methods course is offered in the second year of the social studies teaching program. Two distinct groups of participants were involved: the first group consisted of 46 students from whom quantitative data were collected, and the second group included 8 students from whom qualitative data were gathered. All participants were pre-service teachers studying at the same university where the researchers are employed.

The convenience sampling method was employed to select the quantitative group. This method involves selecting the most readily available subjects due to time and other constraints (Büyüköztürk, 2020). Details about the quantitative group are presented in Table 1. As seen Table 1, there were more females (54.35%) and males (45.6%).

Table 1. Demographic Characteristics of the Quantitative Group

Variable	Category	*f*	*%*
Gender	Female	25	54.35
	Male	21	45.65
	Total	46	100

In the second phase, the qualitative group was established, consisting of volunteer pre-service teachers who agreed to participate in interviews. This group included 8 volunteers: 3 males and 5 females. To maintain confidentiality in accordance with ethical principles, the participants' names were anonymized and coded as S1, S2, S3, etc., in the research.

Data Collection

Data were collected using a personal information form, the "Scientific Research Self-Efficacy Scale" developed by Tuncer and Özeren (2012), and a semi-structured interview form created by the researchers. The scale comprises 12 items across four dimensions: (1) literature review, (2) methodology, (3) conclusions and discussions, and (4) suggestion development and reference writing. It is structured as a five-point Likert scale. Tuncer and Özeren (2012) reported a Cronbach's Alpha coefficient of .846 for this scale. To confirm its applicability for this research, the scale's reliability was reassessed with a group of 187 pre-service teachers. The Cronbach's Alpha values for both the overall scale and its sub-dimensions are presented in Table 2. As illustrated in Table 2, the Cronbach's Alpha values exceed .70 for both the overall scale and its sub-dimensions, indicating that the scale is sufficiently reliable for use in this research (Tabachnick & Fidell, 2001).

Table 2. Reliability Test results for Scientific Research Self-Efficacy Scale

Sub-scale	Cronbach's Alpha
Total	.848
Literature	.738
Method	.777
Conclusion and Discussion	.884
Suggestion Development and Reference Writing	.873

Data Analysis

To determine the appropriate statistical techniques for analyzing the research data, the normality of the differences between the pre-test and post-test data was assessed. This involved examining the skewness and kurtosis of the pre-test and post-test differences, as well as the results of the Kolmogorov-Smirnov (K-S) test. The K-S test was utilized to investigate the normality distribution due to the sample size exceeding 30 participants (McKillup, 2012). The results are presented in Table 3.

Table 3. Skewness and Kurtosis Values of the Pre-test Data

Variable	***Skewness***		***Kurtosis***		***Kolmogorov-Smirnov***
	Skewness	*SD*	*Kurtosis*	*SE*	
Total	.163	.350	-.395	.688	.000
Literature	-.165		.027		.004
Method	.485		-.558		.002
Conclusion and Discussion	.822		.623		.124
Suggestion Development and Reference Writing	-.194		-.523		.055

As shown in Table 3, the skewness and kurtosis values for the overall scale and all sub-dimensions fall within the range of -1.5 to 1.5 (Tabachnick & Fidell, 2019). Upon examining the K-S test results in the table, it is evident that the values for the literature and method sub-dimensions, as well as the overall scale, are less than .05, indicating a non-normal distribution. Conversely, the values for the conclusion and discussion, and suggestion development and reference writing sub-dimensions are greater than .05, indicating a normal distribution. Based on these findings, the Wilcoxon signed-rank test, a non-parametric test, was used to analyze data from the overall scale and the literature and method sub-dimensions. The dependent sample t-test, a parametric test, was employed to analyze data from the conclusion and discussion, and suggestion development and reference writing sub-dimensions. Additionally, the research fit matrix developed by Kaya and Bayram (2021) was utilized to assess the fit between the research variables.

Research Process

Prior to the commencement of the implementation phase of the study, pre-service social studies teachers underwent a pre-test using a specific scale to assess their levels of SRSE. Subsequently, the training program aimed at enhancing scientific research self-efficacy was initiated. Following the completion of the training, a post-test was administered to re-evaluate their SRSE levels. In the subsequent phase, interviews were conducted with the pre-service teachers. The qualitative data obtained from these interviews, along with the quantitative data, were thoroughly analyzed. The research process is illustrated in Figure 1.

