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AN INVESTIGATION OF PRE-SERVICE PRESCHOOL TEACHERS' ATTITUDES AND SELF-EFFICACY TOWARDS SCIENCE EDUCATION ACCORDING TO VARIOUS VARIABLES

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Abstract:
Science education helps individuals understand the events occurring in their environment and the world, starting from their immediate environment. This study aims to determine pre-service preschool teachers' science education self-efficacy and attitudes toward science teaching according to various variables. This research is a descriptive study based on the survey model. The study group of the research consists of 320 pre-service teachers studying at Akdeniz University, Faculty of Education, and Department of Preschool Education. The data of the study were collected through the "Attitude Scale of Preschool Teachers Towards Science Teaching and "Self-Efficacy Scale of Preschool Teachers Towards Science Education. As a result of the study, it was determined that pre-service preschool teachers had positive attitudes toward science teaching and self-efficacy toward science education was high.

Keywords: preschool education, science education, pre-service preschool teacher, self-efficacy, attitude

1. Introduction

Science education helps individuals understand the events occurring in their environment and the world, starting from their immediate environment. It is a concrete education that should be carried out with appropriate methods and techniques in line

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with the interests and needs of children, such as breathing air, food eaten, water drunk, animals fed, and the solar system, by taking into account their developmental levels (Telli et al., 2004). Science education aims not only to train qualified scientists for the development of countries but also to raise qualified individuals for society. Science education in schools aims to help individuals make sense of life through scientific processes (Ward et al., 2005). In addition, it aims to provide individuals with curiosity, objectivity, realism, critical thinking, honesty, open-mindedness, and positive attitudes toward human values (Margolin, 1976).

In order for children to make sense of the world, science education in preschool education is seen as a right of children. Children are innately curious and can learn science. Introducing children to science in their early years will support society's and children's future development (Larimore, 2020). Therefore, providing opportunities and experiences to engage preschool children in science education is very important. In preschool education, science education should be included by capitalizing on children's innate curiosity and ability to learn science (Eshach & Fried, 2005; Gopnik et al., 1999; Greenfield, 2017). Including science education in this period enables children to develop positive attitudes and motivation toward science, acquire the language of science, and acquire scientific process skills (Akerson et al., 2011; Gomes & Fleer, 2019; Fusaro & Smith, 2018). Moreover, learning in this period is meaningful not only for children to make sense of science when they are young but also for their science education in later years (Chen et al., 2022). Science education in the preschool period should not be the transfer of basic science knowledge. Still, it should be in a way that satisfies children's curiosity and encourages them to explore and search (Larimore, 2020). Children should be introduced to science at the earliest possible period to develop positive attitudes toward science (Duschl et al., 2007; French, 2004). In this respect, preschool teachers will introduce children to science after their parents.

Preschool teachers are very important in developing scientific thinking in children and their positive attitudes toward science in the following years (Olgan et al., 2014; Thulin & Redfors, 2017). Suppose children are not adequately supported by their teachers in science activities in preschool and have negative experiences. In that case, they will mostly prefer to avoid science-related activities in the following years. For this reason, teachers' knowledge, opinions, attitudes, and competence levels about science education are essential for science education (Nacar & Kutluca, 2020). However, early science education can be challenging for some teachers. One of the biggest challenges in science teaching is teacher confidence and competence (Olgan et al., 2014). Research has shown that preschool teachers' limited content knowledge and lack of confidence in science teaching negatively affect science education in the classroom (Garbett 2003). In their study, Sundberg & Ottander (2013) reported that preschool teachers' negative attitudes towards science teaching stemmed from teachers' reluctance. What teachers think and feel about science teaching is also effective (Fleer et al., 2014). As a result of the literature review, it is noteworthy that there are results that preschool teachers have insufficient knowledge about science education (Garbett & Yourn, 2002). Although preschool

teachers have positive attitudes toward science teaching (Pendergast et al., 2017), most teachers are not confident in implementation (Garbett, 2003; Torquati et al., 2013), and their self-efficacy is low. (Greenfield et al., 2009; Gerde et al., 2018). Bandura (1997) stated that individuals with high self-efficacy would be highly determined to complete the events in the experiences they encounter and struggle with. In support of this view, similar studies show that teachers' self-efficacy in teaching practices is a strong predictor (Enochs et al., 1995; Riggs & Enochs, 1990; Tschannen-Moran et al., 1998).

