IJASTE | International Journal of Academic Studies in Technology and Education

Year 2024, Vol. 2, No. 2, Pages 149-168 www.ijaste.com

OPEN ACCESS

An Investigation of Science Teachers' Self-Efficacy of Inquiry-Based Teaching Method

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Article Info

Article History

Received:
1 April 2024

Accepted:
25 November 2024

Keywords

Science teaching, Inquiry-based instruction, Self-efficacy, Science teachers

Abstract

With the impact of developing and changing science and technology, it is important to raise science literate individuals. It is important for teachers who employ inquiry-based learning to feel sufficiently competent to cultivate individuals who investigate, question, and reach knowledge on their own. The aim of this study is to investigate science teachers' inquiry-based teaching self-efficacy in terms of gender variable. The study also examined the level of inquiry-based science teaching self-efficacy of science teachers and the relationship between inquiry-based science teaching self-efficacy and age variable. The sample of the study consisted of a total of 105 science teachers (79 female and 26 male). "Research-Based Science Teaching Scale" was used as a data collection tool. The data were analyzed using SPSS-22 program. As a result of the analysis, there was no significant difference between the gender variable and inquiry-based self-efficacy. No significant relationship was found between the age factor and the scale. When the distributions of each statement were analyzed, it was seen that disagreement or indecision was mostly in the statements of 'asking questions and making explanations'.

To cite this article

Ince A. E., & Genc, H. N. (2024). An Investigation of Science Teachers' Self-Efficacy of Inquiry-Based Teaching Method. *International Journal of Academic Studies in Technology and Education (IJASTE), 2*(2), 149-168. https://doi.org/10.55549/ijaste.41

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Introduction

Education is a journey that involves many factors and the main character of this journey is the teacher. The teacher does not manage this journey, guides it. The teacher looks at children not as memorization machines but as participants on this journey. Knowledge is not a ready-made product, it is "alive". Thus, the era of transferring memorization is over (MEB, 2019). Accurate and complete learning of basic knowledge and concepts is essential for science education in order to learn the knowledge and concepts they will encounter in the future. Inaccuracies and deficiencies in comprehension lead to errors in learning advanced knowledge. For this reason, science teaching at the primary education level is very important (Ebren Ozan & Karamustafaoğlu, 2020).

As a world, we need young people who can adapt to scientific and technological developments, research, observe, solve problems and questions. Therefore, in order to raise individuals with these skills, developed countries work more sensitively on their education systems and create appropriate programs that contain the desired goals (Tatar & Kuru, 2006). Constructivism initially emerged as a theory concerning individuals' way of learning knowledge. Over time, this process evolved into an approach focusing on how individuals construct knowledge (Erdem & Demirel, 2002). In the constructivist approach, individuals find and process information themselves and the teacher acts as a guide. The teacher creates an environment of questioning and discussion with students. Thus, more meaningful, effective and permanent learning is realized through such activities (Yaşar & Duban, 2009).

The inquiry-based approach is based on constructivism. The most important thing is to learn how to learn (Tatar & Kuru, 2006). Inquiry-based activities provide students with the skills of questioning, criticizing, understanding and making sense of life and help them develop scientific process skills. Inquiry-based learning approach is based on John Dewey's ideology that "Education begins with the learner's sense of curiosity" (Boğar, 2019).

Inquiry is the act of asking questions while learning new information, utilizing your attitudes and skills. Inquiry-based learning approach provides students with the skills of problem solving, discovery, questioning, research, curiosity, critical and creative thinking, comprehending and making sense of their experiences (Avcı & Kırbaşlar, 2023). The basis of inquiry-based learning is to teach students to produce solutions to problems by adopting the methods and ways that scientists use in their research. In this way, students use observation, research and inquiry methods like scientists to understand and make sense of nature and what happens in their lives and to reach conclusions. The teacher's task here is to design and create the learning environment according to the inquiry-based learning approach. If the teacher prepares this process and environment well, students can recognize problems, ask questions, make predictions, formulate definitions, form hypotheses and test them, use different research methods, and establish a relationship between their experiences and scientific knowledge (Ünal, 2018).

