


Examining the relationships among anxiety associated with teaching science, interest in science, and self-efficacy

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Abstract

Self-efficacy is one of the important variables for teachers' professional development. However, there have been few studies investigating the relationship between anxiety related to teaching science, interest in science, and self-efficacy. Therefore, this study aimed to explore this relationship with preservice teachers. The researchers used a path analysis model, descriptive statistics, correlations, and a path diagram to analyze the data. The results revealed that outcome expectancy positively predicted personal self-efficacy beliefs, and variables accounted for 64.0% of the variance in personal self-efficacy. Personal science-teaching self-efficacy has no significant direct relationship with science-teaching anxiety or interest in science. Specifically, anxiety has a small positive effect on personal science-teaching self-efficacy. Interest in science does not directly predict personal self-efficacy efficacy beliefs. Anxiety related to teaching science had a major negative effect on interest in science and a minor positive impact on outcome expectancy. The results also showed that personal self-efficacy beliefs depend profoundly on perceptions of outcome expectancy rather than directly on teaching anxiety or science interest levels per se. These findings are noteworthy for future research that aims to boost teachers' science-teaching self-efficacy. Recommendations are made based on these findings.

Keywords: science teaching anxiety, interest in science, self-efficacy, outcome expectancy

INTRODUCTION

It is important to recognize the significance of science education in shaping the future of our society. With the ongoing technological advancements and scientific developments, the role of teachers in a scientifically literate society has become increasingly important. Therefore, it is imperative to understand the factors that impact the experiences and outcomes of teachers. While science education is fundamental for students, it can pose several challenges that may cause anxiety for students and teachers. Previous research has reported anxiety associated with teaching science (Bursal & Paznokas, 2006; Kurbanoglu & Akin, 2010; Putra et al.,

2021; Senler, 2016). This anxiety stems from the complexity of scientific concepts, the need to maintain student engagement, and the ever-evolving teaching methods (Putra et al., 2021; Rukijat & Karimat, 2021). Teachers' anxieties can seriously affect the quality of science education provided to students (Dickson et al., 2017).

Teachers' attitudes and beliefs in their talent to facilitate meaningful learning experiences directly impact their teaching practices, classroom management, and student outcomes (Berger et al., 2018; Veldman et al., 2020). As science teachers' professional development gains importance, research on teachers' attitudes and beliefs has become educators' focus (Ilhan et al., 2015;

Contribution to the literature

- Previous research has shown that it is essential to consider the various factors that can impact how effectively science is taught by teachers, which can improve students' learning outcomes.
- However, few studies in science education have examined the relationship between teachers' anxiety regarding teaching science and their attitudes and beliefs.
- This study contributes to the literature by showing how teaching anxiety, self-efficacy and science interests interact and influence each other. Thus, educators can develop targeted interventions to boost teacher confidence and create a learning environment for pre-service teachers.

Navarro et al., 2022; Sultan, 2020; Yildirim & Tezci, 2016). Teachers' attitudes, interests, and self-efficacies about teaching science significantly impact their ability to teach effectively (Ualesi & Ward, 2018). Various factors influence their effectiveness, including teacher anxiety about teaching science, interest in science, and self-efficacy. These are among the critical factors for teacher's professional development (Navarro et al., 2022; Novak et al., 2020, 2022; Yuruk, 2011).

The relationship between these variables, including skills, attitudes, and beliefs, is worth exploring. Previous research has suggested the importance of considering the factors influencing teachers' practices to teach science effectively and increasing students' learning outcomes (Kang & Wallace, 2004; Smith, 2005). However, a few studies in science education literature have explored the association between preservice science teachers' science teaching anxiety, attitudes, and beliefs. McLean et al. (2023) highlighted that teachers' science anxiety has been studied less, and there is a need to study teachers' anxiety about supporting young students' scientific learning. Senler's (2016) study omitted the science teaching outcome expectancy (STOE) subscale because she stated that her study did not focus on STOE. The exclusion of STOE subscale in her study was based on the lack of emphasis on STOE in her research. Hence, this research necessitates more research on the factors influencing the relationship between prospective science teachers' interests in science, science teaching anxiety and self-efficacy, and background factors for teaching science in different countries. The main research question examined the relationship between anxiety related to teaching science, interest in science, and self-efficacy. In addition, the authors examined the following research questions:

1. Do science-teaching anxiety, interest in science, and outcome expectations influence personal science-teaching self-efficacy beliefs?
2. Does anxiety impact participants' science interests, outcome expectations, and personal self-efficacy beliefs?
3. Does science interest affect participants' personal science-teaching self-efficacy beliefs?

