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An Analysis of Preservice Geography Teachers' Scientific Research Self-Efficacy

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Abstract

The purpose of the study is to examine the scientific research self-efficacy of preservice geography teachers studying at COMU Faculty of Education. To this end, a scientific research self-efficacy scale consisting of six factors and 37 items was used. The sample group of the study was the teacher candidates studying in the Department of Geography Education, Turkish and Social Sciences Education, at a Faculty of Education of a state university in Marmara region of Turkey. The sample of the research consists of 72 teacher candidates who continue their education in the same department (1,2,3 and 4th grades). The results show that male geography teacher candidates' opinions on scientific self-efficacy were more positive than their female peers. It was also determined that they had high self-efficacy in continuing investigation, but that their self-efficacy was low in identifying the problem situation. While the candidates had high self-efficacy in examining the literature in the context of the problem situation, they had low self-efficacy in accessing national and international databases for literature review. It was also observed that the geography teacher candidates had high self-efficacy in determining the appropriate method for testing hypotheses, but had low self-efficacy in performing validity and reliability analyses of the data collection tools. It was further observed that they had high self-efficacy in discussing and presenting study findings to the reader in the reporting process, and low self-efficacy in writing the reporting process according to the testing of the hypotheses.

Keywords: Geography Education, scientific research, self-efficacy, reporting, data analysis, method, hypothesis, defining the problem.

Introduction

The integration of education and science is a fundamental phenomenon. Throughout history, human beings have tried to recognize, understand and/or make sense of their environment, as a result of which the knowledge has been accumulated and gained a scientific character. In the process of producing scientific knowledge, it is examined and evaluated in all aspects of the matter as a result of the determination of problem and the use of scientific methods (NA, 2014). Today, scientific knowledge is produced in various laboratories in various research centers, especially universities. The function of universities is to research and transfer the research results to students through education, and to try to improve social development. However, although universities emphasize developing the investigative characteristics of individuals, the content and quality of education are not compatible with that emphasis (Saracaloğlu, 2008, 180; Tasdemir, 2011).

Science has a significant impact on everyone's life, and it is expected to play an increasingly important role in the future of countries (Bowtwll, 1996). Today, the number of scientific studies on different subjects in different fields is increasing day by day. The purpose of theoretical research is to expand knowledge (Thebaud, 1978).

With the systematic development of science, many different methods have evolved. There are two types of scientific knowledge production: "Basic research" and "Applied research" (Oral and Çoban, 2020). The scientific method has certain standard processes that are assumed to be reliable (Karasar, 1999; Tavşancıl vd, 2010). Scientific knowledge production is as much related to the psychological and sociological state of the researcher as it should include originality and creativity rather than just a standard and routine process (Wilson, 1990). Researchers reach scientific results by compiling and analyzing data by applying a certain method to define the subject and problems they examine and to answer the questions they create. An analysis method used in inductive knowledge production is Meta-Analysis (Glass, 1976). Experimental studies are a priority in this analysis method, increasing the number of samples allows the result to have a wider scope of impact. As a result of the emerging inferences and theses, a scientific knowledge synthesis is generated as a result of comparison with the studies of other scientists (Aydoğdu et al., 2017).

Teachers with investigative characteristics contribute to individual development and research skills (Godson, 1994). Scientific thinking is the ability of an individual to solve a problem in a scientific, logical and consistent way. Scientific thinking is a process to establish hypotheses for the solution of the problem and to determine whether these hypotheses are correct or not. It is viewed as a testing process in a systematic way (Gündoğdu, 2001).

According to Stuessy (1984), scientific thinking is an individual's consistent, logical thinking applied to the solution of a problem. According to Geban (1990), the basic scientific processing skills are determining variables, identifying and expressing hypotheses, making funtional definitions, and interpreting results.

Self-efficacy affects the selection of activities, the effort and persistence of individuals, as well as expressing and motivating the individual's determination to do anything (Bandura, 1977; Kotaman, 2008). Students who lack self-confidence and doubt themselves work less and give up more easily than those who have confidence. The sense of motivation, which is supported with determination and belief, is an important internal factor that enables students to perform tasks with increasing learning ability. Through observational experiences and the projects they carry out, students gain information about their personal self-efficacy. Confidence

is gained through both psychological suggestions and physiological responses to evaluate self performance and self-efficacy. Guidance is another factor that increases motivation in this process. Therefore, the successful individual/student gains self-efficacy as a result of renewing his/her self-confidence. When all these are considered together, failure does not pose an obstacle for students since the problems/obstacles they encounter can be overcome with the formation of self-efficacy (Bandura, 1986).