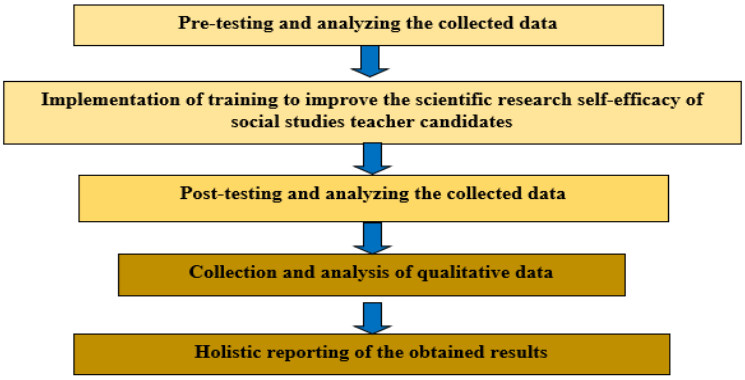

Figure 1. *Research Process*

The educational intervention aimed at enhancing self-efficacy in scientific research incorporated a hybrid learning framework, grounded in four distinct pedagogical models or approaches. Each week of the four-week training program employed a different learning approach. This variation was intentional, as the focus of the research was on the overall impact of the hybrid educational process rather than the singular effects of individual learning models. The learning approaches utilized throughout the training are detailed below:

In the first week, the objective was to equip pre-service social studies teachers with skills in literature review, summarization, and clear articulation of research goals. To achieve this, a Problem-Based Learning (PBL) approach was employed. Prior to the lessons, lesson plans and activities tailored to PBL were developed and implemented. During the lessons, participants were organized into groups and presented with problems related to literature review. They were then tasked with devising solutions in line with PBL principles, which emphasize experiential learning through the investigation and resolution of complex, real-world issues and necessitate active engagement of participants (Deveci, 2002; Allen, Donham, & Bernhardt, 2011).

The second week focused on enhancing participants' competence in methodological aspects such as writing sub-objectives, data collection, data analysis, and participant selection. The 5E Learning Approach was applied during this phase. Lesson plans and activities were crafted according to the 5E framework, which includes the stages of "engage, explore, explain, elaborate, and evaluate" (Bybee et al., 2006; Gürel, 2021). The training adhered to these stages to facilitate the development of methodological skills.

In the third week, the goal was to improve participants' ability to interpret and organize research results comprehensively and to discuss these results in relation to existing literature. The 7E Learning Approach was utilized for this purpose. Prior to the lessons, lesson plans and activities based on the 7E model were designed and implemented. This approach involves a sequential process starting with assessing prior knowledge and culminating in the application of learned information to real-life contexts. The stages of the 7E model are elicit, engage, explore, explain, elaborate, evaluate, and extend (Bayram, 2022; Eisenkraft, 2003).

The final week aimed to enhance the participants' ability to formulate research-based proposals and to write references in compliance with international standards. The Mastery Learning Approach was employed during this phase. Lesson plans and activities reflecting the principles of mastery learning were prepared and executed. This approach operates on the premise that with appropriate conditions and environment, all students can learn effectively. It emphasizes the identification of student levels, learning speeds, and affective characteristics to design suitable educational and assessment strategies (Senemoğlu, 2010).

Research Ethics

This study was conducted with approval from the ethics committee, in accordance with the decision of the Ağrı İbrahim Çeçen University Scientific Research Ethics Committee, dated November 8, 2022, and numbered 239. Subsequently, the researchers provided participants with detailed information about the study, and consent was obtained through the signing of a consent form. Participants' identities were kept confidential.

FINDINGS

The results of the study are categorized into two principal sections: quantitative findings and qualitative findings. The details pertaining to each of these categories are presented below.

Quantitative Findings

In the study, SRSE levels of pre-service social studies teachers were initially assessed. Subsequently, pre-test data were gathered and analyzed. Following the training intervention, post-test data were collected. The Wilcoxon signed-rank test was employed to analyze the data from the overall scale, as well as from its literature and method sub-dimensions. The results are presented in Tables 4, 5, and 6.

Table 4. Wilcoxon Signed Ranks Test General Results

Posttest-Pretest	*n*	*So*	*St*	*Z*	*p*	*r*
Negative order	0	.00	.00	-5.909	.00	.87
Pozitive order	46	23.50	1081.00			
Equal	0					

As indicated in Table 4, there was a significant increase in the proficiency levels of pre-service social studies teachers on the total scale ($p<.05$; positive=46), suggesting that the training aimed at enhancing SRSE was effective in improving the SRSE of the pre-service teachers. The data presented in Table 4 further demonstrate that the effect size of the training was substantial, as evidenced by the large impact on the total scale ($r>.50$). Additionally, the results led to the rejection of the null hypothesis (H_0) and the confirmation of the alternative hypothesis (H_1).