Based on this research question and the results, understanding the factors contributing to anxiety in the science classroom is critical to developing targeted

interventions and support systems for teachers. By uncovering the backgrounds of anxiety and beliefs, researchers can create an environment that enables teachers to face the challenges of their profession with confidence, ultimately improving the quality of teaching for students. By understanding how teaching anxiety, self-efficacy, and science interests interact and influence each other, educators can develop targeted interventions to build teachers' confidence and create a learning environment for preservice teacher programs.

Science Teaching Anxiety

Science teaching anxiety education is crucial as it profoundly affects teachers, students, and teaching and learning experiences (Naquila & Israel, 2022). Firstly, the teaching profession is very challenging (Jaleel & Verghis, 2017; Moraru & Cristea, 2013), and anxiety can lead to stress, burnout, and reduced overall job satisfaction (Skaalvik & Skaalvik, 2018; Veldman et al., 2016). Teachers' anxiety can directly impact student engagement and learning outcomes (Dickson et al., 2017). An anxious teacher may find it difficult to communicate complex scientific concepts understandably and engagingly, which can lead to reduced student interest and understanding. Anxiety may be a barrier that prevents teachers from adopting and implementing these effective pedagogical strategies (Dickson et al., 2017). Teachers who are more confident and less anxious are likely to be more open to experimentation and innovation in their teaching practice, thus improving the overall quality of science teaching (Docherty-Skippen et al., 2020).

Effective teaching is not just about imparting knowledge but also about building positive relationships with students. Teaching anxiety in science teaching is an emotion that can have a negative impact on a teacher's performance, preventing them from starting, continuing, or completing a teaching task (Naquila & Israel, 2022). There have been fewer studies conducted on the anxiety experienced by preservice teachers when it comes to teaching science. For example, Senler (2016) examined the correlation between locus of control, attitudes, teaching anxiety, and self-efficacy. Similarly, Novak et al. (2022) created a scale to measure science teaching anxiety amongst preservice teachers. Their findings underscored the importance of

addressing and mitigating science teaching anxiety to enhance teachers' self-efficacy beliefs. The results from these studies emphasize the need to examine science teaching anxiety among preservice teachers.

Science Teaching Self-Efficacy

Science teachers' beliefs regarding their self-efficacy are important determinants of students' learning experiences (Koksal, 2018; Shahat et al., 2022). Self-efficacy, a term introduced by psychologist Bandura (1997), pertains to an individual's belief in their capacity to complete specific tasks and attain specific objectives successfully. Teachers with robust self-efficacy beliefs are more likely to utilize effective teaching strategies (Ramli & Yusoff, 2020; Karakaya et al., 2023). They demonstrate confidence in planning and delivering engaging lessons, teaching complex academic concepts, and utilizing various instructional strategies (Asilevi et al., 2024). This confidence influences their skills to engage students effectively. Studies have demonstrated that a teacher who possesses a strong belief in their capacity to make science captivating and applicable is more inclined to stimulate curiosity and foster active engagement from students (Simsar & Davidson, 2020). Science teachers with a strong sense of self-efficacy perceive obstacles as opportunities to be conquered rather than impossible (Karakaya et al., 2023). Teachers' beliefs can influence other background factors, including classroom practices, classroom management, and student engagement (Karakaya et al., 2023; Kazempour & Sadler, 2015).

Interest in Science

Teachers interested in science can inspire students' curiosity, captivate their attention, and drive them to actively engage in science activities (Canipe & Verdugo, 2020; Williams et al., 2020). In addition, teachers with a strong interest in science can connect classroom content and everyday experiences, helping students see the practical applications of their learning (Pugh et al., 2010). The increased interest in science may allow them to answer students' questions more thoroughly, provide additional context, and address misconceptions. Thus, teachers' interest in science has been accepted as one of the important factors in creating a positive and effective learning environment (Kazempour, 2014).