In inquiry-based learning, it is not the teacher's task to teach concepts, facts and information as in the traditional method. The main task of the teacher is to help and guide the students. The teacher has the role of facilitating and guiding students in the inquiry process. The teacher uses different techniques and methods in the inquiry process, serves as a model for the students, has a good command of body language (Çavuşlu, 2014). In inquiry-based learning method, students ask questions, form hypotheses to solve questions and test them, collect data, record and analyze the data they collect, and construct the results. However, studies also reveal that inquiry-based teaching method can only be implemented by teachers with high self-efficacy (Dawson et al., 2006). Self-efficacy first appeared in Bandura's Social Learning Theory. Self-efficacy is the belief in one's capacity and ability to succeed in the activity required to perform a certain performance (Bandura, 1994; as cited in Yılmaz & Gürçay, 2011).

It is thought that self-efficacy was effective in improving teachers' teaching behaviors. The training of teachers who are selfless, capable of coping with challenges, eager, and able to fulfill the competencies of the teaching profession is achievable through enhancing teachers' self-efficacy (Yılmaz & Gürçay, 2011). Inquiry-based learning approach has been the subject of many studies in the field of education until today. It has been encountered that teachers are undecided about the inquiry-based teaching method that they will integrate into the lessons, and some teachers think that it is easy and some teachers think that it is difficult in practice. In dedication to this, the research question was found through this problem in the study and the research was conducted based on the literature review. In this context, the research question of the study was determined as follows.

“What is the level of inquiry-based teaching self-efficacy of science teachers and is there a difference according to gender?" The following sub-problems were identified for this problem situation.

1. What is the level of science teachers' inquiry-based science teaching self-efficacy?
2. Is there a significant difference between science teachers' inquiry-based science teaching self-efficacy and gender?
    a) Is there a significant difference between the sub-dimension of opportunity and gender?
    b) Is there a significant difference between the sub-dimension of guidance and gender?
    c) Is there a significant difference between the sub-dimension of evidence and gender?
    d) Is there a significant difference between the sub-dimension of explanation and gender?
3. Is there a significant relationship between inquiry-based science teaching self-efficacy and age?

Method

Research Model

In this study, the survey model, one of the descriptive research methods, was used as the research model. According to Karasar (2012), survey models are research approaches that aim to describe a past or current situation as it exists. In this model, the event, individual or object that is the subject of the research is tried to be handled within its own conditions, and we can observe the thoughts without changing them.

Working Group

The sample of the study consisted of a total of 105 science teachers (79 female and 26 male). Easily accessible case sampling, one of the purposive sampling methods, was used in the study. In this method, the closest or easily accessible individuals are selected until the required sample size is reached (Cohen et al., 2007).

Data Collection Tool

Scales are measurement tools developed to reveal a certain psychological structure (Ekiz, 2013). For this reason, in this study, the Likert-type "Research-Based Science Teaching Self-Efficacy Scale" consisting of 69 items and 4 sub-dimensions developed by Smolleck (2006) and adapted by Akçay and İnaltekin in 2011 was used as a data collection tool after obtaining permission to use it. The scale is a 5-point Likert type, with response options including "Strongly Agree," "Agree," "Undecided" "Disagree," and "Strongly Disagree." The original version of the scale, developed by Smolleck (2006), comprised 69 items across 4 subdimensions and was tested with 190 teacher candidates, resulting in a Cronbach's Alpha coefficient of .68. The Turkish adaptation of the scale by Inaltekin and Akçay (2011) involved 281 teacher candidates and yielded a Cronbach's Alpha coefficient of .83. The subdimensions include Opportunity (18 items), Guidance (19 items), Evidence (17 items), and Explanation (15 items).

Data Analysis

The statistical analysis of the data collected through the Google Form address was analyzed using SPSS (Statistical Package for Social Sciences) 22.0 program. One Sample Kolmogorov-Smirnov test was applied to find out whether the teachers' responses to the scale were normally distributed, and skewness and kurtosis values were examined. The dimensions were normally distributed. Since the scale and sub-dimensions were normally distributed, parametric tests were used. However, since the number of male teachers in the gender variable was less than 30, Mann Whitney-U Analysis was used. In normally distributed data, parametric tests can be used if the number of samples is less than 30 (Kul, 2014; Sümbüloğlu & Sümbüloğlu, 2007). Since the age variable did not show a normal distribution, non-parametric test was used. A frequency table was created for sociodemographic questions. In order to see the differences in the group averages of the gender variable, Mann Whitney-U Analysis was applied for variables with 2 groups. Pearson correlation analysis was applied to determine the direction and strength of the relationship between the research-based science teaching self-efficacy scale and the sub-dimensions of opportunity, guidance, evidence, explanation, and Spearman correlation analysis was applied to determine the direction and strength of the relationship between the scale, sub-dimensions and age variable.