Table 5. Wilcoxon Signed Rank Test Literature Results

Posttest-Pretest	*n*	*So*	*St*	*Z*	*p*	*r*
Negative order	0	.00	.00	-5.737	.00	.84
Pozitive order	21.50	903.00	.00			
Equal	4					

An examination of Table 5 reveals that the proficiency levels of pre-service social studies teachers in the literature sub-dimension have significantly increased (p<.05). Specifically, proficiency improved for 42 participants, while 4 participants showed no change (positive=42; equal=4). The effect size was determined to be large (r>.50), indicating that the training substantially enhanced the participants' competencies in this area.

Table 6. Wilcoxon Signed Rank Test Method Results

Posttest-Pretest	*n*	*So*	*St*	*Z*	*p*	*r*
Negative order	0	.00	.00	-5.917	.00	.87
Pozitive order	46	23.50	1081.00			
Equal	0					

Similarly, Table 6 demonstrates a significant increase in proficiency levels for pre-service social studies teachers in the method sub-dimension (p<.05; positive=46). The effect size was also large (r>.50), suggesting that the training effectively improved the participants' skills in this dimension as well.

The data for the results and discussion, suggestion development, and reference writing sub-dimensions were analyzed using a dependent samples t-test. The results, presented in Table 7, show that the p-values for these sub-dimensions were below .05. This indicates a significant improvement in the proficiency levels of pre-service social studies teachers, with a substantial impact (η2>14).

Table 7. Dependent Samples T Test

Variable	Test type	*n*	*x*	*ss*	*t*	*p*	*η2*
Conclusion and Discussion	Post-test	46	4.4638	.49927	8.419	.000	.61
	Pre-test		3.2029	.89022			
Suggestion Development and Reference Writing	Post-test		4.4348	.52291	10.928	.000	.72
	Pre-test		2.9348	.80006			

Qualitative Findings

To complement the quantitative findings, semi-structured interviews were conducted with volunteers from the sample group at the conclusion of the study. The data collected from these interviews, which sought to gather pre-service teachers' opinions on the impact of the training, were analyzed using descriptive analysis. The results are detailed in the following sections.

Development of Scientific Research Self-Efficacy

It was found that all of the participants were of the opinion that the training aimed at gaining SRSE applied in the research improves their scientific research self-efficacy. The most striking of the views that form the basis of this finding are presented below. S3 expressed that,

> *"I have learned a lot about scientific research from the beginning of the term until now. In other words, to be frank, I learned what scientific research means during this period. How is work done? He expressed that the education applied with the expression "What should one pay attention to while working."*

A similar opinion was presented by S6:

> *"We are now in the second grade. We have taken a scientific research course before, but it has not fully settled in our minds. So it wasn't in my head. In this course (Experimental process in which the training process is applied), we made various applications. Everything got better in our heads. You (the*

researcher who conducted the interview) had us do studies to set an example in the classroom. It is evident from the work we have done, that we have made quite a bit of progress. That's for sure. Now I can say that we know something."

Another participant who had the opinion that it improved SRSE was S2 who said, *"I think I have learned scientific research now. If you tell me now, go do some scientific research, I think I can do it now."* He stated that he had the opinion that the experimental procedure made gains for him. Similar to S2's statements, S8 said, *"I think I can do scientific research on my own now. This period has given me a lot in terms of scientific research."*

It was seen that the qualitative findings arrived at in the research supported the quantitative findings. Accordingly, it can be stated that the education aimed at improving SRSE improved the SRSE of pre-service social studies teachers.

Competence in Literature Review

It was determined that the participants in the research developed a perspective that the training aimed at improving SRSE makes them competent in the review of the literature. S7, one of the participants with this point of view, used the following statements:

"Now I knew beforehand what literature was. I knew, but I thought scanning the literature was just a Google search. But now I learned that there are a lot of other databases. I also learned that the literature review cannot be done only on the internet. One must sit down and read books and articles. It is not just a job to search the literature on the internet. Because why do I say so? When we do research from solid books (the most accepted sources in the scientific literature), we reach the most solid information. This is crucial for robust literature research."