Related Literature

Researchers have studied teachers' anxiety, interest, and self-efficacy beliefs in training for over thirty years when teaching science. Yuruk (2011) investigated the correlation between the anxiety of preservice elementary teachers regarding teaching science, their self-efficacy beliefs, and their previous experiences in teaching science. The results showed that teachers' beliefs about teaching science and the number of science courses taken

in college are key factors that affect their anxiety about teaching science. In addition, she found that prospective teachers' perceptions of teaching science, grade point average, and background indirectly influence their anxiety in teaching science. Senler (2016) investigated the associations between teaching self-efficacy, locus of control, attitudes toward science teaching, and teaching anxiety in pre-service teachers. The results indicate a positive correlation between attitudes toward science teaching and self-efficacy in teaching. Conversely, anxiety about teaching is negatively correlated with attitudes towards science teaching. A study by Novak et al. (2022) discovered a noteworthy association between anxiety related to teaching science, interest in science, and self-efficacy in teaching. The study revealed a negative association between anxiety related to teaching and both self-efficacy and interest in teaching science. On the other hand, there was a direct relationship between interest in science and self-efficacy in teaching science. The researchers additionally found that anxiety related to teaching science was the most influential factor in predicting negative outcomes while having an interest in science was a predictor of positive outcomes.

In a prior study by Novak et al. (2020), the authors investigated the connections among science-teaching anxiety, science-teaching self-efficacy, interest in science, design thinking, and previous science experience. Their findings revealed that students with low science teaching anxiety had significantly higher levels of science teaching self-efficacy, science interest, and design thinking than their peers with high science teaching anxiety. According to the study, a combination of anxiety and interest in science teaching was responsible for 50.0% of the variation in self-confidence among science teachers. Furthermore, it was found that anxiety had the most major negative effect on self-efficacy in teaching science, even when considering the positive influence of science interest on the self-efficacy of prospective teachers. Naquila and Israel (2022) examined whether the attitudes and self-efficacy of prospective teachers toward teaching science subjects can accurately predict their actual teaching practice. The findings indicated a significant correlation between attitudes toward teaching science and self-efficacy and anxiety related to teaching. Additionally, it was found that individuals' attitudes toward teaching science can indicate the extent to which prospective teachers experience anxiety when teaching science. The research findings highlight the significance of examining the correlation between anxiety, science interest, and self-efficacy in teaching. The study on the anxiety and self-efficacy of future teachers emphasizes the importance of addressing these concerns to enhance the quality of science education in teacher training programs.

METHOD

Participants

The study involved 378 student teachers (231 males with 61.1% and 147 females with 38.9%) from a university in Russia. Of the participants, 61.1% were male, and the rest, 38.9%, were female. All participants had fulfilled the required training to become elementary school teachers and were in the last year of their academic program. The participants had an average age of 21.4 years. All participants completed the same teacher training programs provided by the college. Over four years, elementary school science teachers took earth science, physics, chemistry, and biology courses. In addition, they took courses concerning specialized subject training and pedagogical instruction.

Data Collection Instruments

The information regarding the instruments used to collect data in this research is presented in sub-titles below.

Science teaching efficacy belief instrument

This study used the science teaching efficacy belief instrument form B developed by Enochs and Riggs (1990). It comprises 23 items divided into three subscales: personal science teaching efficacy (PSTE), STOE, and science teaching interest. It had a five-point Likert scale, from one (strongly disagree) to five (strongly agree). Cronbach's alpha coefficients were 0.86 and 0.79 for PSTE and STOE subscales. In this study, the reliability score of PSTE for Cronbach's alpha was found to be 0.82.

Science interest

The topic of scientific inquiry. The researchers in this study used a modified version of a five-item scale to assess participants' interest in science. The items were acquired through research by Novak et al. (2022). The researchers utilized the same questions derived from the interest/enjoyment subscale of the intrinsic motivation inventory developed by Deci et al. (1994). The measurement tool used to assess science interest consisted of five Likert-type items, each rated on a five-point scale. The science interest scores were calculated by averaging the values of the five items on the scale. The minimum score is one, whereas the maximum achievable score is five.