Results

Normality Assumption Analysis and Reliability Analysis

One Sample Kolmogorov-Smirnov test was applied to find out whether the teachers' responses to the scale were normally distributed, and skewness and kurtosis values were examined.

Table 1. Normality Assumption Analysis and Reliability Analysis

Scale	N	M	Sd	Kolmogorov Smirnov	Skewness	Kurtosis	Cronbach Alpha
Opportunity	105	74,60	7,92	,045	-,629	,131	,899
Guidance	105	74,98	7,59	,000	-,712	-,249	,895
Evidence	105	66,34	6,87	,000	-,727	-,425	,893
Explanation	105	83,39	10,12	,004	-,864	,420	,867
Total	105	299,31	30,23	,036	-,763	,008	,966
Age	105	26,49	3,94	,000	2,579	11,394	-

Since the kurtosis and skewness values of the scales did not exceed the -2; +2 limit, it was assumed that they showed normal distribution and parametric tests were used in the analyzes. Since the kurtosis and skewness values for the age variable exceeded the -2; +2 limit, non-parametric tests were used in the analyzes (George & Mallery, 2010).

A Cronbach Alpha coefficient between 0.60 and 0.80 indicates that the scale is reliable, and a coefficient between 0.80 and 1.00 indicates that the scale is highly reliable. Within the framework of this information, as seen in Table 1, the Cronbach Alpha values of the scale and its sub-dimensions were between 0.80 and 1.00 and their reliability was at a high level (Kayış, 2009; Kılıç, 2016).

As seen in Table 1, the Cronbach Alpha internal consistency coefficient for the whole scale was found .966. When we examined the Cronbach Alpha values of the sub-dimensions, we found .899 for the "opportunity" dimension, .895 for the "guidance" dimension, .894 for the "evidence" dimension and .867 for the "explanation" dimension. Based on these data, it was observed that the scale we used was sufficiently reliable.

Correlation Analysis between Sub-Dimensions

Research-Based Science Teaching Scale is consisting of 4 sub-dimensions. Pearson correlation analysis was applied to determine the direction and strength of the relationship between the research-based science teaching self-efficacy scale and the sub-dimensions of opportunity, guidance, evidence and explanation. The correlation between these sub-dimensions was analyzed in Table 2.

Table 2. Correlation Analysis between Opportunity, Guidance, Evidence, Explanation Sub-dimensions

	1	**2**	**3**	**4**	**5**
Opportunity (1)	1				
Guidance (2)	,934** ,000	1			
Evidence (3)	,877** ,000	,902** ,000	1		
Explanation (4)	,699** ,000	,739** ,000	,836** ,000	1	
Total (5)	,930** ,000	,948** ,000	,963** ,000	,893** ,000	1

*Correlation is significant at 0.05 level. ** Correlation is significant at 0.01 level.

If the Pearson product-moment correlation coefficient is between 0.30 and 0.70, there is a medium level relationship, and if it is between 0.71 and 0.99, there is a high-level relationship (Köklü et al., 2006). There was a positive and highly significant relationship between Opportunity Subdimension and Guidance Subdimension with 99% confidence (r=.934; p=.000), between Opportunity Subdimension and Evidence Subdimension with 99% confidence (r=,877; p=,000), between Opportunity Subdimension and Total Scale with 99% confidence (r=,930; p=,000), between Guidance Subscale and Evidence Subscale with 99% confidence (r=,902; p=,000), between Guidance Subdimension and Explanation Subdimension with 99% confidence (r=,739; p=,000), between the Guidance Subscale and the Total Scale with 99% confidence (r=,948; p=,000), between the Evidence Subscale and the Explanation Subscale with 99% confidence (r=,836; p=,000), between the Evidence Subscale and the Total Scale with 99% confidence (r=,963; p=,000), between the Explanation Subscale and the Total Scale with 99% confidence (r=,893; p=,000) and there was a positive and moderately significant relationship between the Opportunity Subdimension and the Explanation Subdimension with 99% confidence (r=,699; p=,000).

When the relationship between Opportunity, Guidance, Evidence, and Explanation sub-dimensions is analyzed, it is seen that the highest correlation is between Opportunity sub-dimension and Guidance sub-dimension with a value of .934, and the lowest correlation is between Opportunity sub-dimension and Explanation sub-dimension with a value of .699.