Aim of the Study

The aim of the study is to examine the scientific research self-efficacy of geography teacher candidates at a state university in the Marmara region**.** As such, the following three key questions were asked**:**

These;,

1) What is the overall level of scientific research self-efficacy of geography teacher candidates?

2) Does it show a significant difference by gender?

3) Does it show a significant difference by grade level?

4) Does it show a significant difference depending on whether they have taken a research methods in education course or not?

5) What is the level of their self-efficacy regarding the dimensions of the Scientific Self-Efficacy scale?

Method

Research Design

In this study, the survey, one of the quantitative research designs, was used. The survey design reveals the knowledge of and attitudes toward a present or past phenomenon. In the general survey, in the universe consisting of more than one individual, a survey is carried out on a group of individuals to reach a general opinion about the universe (Karasar, 2011).

Research Sample

The universe of the research consists of the teacher candidates studying at the Department of Geography Education at Çanakkale Onsekiz Mart University, Faculty of Education, Department of Turkish and Social Sciences Education in the spring semester of the 2021-2022 academic year. The sample of the research consists of 72 teacher candidates in the same department (1,2,3 and 4th grades). Since n= N t2pq/ d2 (N-1)+t2pq=70 (Baş, 2003), the sample covers the universe. Since the universe of the research consists of 85 teacher candidates, the sample covers the universe. The sample of the study was determined randomly.

Data Collection Tool

In this study, the *Scientific Research Self-Efficacy Scale* developed by Akçöltekin (2019) was used. The measurement tool consists of 37 items and 6 dimensions in five-point Likert type. The sub-dimensions of the measuring tool are “Reporting” (Article 7), “Data Analysis” (Article 6), “Literature Review” (Article 7), “Method” (Article 6), “Determining hypotheses” (Article 5) and “identifying the problem” (Article 6), respectively. In this study, The Cronbach Alpha coefficient of the entire scale was calculated as 97. Akçöltekin (2019), on the other hand, determined the Cronbach Alpha reliability coefficient as 95.

Data Analysis

The data of the study were analyzed with statistical values such as arithmetic mean (x̄) and standard deviation (Ss). In addition, since the normality test was performed and calculated as skewness (-.52) and kurtosis (.36), it was determined that the research data showed a normal distribution (George and Mallery, 2010). T test and one-way Anova tests, which are among the parametric independent sampling tests, were also used.

Results

The findings obtained in the study were evaluated according to the independent variables and explained in tables.

Table 1. Geography Teacher Candidates' views on Scientific Self-Efficacy by arithmetic mean and standard deviation

Scale	x̄	ss
1	3,70	,71

According to Table 1, Geography Teacher Candidates' views on the subject of Scientific Self-Efficacy are mostly in the form of "I agree" (x̄=3,70). Thus, it can be said that Geography teacher candidates' perspectives on scientific self-efficacy are positive.

Table 2. Geography Teacher Candidates' views on Scientific Self-Efficacy by gender

Gender	N	x̄	ss	df	t	p
Women	36	3,67	.79	70	-381	.281
Men	36	3,73	.63			

When Table 2 is taken into account, the views of the Geography Teacher Candidates on the subject of Scientific Self-Efficacy do not vary significantly by gender. [t(70)=.-381, p>.05] On the other hand, male geography teacher candidates' views on scientific self-efficacy (x̄=3.73) are more positive than female geography teacher candidates.

Table 3. Geography Teacher Candidates' views on Scientific Self-Efficacy by year of study

Scale	Sum of Squares	Sd	Mean of Squares	F	p	Difference
Between Groups	,647	3	,216	,412	,745	-
In groups	35,60	68	,523			
Total	36,25	71				

When Table 3 is examined, the views of the Geography Teacher Candidates on the subject of Scientific Self-Efficacy do not show a significant difference in terms of year of study. [F(3,68) =.412, p>.05] In other words, it can be said that year is not an important variable that affects the Geography Teacher candidates' views on scientific self-efficacy.

Table 4. Geography teacher candidates' views on scientific self-efficacy by year of study

Year of study	Arithmetic Mean	Standard Deviation
1	3.7492	.68391
2	3.5420	.65455
3	3.7604	.65313
4	3.7696	84826

When the opinions of the Geography Teacher Candidates on the subject of Scientific Self-Efficacy were examined in terms of the grade level variable in Table 4, it was seen that the 4th year teacher candidates had the highest arithmetic average, and the 2nd year teacher candidates had the lowest arithmetic mean. In terms of standard deviation values, the highest value belongs to 4th year students, while the lowest value belongs to 2nd year students.

Table 5. Geography Teacher Candidates' views on Scientific Self-Efficacy in terms of "Taking the Educational Research Methods course".