Science teaching anxiety scale

Novak et al. (2022) developed this instrument to determine preservice teachers' anxiety toward teaching science content. Overall, their results yielded an instrument with 13 five-point Likert-scale items. The response options for Likert-type items were from one

(not true) to five (very true). Eight items have a negative meaning, and they need to be reverse scored. The science teaching anxiety scale (STAS) demonstrated strong indications of validity and reliability, suggesting its potential for future use in assessing the anxiety of prospective teachers when teaching science subjects that do not involve engineering concepts. The authors conducted a Rasch analysis to develop the scale, showing that STAS is a unidimensional instrument. Researchers in this study calculated the participants' science teaching anxiety scores as a mean of the 13 items on the scale. The Cronbach's alpha scores for the scales measuring science-teaching anxiety, interest in science, and science-teaching efficacy belief were 89, 70, and .90, respectively. These values refer to a good level of reliability, as it is above the 0.70 threshold, which is often considered acceptable.

Data Collection

Participation in the study was entirely voluntary. At first, the aspiring elementary teachers were requested to complete a participant information form to gather descriptive data, and subsequently, they filled out data collection instruments. The administration of these instruments took approximately 30 minutes. The authors collected the data in October 2023.

Data Analysis

The data collected from the instruments were analyzed to examine the relationships between them. The high values of Cronbach's alpha suggested that the instruments had a good reliability level and a good internal consistency of the scales. This means that the items within each scale are closely related and consistently measure the same construct. Furthermore, the inter-item correlation matrix provided insights into the relationships between the variables. The statistical results suggested a comprehensive analysis of the data collected from the instruments, shedding light on the relationships among the variables of interest. Path analysis was used in this research. Direct and indirect associations among variables were examined to evaluate a model by proposing a predetermined set of relationships based on theoretical, empirical, and general knowledge. The path analysis was conducted with AMOS 20.

RESULTS

Table 1 displays the descriptive statistics, including the number of respondents, scale items, means, and standard deviations for each of the four key variables: science teaching anxiety, outcome expectancy, self-efficacy beliefs, and science interest. STAS, with a lower mean of 2.64, indicates that, on average, respondents reported a moderately low level of anxiety about teaching science. This suggests that teaching science

Table 1. Descriptive statistics related to variables that were utilized in research

	Number of participants	Number of items	Mean	Standard deviation
Science teaching anxiety	378	13	2.64	.67
Science teaching outcome expectancy beliefs	378	10	3.49	.63
Personal science teaching efficacy beliefs	373	13	3.52	.67
Science interest	378	5	3.49	1.18

Table 2. Correlations among anxiety related to teaching science, interest in science, & self-efficacy

	1	2	3	4
Science teaching anxiety	1.000			
Science teaching outcome expectancy beliefs	.196**	1.000		
Personal science teaching efficacy beliefs	.123*	.746**	1.000	
Science interest	-.552**	-.226**	-.157**	1.000

Note. *Correlation is significant at 0.050 level (2-tailed) & **Correlation is significant at 0.010 level (2-tailed)

does not provoke high anxiety for this group of prospective teachers overall. In contrast, the outcome expectancy (mean [M]=3.49) and self-efficacy scales (M=3.52) have higher means, around 3.50, conveying more mid-range, moderate confidence in teaching science effectively and impacting student outcomes. Efficacy beliefs seem moderately positive. Science interest receives an average score of 3.49, implying this sample has a moderately high interest in science overall. Many respondents appear to find aspects of science enjoyable. Similar standard deviations across variables, ranging from .63 to 1.18, show good variability around these average scores at the individual level. While the sample mean tendencies give a general picture, participants likely have their trait profiles.

In summary, **Table 1** provides a helpful numerical overview of where the sample stands on average for each variable of interest while highlighting room remains for meaningful individual differences within the group.

Table 2 displays Pearson correlation coefficients between the key variables—science teaching anxiety, outcome expectancy, self-efficacy beliefs, and science interest. A strong positive correlation ($r=.746$) between outcome expectancy and self-efficacy beliefs indicates that individuals with greater confidence in their ability to teach science effectively also tend to believe their teaching impacts student outcomes. So, personal efficacy aligns with teaching expectations. However, a moderate negative correlation ($r=-.552$) exists between science interest and anxiety. Those more interested in science appear less anxious about teaching it. Boosting interest may help temper science teaching anxiety. The negative correlations, albeit weaker, between efficacy as well as outcome expectancy and interest imply that those confident in science teaching and expectations may not necessarily find science itself more interesting. Motivations can differ. Additionally, while significant, the correlations between anxiety and efficacy beliefs ($r=.123$) and outcome expectancy ($r=.196$) are small. Anxiety relates but also provides a distinct perspective. In summary, these results reveal meaningful

connections alongside nuances between these attributes that influence science teaching and learning.