Frequency Analysis of Sub-Dimensions

As a result of the analysis, a frequency table was created for each sub-dimension. Teachers' responses were analyzed separately for each sub-dimension, and as a result of the analysis, it was noticed that there were more different opinions in the distribution of some items and these items were analyzed.

Examination of the Opportunity sub-dimension

Opportunity sub-dimension consists of 18 items. The frequency table of the Opportunity sub-dimension was examined, and the answers given to 3 items attracted attention and the answers given were shown in Table 3.

Table 3. Frequency Table of Opportunity Subdimension Statements

	Strongly Disagree		**Disagree**		**Undecided**		**Agree**		**Strongly Agree**	
	F	**%**	**F**	**%**	**F**	**%**	**F**	**%**	**F**	**%**
I give students the chance to formulate their own research questions.	2	%1,9	15	%14,3	17	%16,2	32	%30,5	39	%37,1
I expect my students to ask scientific questions.	2	%1,9	9	%8,6	16	%15,2	36	%34,3	42	%40,0
My students decide which evidence would be most useful in answering a scientific question or questions.	3	%2,9	10	%9,5	15	%14,3	33	%31,4	44	%41,9

When the statements in the Opportunity sub-dimension were analyzed, it was seen that teachers frequently gave opportunities to their students in different fields. However, the frequencies of the statements given in Table 3 in this sub-dimension draw attention.

Examination of the Guidance sub-dimension

Guidance sub-dimension consists of 19 items. The frequency table of the guidance sub-dimension was examined, and the answers given to 4 items attracted attention and the answers given were shown in Table 4.

Table 4. Frequency Table of Guidance Subdimension Statements

	Strongly Disagree		**Disagree**		**Undecided**		**Agree**		**Strongly Agree**	
	F	**%**	**F**	**%**	**F**	**%**	**F**	**%**	**F**	**%**
When investigating scientific phenomena, my students have a choice of questions I give them.	3	%2,9	6	%5,7	15	%14,3	34	%32,3	47	%44,8
I play a decisive role in defining scientific questions.	0	%0,0	4	%3,8	19	%18,1	48	%45,7	34	%32,4
I guide students to scientifically accepted ideas for better understanding of science subjects.	0	%0,0	4	%3,8	17	%16,2	38	%36,2	46	%43,8
Students construct scientific explanations using evidence with my help.	2	%1,9	3	%2,9	16	%15,2	43	%41,0	41	%39,0

When the statements in the guidance sub-dimension were analyzed, it was seen that teachers mostly guide their students in many areas. However, the answers given to 4 statements in Table 4 in this sub-dimension draw attention.

Examination of the Evidence sub-dimension

The evidence sub-dimension consists of 17 items. The frequency table of the evidence sub-dimension was examined, and the answers given to 2 items attracted attention and the answers given were shown in Table 5.

Table 5. Frequency Table of Evidence Subdimension Statements

	Strongly Disagree		Disagree		Undecided		Agree		Strongly Agree	
	F	%	F	%	F	%	F	%	F	%
My students construct their explanations using the evidence given to them.	2	%1,9	6	%5,7	14	%13,3	35	%33,4	48	%45,7
My students construct their explanations based on evidence according to the method I present to them.	1	%1,0	14	%13,3	15	%14,3	40	%38,1	35	%33,3

When the statements in the evidence sub-dimension were analyzed, it was observed that students generally used and presented evidence, while teachers provided supportive ideas and evidence to students in this process.

Examination of the Explanation sub-dimension

The explanation sub-dimension consists of 15 items. The frequency table of the explanation sub-dimension was examined, and the answers given to 5 items attracted attention and the answers given were shown in Table 6.

Table 6. Frequency Table of Explanation Subdimension Statements

	Strongly Disagree		Disagree		Undecided		Agree		Strongly Agree	
	F	%	F	%	F	%	F	%	F	%
I ask most of the scientific questions that students need to do research.	8	%7,6	27	%25,7	28	%26,7	26	%24,8	16	%15,2
Students choose the questions they want to investigate from a list of questions given to them.	2	%1,9	15	%14,3	12	%11,4	37	%35,2	39	%37,1

My students analyze the data presented to them according to the teacher's narration.	3	%2,9	14	%13,3	20	%19,0	43	%41,0	25	%23,8
I provide students with all the evidence they need to construct explanations through the lectures and the textbook.	8	%7,6	26	%24,8	18	%17,1	25	%23,8	28	%26,7
I expect my students to follow predetermined methods when defending their explanations.	0	%0,0	6	%5,7	25	%23,8	35	%33,4	39	%37,1

When the statements in the Explanation sub-dimension were analyzed, it was seen that teachers mostly guide their students in many areas. However, the answers given to 5 statements in Table 6 in this sub-dimension draw attention.