As can be understood from the statements of S7, S7 has the opinion that he has become competent on how to examine the literature during the applied training process. Another participant, S4, stated that *"Literature scanning is not just collecting information from the internet. It is fed from many different sources. My other friends and I used to think so too (before the experimental procedure). Now I realize it means doing decent research."* Two very similar opinions came from S1, S3 and S8, in line with the fact that the training process enabled pre-service teachers to become competent in the review of the literature. The mentioned participants used clear and short statements on the subject. The statements of the participants are as follows:

S1: *"It is necessary to reach scientific sources in the literature review."*

S3: *"When scanning the literature, it is absolutely necessary to conduct comprehensive research."*

S8: *"The review of the literature is the primary step of scientific research. If we're going to do something that everyone can accept. We need to know how to examine the literature well."*

The alignment between the qualitative and quantitative findings suggests that the training significantly enhanced pre-service social studies teachers' abilities in literature review.

Competence in the Method

Intense content related to scientific research methods was used in the research. In the lessons, activities related to quantitative, qualitative and mixed research methods were carried out and it was tried to ensure that pre-service teachers learn about these methods. At the end of the research, it was determined that majority of the participants believed they were competent in the method. Some of the opinions in this context are given below:

"I realized that the scientific method is a very broad subject. It branches out within itself. I think I've learned a little more in this month. It used to be qualitative and quantitative karma... I never knew about these. But now maybe I'm able to do some research myself." (S5)

In line with the expressions used by S5; It can be said that S5 both learned descriptive information about the method and had the view that he made progress in method design during the implementation process. Another participant S8, who has the view that the experimental process makes the pre-service social studies teachers competent about the method, expressed that:

"We did a research project a couple of weeks ago. We did group work on the project. We saw that the method was very important in that project. Because method means programming the research from start to finish. That's why the method is so important. If the method is not known, research cannot be done. There is no research in life. That's why we focused on the method. Now I think we know the method."

When the above statements are examined, it is understood that S8 sees the experimental process of the research as a process that enables the method to be learned both theoretically and practically. A close view was presented by participant S2 who expressed that *"It is necessary to learn the method. We learned quite a bit about the method during this period. The backbone of a research is method part."* He stated that he understood the importance of the method in the implementation process. Continuing his words, S2 said that *"I can say that I learned a little about the method on my own behalf. Okay, maybe I don't know as much as an academic, but I still learned a lot."* He expressed his opinion that the experimental process made him competent in the method.

These qualitative insights support the quantitative findings, indicating that the training improved pre-service social studies teachers' methodological competencies.

Competence in Conclusion and Discussion

Participants acknowledged that the training improved their abilities in the conclusion and discussion phases of scientific research. Notable comments include:

S3: *"Writing conclusions and discussing the results shows what the contribution of scientific research to science is. In my exemplary project with my own group, I see myself as proving that I have progressed in writing and discussing results."*

S6: *"The more important the aims of a research are, the more important it is to express the results well. We totally understand this. I don't think I'm the only one who understands this. I think my other friends understand that too. Because in the work we have done with groups, I have seen that everyone learns this trade."*

S8: *"If scientific results are discussed, they can be important. If I do scientific research, one day, I will definitely take this into consideration. We have seen with our own eyes how important it is (result and discussion) in our case studies so far. This is important."*

Direct quotations from the statements of these participants indicate that they have realized the importance of the conclusion and discussion sections in scientific research. It is understood that the participants also think that they have become competent about the conclusion and discussion sections.

These statements reveal an increased awareness of the significance of conclusion and discussion in scientific research. The qualitative findings corroborate the quantitative results, indicating that the training effectively enhanced pre-service social studies teachers' competencies in this phase.

Competence in Proposal Development and Reference Writing

In the research, it was found that the participants believed they were competent in developing suggestions and writing references as a result of the implementation process. The most important views on which these findings are based are presented below with direct quotations.

S2 expressed his opinion on the subject in a comprehensive way stating that

> *"For example, we are doing research. After doing the work, we reach the results. We also need to make recommendations from the results. Otherwise, no one will see the benefit of our work. Making suggestions should also be in the form of "can, can be done" as you (the researcher who conducted the interview) taught us."*

Another participant, S5, said that *"We need to indicate in our research in a way that it can be understood which authors the information we use in the research belongs to. Scientific ethics and scientific morality require this."* He showed that he was aware of the importance of writing a reference by voicing his words. Another participant stated that *"The bibliography is important. We need to rank our sources in alphabetical order and in chronological order. We should also make it suitable for formats such as APA or MLA. We use APA because we are educators"* (S7). S7's mention of some of the approaches used in specifying references reveals that he has learned about writing references.