Path analysis models were tested for all participants to examine the associations between anxiety related to teaching science, interest in science, and self-efficacy (**Figure 1**). The model showed adequate fit (CMIN/df=0.00, RMSEA=0.00, TLI=1.00, CFI=1.00). Science teaching anxiety had a significant negative direct impact on interest in science ($\beta=-0.929$) and a minor positive impact on outcome expectancy ($\beta=0.185$). Outcome expectancy positively predicted self-efficacy ($\beta=0.800$). Together, the variables accounted for 64.0% of the variance in self-efficacy. Based on the path analysis, personal science-teaching self-efficacy has no significant direct relationship with science-teaching anxiety or interest in science in the total sample. Specifically, science-teaching anxiety has a small, non-significant negative direct effect on personal science-teaching self-efficacy ($\beta=-0.021$). This result means that reducing science teaching anxiety does not appear to influence efficacy beliefs directly. Similarly, there is no reported direct effect of interest in science on personal science-teaching self-efficacy. Personal interest in science does not directly predict efficacy beliefs. However, science-teaching anxiety and interest in science indirectly affect personal science-teaching self-efficacy mediated through outcome expectations. Science-teaching anxiety positively affects personal science-teaching self-efficacy ($\beta=0.150$) through its relationship with outcome expectations. Though science-teaching anxiety does not directly impact efficacy, decreasing anxiety predicts higher outcome expectancy, which shows a strong positive direct effect on personal science-teaching self-efficacy ($\beta=0.800$). Interest in science slightly negatively affects personal science-teaching self-efficacy ($\beta=-0.042$) via outcome expectations. Less interest slightly diminishes outcome expectancy, indirectly reducing efficacy beliefs. Science-teaching anxiety ultimately has a small positive effect on personal science-teaching self-efficacy ($\beta=0.129$). This result suggests that addressing science-teaching anxiety could improve self-efficacy overall. However, this occurs fully through the