Course	n	$\bar{x}$	Ss	df	p	t
I Do	51	3,77	.69	70	1.25	.214
I Don't	21	3,54	.75			

When Table 5 is examined, it does not show a significant difference in terms of the "Taking the Educational Research Methods course" variable regarding the views of the Geography Teacher Candidates on the subject of Scientific Self-Efficacy. [t(70)=1.25, p>.05] Therefore, it can be said that the teacher candidates who took the undergraduate course of *Educational Research Methods* have more positive views on the subject of scientific self-efficacy, but they do not show significant difference from those who did not take this course.

Table 6. The arithmetic mean and standard deviation results of Scientific research process of Geography Teacher Candidates about the self-efficacy levels

Article	Defining the Problem	$\bar{x}$	ss
1	I can identify the problem situation by observing the environment	3,87	,855
2	After identifying the problem situation, I can continue the research in this direction.	3,96	,813
3	I can conduct the process of identifying the problem situation individually	3,46	,903
4	When defining the problem situation, I consider that it will fill a gap in the relevant field.	3,94	,803
5	I can determine whether the problem situation has its original value	3,85	,883
6	I can identify the problem situation by considering the priorities and needs of the society.	4,11	,912
Article	Literature Review	$\bar{x}$	ss
7	I can analyze the literature in the context of the problem situation	3,61	,958

8	I can reveal originality of the problem situation with the literature review	3,54	,934
9	I have sufficient information about the purpose and rationale of the literature review	3,43	1,005
10	I can review the relevant literature with the help of keywords from appropriate databases	3,51	1,035
11	I can reveal the reasons of the problem situation with a literature review.	3,58	,989
12	I can access national and international databases for literature review.	3,40	1,146
13	I can transfer the information I obtained from the literature review according to the scientific rules	3,53	,978
Article	Identifying the Hypotheses	$\bar{x}$	ss
14	I make sure that the hypotheses are rational, clear and understandable.	4,08	,900
15	I can use the hypotheses as a guide to carry out other steps of the research	3,87	,887
16	I make sure the hypotheses are open to predictions, experiments and observations	4,03	,903
17	I make sure that the hypotheses are free of values and general judgments	4,01	1,014
18	I make sure that the hypotheses are testable.	4,03	,949
Article	Method	$\bar{x}$	ss
19	I can identify the appropriate method for testing hypotheses	3,94	,902
20	I can identify the limitations of the method I use	3,79	,978
21	I can determine the appropriate method to identify the study group (Universe/Sample)	3,76	,911
22	I can choose appropriate data collection tools for research.	3,81	,898
23	I can develop or adapt appropriate data collection tools for research	3,58	,915
24	I can do the validity and reliability analyses of the data collection tools that I will use in the research.	3,56	,948
Article	Data Analysis	$\bar{x}$	ss
25	I can test the assumptions of statistical analysis techniques I use in data analysis.	3,44	,977
26	I can make the data ready for the analysis I will apply	3,57	1,032
27	I can apply appropriate data analysis techniques (Quantitative/Qualitative) to test the hypotheses	3,63	1,106
28	I can statistically interpret the numerical statements I obtained during the data analysis phase	3,53	1,061
29	I can perform descriptive statistical operations (frequency, percentage, arithmetic mean, standard deviation, etc.) on data.	3,37	1,168
30	I can use qualitative and quantitative data analysis programs	3,50	1,101
Article	Reporting	$\bar{x}$	ss
31	I can interpret the tables in the program outputs that I obtained as a result of the analysis in the context of hypotheses	3,54	,963
32	I can interpret the program outputs that I obtained as a result of the analysis by tabulating	3,57	1,059
33	I can write the reporting process according to the testing of hypothesis(s).	3,46	1,087
34	I can complete the reporting process by considering the	3,69	1,030

	research as a whole.		
35	I can support the reporting process with current research findings	3,85	1,030
36	I can make suggestions based on the findings I obtained from the study in the reporting process	3,81	,944
37	I can discuss the study findings in the reporting process and present them to the reader	3,87	1,034

When Table 6 is examined; the highest average found with $\bar{x}$ = 3.96 was the 2nd item “After identifying the problem situation, I can continue the research in this direction.”, while the lowest average found with $\bar{x}$ = 3.46 was the 3rd item “I can conduct the process of identifying the problem stuation individually”.

According to the literature review dimension, the highest average with $\bar{x}$ = 3.61 was the 7th item “I can analyze the literature in the context of the problem situation”, while the lowest average found with $\bar{x}$ = 3.40 was the 12th item, “I can access national and international databases for literature review.”.