An individual's attitude toward a subject is the tendency that prepares them for behavior towards that subject. Therefore, it is essential to know preschool teachers' attitudes toward science teaching to influence their behaviors toward education (Adak, 2006). Teachers' attitudes toward science teaching are one factor that plays a critical role in the success of science education (Okur Akçay, 2014; Dawies & Howe, 2003; Özbek, 2009). In the literature, there are studies on preschool teachers' attitudes towards science teaching (Bahçeci Sansar, 2010; Bay, 2019; Can & Şahin, 2015; Cho et al., 2003; Çakır & Altun Yalçın 2021; Erden & Sönmez, 2011; Sıcak, 2018) and self-efficacy towards science education (Alabay, 2006; Barenthien et al. 2020; Buldur & Alisinanoğlu, 2020a; Chen et al., 2022; Ekinci Vural & Hamurcu, 2008; Guo et al., 2011; Oppermann et al., 2021; Şeker & Çavuş, 2017), but there is no study investigating pre-service preschool teachers' attitudes and self-efficacy with various variables. Based on this glaring deficiency in the related literature, this study aims to determine pre-service preschool teachers' science education self-efficacy and attitudes toward science teaching according to various variables. It seeks answers to the following research questions:

- What is the level of pre-service preschool teachers' attitudes toward science teaching?
- What is the level of pre-service preschool teachers' self-efficacy toward science education?
- Is there a significant difference between pre-service preschool teachers' attitudes toward science education and their gender, grade level, and GPA?
- Is there a significant difference between pre-service preschool teachers' self-efficacy toward science education and their gender, grade level, and GPA?
- Is there a relationship between pre-service teachers' self-efficacy toward science education and their attitudes toward science teaching?

2. Material and Methods

2.1. Research Model

This research is a descriptive study based on the survey model. According to Karasar (2005), the survey model aims to describe a past or ongoing situation as it exists. In this study, the attitudes and self-efficacy of pre-service preschool teachers toward science education were tried to be described.

2.2. Study Group

The study group of the research consists of 320 pre-service teachers studying at Akdeniz University, Faculty of Education, and Department of Preschool Education. Demographic information of the prospective teachers in the study group is given in Table 1.

Table 1: Demographic information of pre-service teachers

		f	%
Gender	Female	242	75,6
	Male	78	24,4
Grade	1st grade	54	16,9
	2nd grade	105	32,8
	3rd grade	82	25,6
	4th grade	79	24,7
GPA	0-2,99	89	27,8
	3,00-3,49	162	50,6
	3,50-4,00	69	21,6
Total		320	100,0

The data of the study were collected through the "Attitude Scale of Preschool Teachers Towards Science Teaching (Çamlıbel Çakmak, 2012)" and "Self-Efficacy Scale of Preschool Teachers Towards Science Education (Buldur & Alisinanoğlu, 2020b)".

The Attitude Scale of Preschool Teachers Toward Science Teaching was developed by Cho, Kim, and Choi (2003) and adapted into Turkish by Çamlıbel Çakmak (2012). The 5-point Likert-type scale consisting of 17 items is evaluated over 85 points. The scale has four dimensions: "comfort-discomfort, pre-instructional preparation, science teaching by doing-living method, and developmental appropriateness." The Cronbach alpha reliability coefficient of the scale is α = .81.

Pre-service Preschool Teachers' Self-Efficacy Scale Toward Science Education (Buldur & Alisinanoğlu, 2020b) is a 5-point Likert-type scale comprising 16 items. The scale has a single-factor structure. The lowest score is 16 points, and the highest is 80 points. A high total score means that teachers' self-efficacy is high. The Cronbach alpha reliability coefficient of the scale is α = .92.