It has been determined that the qualitative findings on proposal development and reference writing support the statistical findings. In this context, it can be said that the education aimed at improving SRSE makes pre-service social studies teachers competent in developing suggestions and writing references dimension.

DISCUSSION & CONCLUSION

This study aimed to enhance SRSE of pre-service social studies teachers through a structured training program. The results of this research are discussed in relation to similar studies found in the literature.

As previously mentioned, an eclectic or hybrid educational model was employed in this research. During the initial week of the training, the goal was to equip pre-service social studies teachers with skills in literature review, summarizing information, and clearly articulating research objectives. The Problem-Based Learning (PBL) approach was utilized for this purpose. Both quantitative and qualitative findings indicate that this training effectively improved the participants' competencies in literature review. These results align with studies that demonstrate the PBL approach enhances students' scientific process skills (Öztürk, 2019; Söyleyici, 2018), though they contrast with studies suggesting that PBL does not significantly impact these skills (Serin, 2009; Yıldız, 2010). The discrepancy may be attributed to differences in the training implementation or the characteristics of the participants. Additionally, variations in age and subject areas of the students may contribute to these differing outcomes.

In the second week, the focus shifted to enhancing participants' knowledge in methodological aspects, including writing sub-objectives, data collection, data analysis, and participant selection. The 5E learning model was applied during this phase. The qualitative findings regarding methodology corroborate the quantitative data, suggesting that the training improved the participants' methodological competencies. These results are consistent with studies indicating that the 5E learning model enhances academic achievement (Güleç, 2020; Kıcır, 2014; Aydoğdu, 2022; Ekmekçi, 2022; Demir & Şahin, 2015; Başer, 2008; Fazelian & Soraghi, 2010; Sakallı, 2011; Dağ, 2015; Omotayo & Adeleke, 2017; Aygün, 2019; Ağgül Yalçın & Bayrakçeken, 2010; Grau et al., 2021; Tüysüz & Geban, 2020; Zia & Choudhary, 2020), primarily in mathematics and science fields. This indicates that the 5E model is also effective in social studies education and enhances SRSE.

The third model applied was the 7E learning model, an advanced version of the 5E model. The findings reveal that the 7E model improved the scientific process skills of pre-service social studies teachers, consistent with the results of Kanlı (2007) and Kanlı & Yağbasan (2008). Additionally, although an academic achievement test was not utilized, the model appeared to increase participants' academic performance, as evidenced by the improvement observed in the end-of-semester evaluation exams. This finding supports previous studies that assert the 7E model's effectiveness in enhancing academic achievement (Avcıoğlu, 2008; Çelik & Özbek, 2013; Çepni et al., 2001; Demirezen, 2010; Eisenkraft, 2003; Gönen & Kocakaya, 2010; Gürbüz, 2012; Köksal, 2014; Özbek et al., 2012; Sornsakda et al., 2009; Turgut et al., 2013; Zıngal, 2015).

The final model employed was the mastery learning model, which operates on the principle that effective learning occurs when appropriate conditions and environments are provided. This model differs from traditional education by centering the student in the learning process. Two exams were administered during the semester: one mid-term and one at the end. The end-of-semester evaluation revealed an increase in academic achievement, indicating that the mastery learning model facilitated learning and improved academic performance. These results are consistent with research showing that mastery learning is more effective than traditional teaching methods (Bucak, 2020; Erdemci, 2015; Ersoy, 2014; İşeri, 2004; Karaca, 2007; Öner, 2005).

In conclusion, the training program applied a different learning model each week over a four-week period. The chosen models were based on constructivist principles, which emphasize student-centered and active learning approaches. By using varied models weekly, the program aimed to avoid monotony in the teaching and learning process. The findings suggest that this diverse, student-centered approach effectively improved the SRSE of pre-service social studies teachers. Therefore, adopting an eclectic approach, rather than relying on a single instructional model, may be more beneficial for enhancing SRSE.

Based on the research findings, the following recommendations are proposed:

- Incorporate additional courses focused on SRSE development into social studies education undergraduate programs.
- Develop educational applications designed to enhance SRSE within the social studies education curriculum.
- Mandate scientific research projects for pre-service teachers during their undergraduate program to foster SRSE.

Statements of Publication Ethics

We hereby declare that the research has not unethical issues and that research and publication ethics have been observed carefully. Ethical approval (approval date: 18.10.2022, and number: 53704) was taken from Ağrı İbrahim Çeçen University.

Researchers' Contribution Rate

The research was conducted and reported with equal collaboration of the researchers.

Conflict of Interest

There is no conflict of interest to disclose.

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