According to the identifying the hypotheses dimension, the highest average with $\bar{x}$ = 4,08 was the 14th item “I make sure that the hypotheses are rational, clear and understandable”, while the lowest average found with $\bar{x}$ = 3,87 was the 15th item “I can use the hypotheses as a guide to carry out other steps of the research”.

According to the method dimension, the highest average with $\bar{x}$ = 3,94 was 19th item “I can identify the appropriate method for testing hypotheses”, while the lowest average, with $\bar{x}$ = 3,56, was the 24th item “I can do the validity and reliability studies of the data collection tools that I will use in the research”.

According to the data analysis dimension, the highest average with $\bar{x}$ = 3,63 was 27th item “I can apply appropriate data analysis techniques (Quantitative/Qualitative) to test the hypotheses”, while the lowest average found with $\bar{x}$ = 3,37 was 29th item “I can perform descriptive statistical operations (frequency, percentage, arithmetic mean, standard deviation, etc.) on data”.

According to the reporting dimension, the highest average with $\bar{x}$ = 3,87 was the 37th item “I can discuss the study findings in the reporting process and present them to the reader”, while the lowest average found with $\bar{x}$ = 3,46 was 33th item “I can write the reporting process according to the testing of hypotheses”.

CONCLUSION

The results revealed that the Geography Teacher Candidates' views on the subject of Scientific Self-Efficacy were mostly in the direction of "I agree". Thus, it can be said that Geography teacher candidates' perspectives on scientific self-efficacy are positive. The views of the Geography Teacher Candidates on the subject of Scientific Self-Efficacy do not show a significant difference by gender. However, male geography teacher candidates' views on scientific self-efficacy are more positive than female geography teacher candidates.

Considering the difference in year of study, the views of the Geography Teacher Candidates on the subject of Scientific Self-Efficacy do not show a significant difference in terms of year. In other words, it can be said that the year variable is not an important variable that affects the Geography Teacher candidates' views on scientific self-efficacy. It does not show a significant difference in terms of the "Taking the Educational Research Methods course" variable regarding the views of the Geography Teacher Candidates who participated in the study and took the Educational Research Methods course on the subject of Scientific Self-Efficacy. Thus, it can be said that the teacher candidates who took the course of Educational Research Methods at the undergraduate level have more positive views on the

subject of scientific self-efficacy, but they do not show significant difference from those who did not take this course.

Based on the results, it can be said that the Geography Teacher Candidates have a high self-efficacy in continuing the research after determining the problem at the problem definition stage of the scientific research process within the scale. However, it was determined that they had low self-efficacy in defining the problem situation personally.

Regarding the literature review aspect of the research, it was revealed that Geography Teacher Candidates have high self-efficacy in examining the literature in the context of a problem situation, while they have low self-efficacy in accessing national and international databases for literature review.

The result obtained regarding the dimension of determining the hypotheses of the scale is that Geography teacher candidates have a high self-efficacy in paying attention to make make the hypotheses rational, open and understandable, while they have a low self-efficacy in using the hypotheses as a guide to carry out the other steps of the research.

According to the method dimension of the scale, Geography teacher candidates have a high self-efficacy in determining the appropriate method to test the hypotheses, and a low self-efficacy in doing the validity and reliability studies of the data collection tools they will use in the research.

Regarding the data analysis dimension, it can be said that Geography teacher candidates have a high self-efficacy in applying appropriate data analysis techniques (Quantitative/Qualitative) to test the Hypothesis(s),while they have low self-efficacy in performing descriptive statistical operations (frequency, percentage, arithmetic mean, standard deviation, etc.) on data.

As regards the reporting dimension of the scale, Geography teacher candidates have high self-efficacy in discussing and presenting the study findings to the reader during the reporting process, and low self-efficacy in writing the reporting process according to the testing of the hypotheses.

Based on the findings, the following suggestions can be made to guide future work:

1. Geography teacher candidates need to be more informed in terms of individually identifying the problem situation more accurately to increase their scientific research self-efficacy.
2. Geography teacher candidates need to be more informed in accessing national and international databases for literature reviews to increase their scientific research self-efficacy.
3. Geography teacher candidates need to be more informed about how they can use the hypotheses as a guide to carry out the other steps of the research to increase their self-efficacy in scientific research.
4. Geography teacher candidates should be more informed about the validity and reliability studies of the data collection tools they will use to increase their scientific research self-efficacy.
5. Geography teacher candidates should be more informed about their ability to perform descriptive statistical operations (frequency, percentage, arithmetic mean, standard deviation, etc.) on data to increase their self-efficacy in scientific research.

6. Geography teacher candidates should be informed in terms of preparing the reporting process of scientific research according to the testing of hypotheses to increase their scientific research self-efficacy.

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