2.3. Data Analysis

SPSS 23.0 package program was used for data analysis. Skewness and kurtosis values for the scores obtained from the scales were evaluated between -1.5 and +1.5. Since all the data were within this range, it was accepted that they were normally distributed. Independent Samples T Test was used to determine the differences depending on the gender variable. Analysis of Variance was used to determine the differences depending on the variables of graduated high school, grade, and GPA. Scheffe, one of the post-hoc analyses, was used to determine between which groups the significant difference observed as a result of the variance analysis of the scores obtained from the scales occurred. In addition, correlations were calculated and tabulated to determine the relationships between the scales.

3. Findings

This section presents statistical analyses of the data obtained from pre-service preschool teachers' scores on the scales and the variables examined.

Table 2: Descriptive statistics values related to the scores of pre-service teachers' attitudes toward science teaching scale

Attitude toward science teaching	N	$\bar{x}$	sd
Total	320	64,3531	8,9742

Table 2 shows that the mean score of pre-service preschool teachers' attitude towards science teaching scale is 64,3531. It can be said that pre-service preschool teachers have a positive attitude toward science teaching.

Table 3: Descriptive statistics of pre-service teachers' scores on the self-efficacy scale for science education

Self-efficacy toward science education	N	$\bar{x}$	sd
Total	320	55,2813	11,9233

Table 3 shows that the mean score of the pre-service teachers' self-efficacy scale for science education is 55,2813. It can be said that pre-service preschool teachers' self-efficacy toward science education is high.

Table 4: The results of independent samples t-test analysis on the scores of pre-service teachers' attitudes towards science teaching scale according to gender

Gender	N	$\bar{x}$	SS	t	sd	p
Female	242	3,8456	,52311	3,661	318	,000*
Male	78	3,5988	,50136			

According to Table 4, the mean scores of pre-service teachers on the scale of attitudes towards science teaching show a significant difference depending on gender (t=3,661, sd=318 p=,000). The mean scores of female pre-service teachers on the scale of attitudes toward science teaching were significantly higher than the mean scores of male pre-service teachers.

Table 5: Anova results of pre-service teachers' scores on attitude towards science teaching scale according to grade level

Source of variance	Squares total	Mean squares	sd	F	p	Source of the difference
Between groups	5,170	316	1,723	6,504	,000*	1-4
Within groups	83,726		,265			2-4
Total	88,897					

According to Table 5, the mean scores of pre-service teachers' attitudes towards the science teaching scale significantly differ depending on the grade level (F=6,504, sd=316, p=,000). According to the result of "Scheffe" test, which is one of the Post Hoc tests conducted to determine between which groups the difference is between, it was seen that the mean scores of pre-service teachers in the 4th grade were higher than the mean scores of pre-service teachers in the 1st and 2nd grades.

Table 6: Anova results related to the scores of pre-service teachers' attitudes towards science teaching scale according to their GPAs

Source of variance	Squares total	sd	Mean squares	F	p	Source of the difference
Between groups	3,942	2	1,971	7,355	,001*	1-2
Within groups	84,954	317	,268			1-3
Total	88,897	319				

According to Table 6, the mean scores of the pre-service teachers' attitudes towards the science teaching scale showed a significant difference depending on the GPA (F=7,355, sd=319 p=,001). As a result of the "Scheffe" test, which is one of the Post Hoc tests conducted to determine between which groups the difference is, it was found that the mean scores of the pre-service teachers with a GPA of 3,00-3,49 and 3,50-4,00 were higher than the pre-service teachers with a GPA of 0-2,99.

Table 7: The results of independent samples t-test analysis of pre-service teachers' scores from the self-efficacy scale for science education according to gender

Gender	N	$\bar{x}$	SS	t	sd	p
Female	242	3,4884	,75663	1,410	318	,159
Male	78	3,3518	,70323			

According to Table 7, the mean scores of pre-service teachers on the self-efficacy scale for science education did not show a significant difference depending on gender (t=1,410, sd=318, p=.159).