Is There a Significant Difference between Science Teachers' Self-Efficacy in Inquiry-Based Science Teaching and Gender?

Table 7 shows the sociodemographic information of the teachers who participated in this study. This study included 79 female (75.2%) and 26 male (24.8%) participants.

Table 7. Socio-Demographic Information

Variable	**Group**	**N**	**Percentage (%)**
Gender	Female	79	75,2
	Male	26	24,8

In order to see the differences in the group averages of the gender variable, Mann Whitney-U Analysis was applied for variables with 2 groups. Mann Whitney-U Analysis was given in Table 8.

Table 8. Mann Whitney-U Analysis for Gender Variable

Scale	Group	N	M	Sd	Z	df	p*
Opportunity	Female	79	75,17	7,12	-,869	88	,385
	Male	26	72,71	10,11			
Guidance	Female	79	75,36	6,85	-,244	88	,807
	Male	26	73,71	9,71			
Evidence	Female	79	66,46	7,05	-,487	88	,626
	Male	26	65,95	6,41			
Explanation	Female	79	83,00	10,70	-,463	88	,643
	Male	26	84,67	7,98			
Total	Female	79	300,00	29,77	-,329	88	,742
	Male	26	297,05	32,34			

*p<0,05

According to the gender variable groups, the opportunity subdimension score of female teachers was 2.46 points higher than male teachers. However, there was no statistically significant difference (p=,385>0.05). The guidance subdimension score of female teachers was 1,65 points higher than male teachers. However, there was no statistically significant difference (p=,807>0,05). The evidence subdimension score of female teachers was 0,51 points higher than male teachers. However, there was no statistically significant difference (p=,626>0,05). The explanation subdimension score of male teachers was 1,67 points higher than female teachers. However, there was no statistically significant difference (p=,643>0,05). The Total Scale Score was found to be approximately 3 points higher for female teachers, but there was no statistically significant difference (p=,742>0.05).

Is There a Significant Relationship Between Inquiry-Based Science Teaching Self-Efficacy and Age?

Spearman's correlation analysis was applied to determine the direction and strength of the relationship between inquiry-based science teaching self-efficacy scale, opportunity, guidance, evidence, explanation sub-dimensions and age variable. Table 9 shows the correlation between these sub-dimensions.

Table 9. Correlation Analysis between Inquiry-Based Science Teaching Self-Efficacy and Age Variables

	Opportunity	Guidance	Evidence	Explanation	Total
Age	-,195 ,065	-,071 ,507	-,114 ,285	,202 ,056	-,051 ,633

*Correlation is significant at 0.05 level.

There was no significant relationship between the Opportunity Subdimension and the age variable (r=-.195; p=.065), between the Guidance Subdimension and the age variable (r=-.071; p=.507), between the Evidence Subscale and the age variable (r=-.114; p=.285), between the Explanation Subscale and the age variable (r=-.202; p=.056), between inquiry-based science teaching self-efficacy and age variable (r=-,051; p=,0633).

Discussion and Conclusion

Rather than raising individuals who memorize existing scientific knowledge, the main purpose of science education is to raise individuals who understand the concepts of science, can find relevance between concepts, have scientific process skills, and can access information on their own (Atasoy et al., 2007; Şahin, 2023). In order to raise science literate individuals, it is important to provide students with accurate and complete basic knowledge and concepts, to enable students to adapt what they learn to their daily lives and to gain scientific process skills (Kayacan & Selvi, 2017).

In the Opportunity sub-dimension, more disagreement and indecision were observed in 3 statements compared to the other statements. It was seen that these 3 items were related to students' asking and answering questions. Since the 2013 science curriculum, it has been emphasized to use the inquiry method in which students are active in learning and responsible for their own learning. It has been emphasized that students should be individuals who question, research and think critically (MEB, 2013; MEB, 2018). For this, students need to think, generate questions and ask questions to reach the right information.