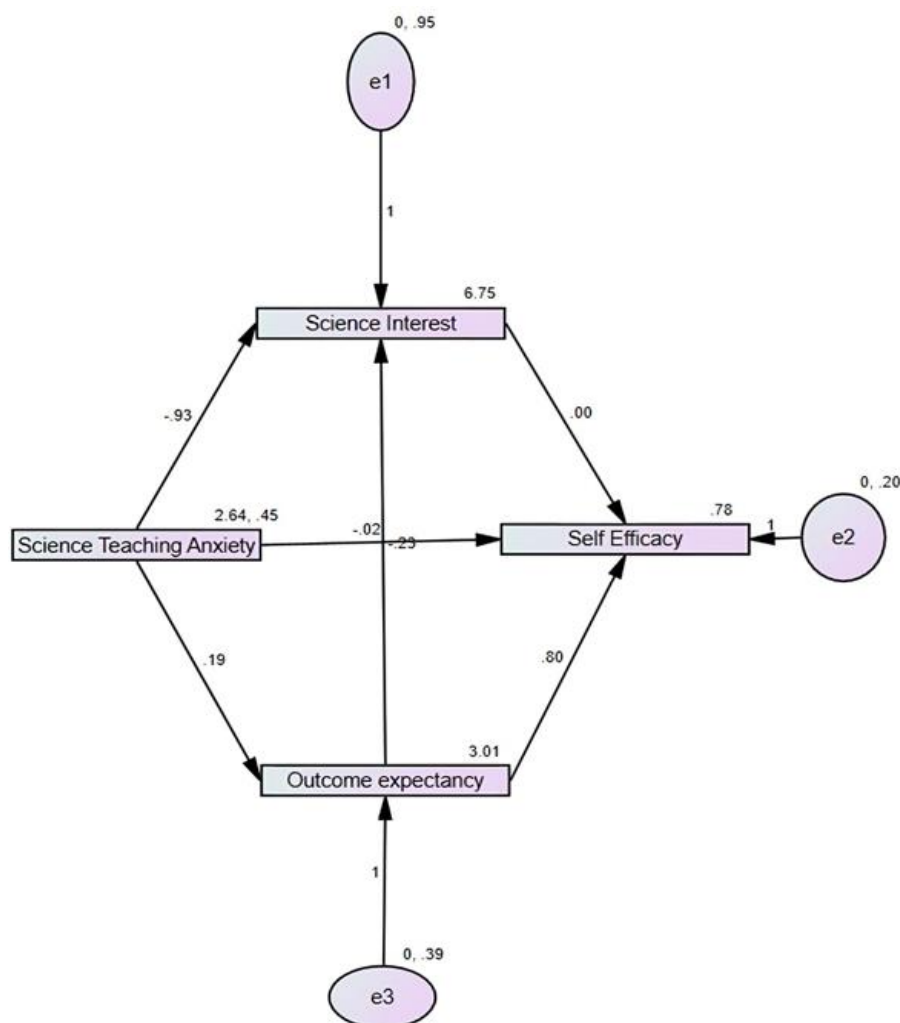


Figure 1. Path diagram & final model (Source: Authors' own elaboration, using IBM SPSS Amos Software)

mediating outcome expectancy variable rather than a direct pathway. Tailoring support to boost outcome expectations may strengthen this effect. In summary, efficacy beliefs depend profoundly on perceptions of outcome expectancy rather than directly on teaching anxiety or science interest levels per se. Supporting teachers in building confidence that their teaching impacts student learning seems critical.

DISCUSSION

This research examined the relationship between anxiety related to teaching science, interest in science, and self-efficacy. The results of the correlation analysis showed a strong positive correlation between personal efficacy beliefs in science teaching and expected outcomes beliefs of science teaching. The path analysis' results showed that outcome expectancy beliefs positively predicted personal self-efficacy beliefs. Together, the variables accounted for 64.0% of the variance in self-efficacy. This finding means teachers with higher science-teaching outcome expectancy impact personal science-teaching efficacy beliefs. This finding supports the results of Novak et al. (2022) and

Riggs and Enochs (1990). Novak et al. (2022) found a positive correlation between outcome expectancy and personal self-efficacy beliefs. However, they found that outcome expectancy did not significantly predict preservice teachers' science teaching self-efficacy after accounting for the influence of anxiety and interest. Similarly, Hartmann et al. (2015) found that prospective science teachers performed slightly worse than natural sciences students. This implies that teaching effectiveness may be influenced by academic achievement and subject-specific knowledge. Our findings may be explained by the nature of participants' academic performance and their background factors. Similarly, Riggs and Enochs (1990) found a positive relationship between science-teaching efficacy beliefs and outcome expectancy. Tailoring support for the development of preservice teachers' professional development can boost their outcome expectancy beliefs and may strengthen this effect. In summary, efficacy beliefs depend profoundly on perceptions of outcome expectancy rather than directly on teaching anxiety or science interest levels per se. It appears crucial to support teachers in building confidence that their teaching positively impacts student learning.

In addition, the results revealed a negative correlation between anxiety in teaching science and interest in science. This finding is like those of Novak et al. (2022). They found a negative correlation between anxiety and interest. In contrast, the lowest negative correlation between efficacy beliefs (outcome expectancy and efficacy) and interest was found. Thus, this result is like those of Novak et al. (2022). Furthermore, a negative correlation was noticed between STOE and science teaching anxiety. This finding aligns with the findings of Novak et al. (2022) and Senler (2016). Senler's (2016) study identified a negative connection between self-efficacy and anxiety. The results from path analysis demonstrated that personal science-teaching self-efficacy has no significant direct relationship with science-teaching anxiety or interest in science. Our research found that interest and science-teaching anxiety did not predict personal self-efficacy beliefs. This result differs from those of Novak et al. (2022) and Senler (2016). On the other hand, we found that anxiety had a small positive effect on outcome expectancy beliefs. These results can explain that emotions, including anxiety, may affect the belief in one's ability to teach science among preservice teachers. Hence, research and teacher training communities must give these emotions greater consideration.