Table 8: Anova results of pre-service teachers' scores on the self-efficacy scale for science education according to grade level

Source of variance	Squares total	sd	Mean squares	F	p	Source of difference
Between groups	13,708	316	4,569	8,834	,000*	1-3 1-4
Within groups	163,443		,517			2-3 2-4
Total	177,151					

According to Table 8, the mean scores of pre-service teachers on the self-efficacy scale for science education show a significant difference depending on the grade level (F=8,834, sd=316, p=,000). As a result of the "Scheffe" test, which is one of the Post Hoc tests to

determine between which groups the difference is between, it was seen that the mean scores of pre-service teachers in the 3rd and 4th grades were higher than the mean scores of pre-service teachers in the 1st and 2nd grades.

Table 9: Anova results of pre-service teachers' scores on self-efficacy scale for science education according to their GPAs

Source of variance		Squares total	sd	Mean squares	F	p	Difference
Total points	Between groups	3,733	2	1,867	3,412	,034*	1-2
	Within groups	173,418	317	,547			1-3
	Total	177,151	319				

According to Table 9, the mean scores of pre-service teachers on the self-efficacy scale for science education showed a significant difference depending on their GPA (F=3,412, sd=319 p=,034). As a result of the "Scheffe" test, which is one of the Post Hoc tests to determine between which groups the difference is, it was found that the mean scores of pre-service teachers with GPAs of 3,00-3,49 and 3,50-4,00 were higher than those of pre-service teachers with GPAs of 0-2,99.

Table 10: Pearson product-moment correlation coefficient analysis results for the relationship between pre-service teachers' attitudes toward science teaching and their self-efficacy levels toward science education

	Self-efficacy toward science education	Attitude toward science teaching
Attitude toward Science teaching	,656*	1
Self-efficacy toward science education	1	,656*

Table 10 shows that there is a positive and moderately significant relationship between pre-service teachers' attitudes toward science teaching and their self-efficacy levels toward science education.

4. Results and Discussion

This study determined pre-service preschool teachers' self-efficacy toward science education and their attitudes toward science teaching according to various variables. As a result of the study, it was determined that pre-service preschool teachers had positive attitudes toward science teaching. Similarly, Aydın Şengül and Ertürk Kara (2016), Babaroğlu and Okur Metwalley (2018), Çınar (2013), Erden and Sönmez (2011), and Sönmez (2007) found that preschool teachers and pre-service teachers had positive attitudes towards science education. Raviv & Galili (2023) also found that most preschool teachers attach importance to teaching scientific content in kindergarten and that all teachers have positive attitudes towards science teaching in preschool education. Teacher

attitudes and beliefs are one of the factors that affect the frequency and quality of science teaching in preschool classrooms (Maier et al, 2013). In this study, the fact that pre-service teachers' attitudes toward science teaching were positive suggests that pre-service teachers' science education practices will be positive when they start their profession.

It was determined that pre-service preschool teachers' self-efficacy toward science education was high. Studies conducted with preschool teachers and pre-service teachers also support this finding. In the study of Ekinci Vural and Hamurcu (2008), it was determined that the self-efficacy level of pre-service preschool teachers was positive; in the study of Alabay (2006), it was determined that the self-efficacy belief levels of pre-service preschool teachers towards science were high, and in the study of Özbey (2006), it was determined that most of the preschool teachers considered themselves sufficient in doing science activities. In Okur Akçay's (2015) study, it was seen that pre-service teachers' science teaching self-efficacy beliefs were at a medium level. However, studies examine variables related to self-efficacy, thoughts, and perceptions of preschool teachers (Furtado, 2010; Oppermann et al., 2021; Saçkes, 2015).

It was observed that the attitude scores of female pre-service preschool teachers towards science teaching were significantly higher than the scores of male pre-service teachers. Similarly, Can and Şahin (2015) found that female pre-service preschool teachers' attitudes toward science teaching were significantly higher than male pre-service preschool teachers' attitudes towards science teaching. Tekbıyık and İpek (2007) also found that female pre-service classroom teachers had more positive attitudes toward science teaching.

It was determined that pre-service preschool teachers' attitudes towards science teaching differed significantly depending on the grade level, and the scores of pre-service teachers in the 4th grade were higher than those of pre-service teachers in the 1st and 2nd grades. In Can and Şahin's (2015) study, it was determined that there was no significant difference between pre-service preschool teachers' attitudes toward science teaching and the grade they attended. In this study, it is thought that 4th-grade pre-service teachers have more positive attitudes toward science teaching because they take the "Science Education in Early Childhood" course and go to teaching practice.