Questions have a very important place in inquiry-based teaching. The teacher is only in the role of a guide and the student is expected to manage the process. When we look at the beginning of the process, there should be a problem and the student should form questions about this problem, this method is called open inquiry-based method. In the open inquiry process, students investigate questions with the methods they design and choose. Students make their own decisions at each step of open inquiry. In this type of inquiry, which requires high-level thinking skills, one of the most important tasks of teachers is to motivate students to ask their questions (Cin & Türkoğuz, 2017). As a result of an extensive search of a range of literature, it has been observed that open inquiry-based instruction has a positive effect on students' academic achievement, self-confidence, and taking responsibility. However, even if all the responsibility of open-ended inquiry-based teaching is seen on the student, the teacher's obligation is very high. When the literature is examined, it is seen that teachers are indecisive and face obstacles for this teaching. Kaya and Yılmaz (2016) found in their study that the effect of open inquiry-based teaching on students' academic achievement is undeniable and that teachers are uncertain about how to provide support and guidance in this process. A similarity was observed with the study.

In the guidance sub-dimension, more disagreement and indecision were observed in 4 statements compared to the other statements. These statements were related to the teacher's help and guidance of the student. In guided inquiry, the problem to be investigated is given by the teacher. Students plan the process and obtain the result. Keçeci (2014) stated in his research that students preferred the guided inquiry method the most in the applications carried out with the inquiry method. He explained this situation as 5th and 6th grade students' need for teacher guidance. For this, it is thought that teachers should be competent in this process. Bayram (2015) examined the difficulties encountered by pre-service teachers while preparing activities with guided inquiry method. As a result of the research, he encountered 6 difficulties. One of them is the guidance dimension of internal difficulties. It was observed that pre-service teachers had concerns about guiding the inquiry process and the ideology of the process. There was a similarity with this study. When we look at the process, inquiry-based learning method is a method that can be used not only to teach subject matter to students but also to raise individuals who have adopted skills such as research, problem solving and questioning.

In the evidence sub-dimension, more disagreement and indecision were observed in 2 statements compared to the other statements. These statements are about students presenting their explanations according to the evidence and methods given by the teachers. In the study conducted by Bayram (2015), it was seen that pre-service teachers faced difficulties in this regard. It was found that the prospective teachers were concerned about whether the students would follow a new process and method based on the process they designed or their own thoughts, whether they would explain from the information they provided or with their own thoughts. In such problems, it is very important which type of inquiry we choose. If we choose the structured inquiry method, we need to apply the process and method according to the steps given by the teacher. Based on the information and evidence provided by the teacher, students were expected to make explanations and draw conclusions.

In the explanation sub-dimension, more disagreement and indecision were observed in 5 statements compared to the other statements. These statements are related to the teacher asking the questions, students choosing the questions from the list, the teacher giving the evidence, the method they follow and analyzing the data according to the teacher's method. It was seen that these problems were equivalent to the problems seen in the opportunity, guidance and evidence sub-dimensions. According to Perry and Richardson, (2001), Wood, (2003), Branch and Solowan, (2003), Zacharia, (2003), Jorgenson, Cleveland and Vanosdall, (2004), inquiry-based learning is defined as the process of learning through asking questions, conducting research and analyzing the findings and transforming the acquired data into useful information. It is also a process in which problems are created and students try to solve these problems in the course. Inquiry-based learning is a student-centered approach that focuses on critical thinking, asking questions, problem solving and research. With inquiry-based learning, learning by using critical thinking and scientific process skills rather than memorizing concepts has come to the forefront. Inquiry-based science teaching has moved away from the teaching of memorizing the book, in which information is given directly, and has adopted a student-centered approach in which students are active, learn by doing and living (Yaşar & Duban, 2009).

According to Altunsoy (2008), the benefits of inquiry-based learning include increasing interest and curiosity in the subject, being motivating due to active learning, giving importance to variables and attracting attention, making sense of the answer rather than defining it, and providing faster and more frequent feedback. With these advantages of inquiry-based learning, it is possible to raise individuals who can compete with individuals in developed countries; individuals with high academic achievement, who have and adopt scientific process skills, who have a good level of cognitive development, etc.

No significant difference was found between science teachers' inquiry-based teaching self-efficacy and gender variable. From the total scale scores, it was concluded that female teachers scored slightly higher than male teachers and had more positive self-efficacy. In a study conducted on physics and chemistry teachers, it was mentioned that female teachers exhibited more positive self-efficacy in the classroom (Jones & Wheatley, 1990).