Anxiety and interest indirectly affect self-efficacy mediated through outcome expectations. Science-teaching anxiety has a positive indirect effect on personal self-efficacy through its relationship with outcome expectations. Though science-teaching anxiety does not directly impact efficacy, decreasing anxiety predicts higher outcome expectancy, which shows a strong positive direct effect on personal science-teaching self-efficacy. Anxiety ultimately has a small positive effect on personal self-efficacy. This result means that addressing science-teaching anxiety could improve self-efficacy overall. This result occurs fully through the mediating outcome expectancy variable rather than a direct pathway. This result is not like those of Senler's (2016) study, which identified a negative connection between self-efficacy and science anxiety.

Regarding interest in science, it indirectly affects personal science-teaching self-efficacy mediated through outcome expectations. Similarly, there is no reported direct effect of interest in science on personal science-teaching self-efficacy. This result suggested that interest in science does not directly predict efficacy beliefs. Interest in science slightly negatively affects personal science-teaching self-efficacy via outcome expectations. This finding is inconsistent with previous research suggesting a positive relationship between science teaching anxiety and interest, with anxiety potentially influencing students' self-efficacy and performance in science, which in turn can impact their interest in the subject (Megreya et al., 2021). The results show that various factors, including science teaching

anxiety, interest in science, and STOE beliefs, influence the development of preservice teachers' efficacy beliefs. Prior studies have shown that teachers' self-efficacy beliefs are shaped by their experience in teaching and their interactions with mentors, colleagues, and students (Charalambous et al., 2007; Cone, 2009). Additionally, instructional activities such as field experiences, peer teaching, and self-evaluation of microteaching have been suggested to improve the efficacy of science teaching for elementary preservice teachers (McDonnough & Matkins, 2010). Furthermore, an effective implementation of scientific inquiry can increase preservice teachers' self-efficacy by developing their scientific knowledge and pedagogical skills in science instruction.

CONCLUSIONS

This research examined the relationships between anxiety, interest, and self-efficacy. To date, very few studies have explored the influence of teaching anxiety on self-efficacy. Consequently, the results of this study present a basis for future research that is interested in examining the relationships between different variables. This study's results can contribute significantly to the existing literature to develop teachers' self-efficacy beliefs to teach science in the classrooms. Firstly, the results demonstrated that STOE had a stronger direct effect on PSTE beliefs. This finding highlights the critical need to address preservice teachers' outcome expectancy and self-efficacy beliefs in preservice teacher education programs. Secondly, the results emphasized the significance of preservice teachers' anxiety towards teaching science and their interest in science in developing their self-efficacy skills. Hence, future research should explore interventions and strategies to develop beliefs in outcome expectancy to cultivate favorable beliefs and build confidence to teach science in science teacher education programs.

RECOMMENDATIONS

First, developing and implementing interventions that can reduce science teaching anxiety. This may include mentorship programs and reflective practices that help preservice teachers manage and alleviate anxiety related to science teaching. Second, providing opportunities for preservice teachers about informal science teaching practices can also enhance their interest and self-efficacy in science teaching. Third, an examination of the origins of preservice teachers' self-efficacy anxiety and self-efficacy beliefs can provide valuable insights for designing specific interventions. Fourth, it needs to consider how context influences the efficacy of personal science teaching and the outcome expectancies of preservice teachers. Researchers can develop targeted interventions and training programs to improve science-teaching anxiety, self-efficacy, and

outcome expectancy beliefs by analyzing how various contexts influence them. Furthermore, implementing student-centered microteaching practices and scientific investigations can effectively enhance the self-efficacy beliefs of preservice teachers in science teaching. Furthermore, longitudinal studies have the potential to offer additional understanding of the connections between these variables.

Limitations

It is essential to acknowledge that this research possesses certain constraints. Initially, the study focused exclusively on potential teachers in their last year. Second, the study only incorporated three variables to predict self-efficacy beliefs among the research participants. Third, some supplementary or background factors might affect the results. Therefore, there is a need to study background factors to explain the potential factors that influence teachers' science self-efficacy beliefs. Another limitation is that this research used the participants' self-reporting as the only source of information. This could lead to bias as participants may answer in a socially desirable manner. To maintain uniformity and precision in findings, forthcoming studies should use qualitative data alongside quantitative data to acquire a more profound comprehension of observed relationships.

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Data sharing statement: Data supporting the findings and conclusions are available upon request from the corresponding author.

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