It was determined that pre-service preschool teachers' self-efficacy towards science education did not differ significantly depending on gender. In the study of Şeker and Çavuş (2017), supporting this finding, it was determined that there was no significant relationship between the gender of pre-service preschool teachers and their self-efficacy towards science education. Ültay et al. (2020) also found that there was no significant relationship between preschool teachers' attitudes toward science teaching and their gender. Okur Akçay's (2015) study found that female pre-service teachers' self-efficacy toward science teaching was higher. Babaroğlu and Okur Metwalley (2018) found that female preschool teachers' attitudes toward science education were more positive than male preschool teachers.

It was determined that pre-service preschool teachers' self-efficacy towards science education differed significantly depending on the grade level, and the self-efficacy of pre-

service teachers in the 3rd and 4th grades was higher than that of pre-service teachers in the 1st and 2nd grades. Similar to the findings of this study, Ekinci Vural & Hamurcu (2008) found that the self-efficacy of 3rd-grade pre-service preschool teachers was higher than that of 1st-grade pre-service preschool teachers. Alabay's (2006) study determined that the self-efficacy levels of pre-service preschool teachers attending the 1st grade were lower than those studying in other grades. The study of Şeker and Çavuş (2017) determined that the self-efficacy scores of pre-service preschool teachers attending the 2nd grade were lower than those in the 1st and 3rd grades. Okur Akçay's (2015) study determined that the self-efficacy of pre-service teachers in the 3rd and 4th grades in science teaching was significantly higher than those in other grades. It is thought that pre-service preschool teachers' taking courses related to science education and practice in their undergraduate education positively affects their self-efficacy over time.

It was found that both pre-service preschool teachers' attitudes towards science teaching and their self-efficacy towards science education differed significantly depending on the GPA, and the self-efficacy and attitudes of pre-service teachers with a GPA of 3.00-3.49 and 3.50-4.00 were higher than those of pre-service teachers with a GPA of 0-2.99. Similarly, in Alabay's (2006) study, it was observed that as the GPA of pre-service preschool teachers increased, their self-efficacy belief levels toward science also increased. This finding is an expected finding. In other words, it is not surprising that students with high-grade point averages, in other words, high academic achievement, consider themselves competent in science education.

It was determined that there was a positive and moderately significant relationship between pre-service preschool teachers' attitudes toward science teaching and their self-efficacy levels toward science education. In a study with preschool teachers, Ültay et al. (2020) found that teachers' science attitudes and science self-efficacy beliefs were positively correlated, and teachers with positive attitudes toward science had high self-efficacy beliefs. Başar and Elyıldırım (2022) also found a positive and moderately significant relationship between preschool teachers' science literacy levels and their attitudes toward science teaching. Opperman et al. (2021) investigated the relationship between teachers' self-efficacy toward science education and the frequency of science practices. They found that the frequency of teachers' practices was related to their science-specific education training and their participation in professional development in science. In parallel with these studies, Hsin et al. (2023) found that preschool teachers' high self-efficacy and attitudes toward science education positively affected science education practices. Davies and Howe (2003) state that teachers' attitudes towards science are related to their professional experiences and that teachers' negative attitudes may cause children to have wrong and incomplete knowledge in science education. In addition, such teachers' attitudes negatively affect children with an innate sense of curiosity and discovery (Simpson & Oliver, 1990).

5. Recommendations

Based on the findings of this study:

- Studies can be conducted to increase the professional qualifications of preschool teachers for science teaching.
- Arrangements can be made to include theoretical and practical courses on science education starting from the first grade in the department of preschool teaching.
- Research can be conducted to determine preschool and pre-service teachers' science teaching practices.
- Research can be conducted to examine the attitudes and self-efficacy of teachers and pre-service teachers in different branches of science education with various variables.
- Necessary arrangements can be made in out-of-school learning environments to support pre-service teachers' positive attitudes and self-efficacy.

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Conflict of Interest Statement
The authors declare no conflict of interest.

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