When studies in the literature were examined, there were studies that have similar findings and there was no significant difference between genders (Akbaş & Çelikkaleli, 2006; Gencer & Çakıroğlu, 2007; Gökdağ Baltaoğlu et al. 2015; Yaman et al., 2004). In addition, there were also studies that found significant differences between genders that contradicted the findings (Aktamış et al., 2016; Çavuşlu, 2014; Kocagül, 2013).

Akbaş and Çelikkaleli (2006) examined whether pre-service teachers' science teaching self-efficacy beliefs differed according to gender variable. As a result of the study, it was found that self-efficacy beliefs towards science teaching did not differ according to gender. Avcı (2019) studied many factors and relationships in his research with pre-service science teachers. While examining inquiry-based science teaching beliefs, he also investigated the gender variable. The result of the study is similar to this study. Avcı found that the gender variable did not cause a significant difference, but the averages of female pre-service teachers were slightly higher than male pre-service teachers. Çavuşlu (2014) examined inquiry-based views using the Inquiry-Based

Science Teaching Scale in a study conducted with pre-service science and technology teachers. He found that there was a significant difference between pre-service teachers' inquiry-based science teaching self-efficacy and gender variable. It was seen that the significant difference was positive in the direction of female pre-service teachers.

Kocagül (2013) conducted a one-group pre-test post-test study with science and technology teachers and examined the differences in beliefs, self-efficacy and skills towards inquiry-based teaching according to gender. It was found that there was a statistically significant difference in inquiry-based self-efficacy according to gender before and after the application. Male teachers increased more than female teachers before and after the implementation and a significant difference was found.

When the data on the Opportunity sub-dimension were analyzed, it was observed that female teachers were more understanding and gave opportunities to their students to improve themselves in every sense compared to male teachers. When the guidance sub-dimension data were analyzed, it was observed that female teachers were more understanding and guided their students than male teachers. When the evidence sub-dimension data were analyzed, it was observed that female teachers scored higher than male teachers in the cases of giving examples and evidence to students, creating and presenting students' associations and explanations of events using evidence. The data obtained in 3 sub-dimensions were similar to the study conducted by Çavuşlu (2014). When the explanation sub-dimension data were examined, it was observed that male teachers scored higher than female teachers and had positive thoughts in the cases where students analyzed the situation, made explanations and teachers made explanations where necessary. There was no similarity with the study conducted by Çavuşlu (2014) because it was observed that there was no significant relationship between the explanation sub-dimension and gender.

In the study, no relationship was found between the scale and sub-dimensions of science teachers and the age variable. When studies in the literature were examined, there are studies that are similar to the findings and there is no significant difference between age (Açıkgöz & Uluçınar Sağır, 2020; Kaçar & Beycioğlu, 2017; Silsüpür & Bilican, 2021). These researchers stated that there was no relationship between self-efficacy belief and age in their studies. Silsüpür and Bilican (2021) examined the opinions of classroom teachers about inquiry-based teaching and their self-efficacy according to the factors in his study; there was no significant difference in the self-efficacy levels of classroom teachers according to the age factor. There was a similarity with this study.

There is no single way of learning. Different methods may be needed for better learning on this path. The use of inquiry-based teaching method in lessons has many effects on students' academic, cognitive and skills. It was found that students' learning was positively affected especially when the science course, which has many abstract concepts and misconceptions, was taught with the inquiry-based method. In order to apply this method in lessons, teachers should have high self-efficacy and be competent in the method. It is possible that teachers with high self-efficacy in inquiry-based teaching method are more successful in terms of knowledge accumulation, process management, providing support, and that it is also effective in terms of students adapting to the process and being active in the process.

Recommendations

Based on the results of this study, suggestions for researchers are listed below:

- In order to cultivate students who possess the principles embraced by the curriculum and the skills it aims to develop, there is a need for competent teachers who possess those skills. For this purpose, inquiry-based education courses that will develop competencies and impart the desired skills are necessary.
- Concrete prefixes and activities can be included in the curriculum.
- In-service practice trainings that provide information about inquiry-based education method can be increased and teachers can participate in these trainings.
- The sample can be expanded in future studies.
- A study comparing science teachers and pre-service science teachers can be conducted.
- Teachers can be interviewed to identify problems in the results of the scale (it can be supported with qualitative research as well as quantitative research).
- Demographic questions can be diversified (age, university attended, year graduated from university, years in the profession, ...).

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