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## **Pre-Service Teachers' Opinions about the Course on Scientific Research Methods and the Levels of Knowledge and Skills They Gained in This Course**

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*Abstract: The purpose of this study was to ascertain whether the pre-service teachers taking the Scientific Research Methods course attained basic research knowledge and skills. In addition, the impact of the process, which is followed while implementing the course, on the students' anxiety and attitude during the course is examined. Moreover, the study attempted to determine the pre-service teachers' self-efficacy beliefs in terms of doing scientific research. The study was carried out using an action research design. The sample of the study consisted of 27 pre-service teachers in the third year of the undergraduate program of Elementary Science Education in a state university in the northwest of Turkey. The study was completed in classes (each class lasting 50 minutes) in 14 weeks (two classes per week). The study data was collected with a questionnaire including nine open-ended questions in order to identify the opinions of the pre-service teachers about the course on Scientific Research Methods. A concept success test including short-answer, true-false, multiple-choice and open-ended questions were used in order to determine whether the course content was learnt by pre-service teachers. According to the research results, the pre-service teachers who took this course had decreased levels of anxiety towards doing scientific research. They stated that this course was important and necessary. It was found that this course ensured that the pre-service teachers gained some skills such as article writing, article review, and literature review.*

### **Introduction**

The issue of training teachers has gone through many changes in Turkey over the years. These changes can be accessed from Higher Education Council-YÖK, (2007). Within the framework of the Higher Education Council/World Bank and National Education Development Project, all undergraduate programs educating teachers have been standardized after the school year of 1997-1998. In order to raise a culture of research amongst the students of our country, the view of transforming the schools into project and research locations has been adopted. For this purpose, the course 'Scientific Research Methods' has been made a required course as of the first semester of the school year of 2006-2007 in the undergraduate teacher education courses. The goals of this course are to develop the scientific thinking skills of pre-service teachers, generate solutions for the encountered problems by using a scientific method, be able to do a research project even in a small scale, turn research results into a report and be able to present them in a scientific article.

According to McMillan and Schumacher (2006), scientific research is the process of data collection and the analysis of collected data in order to reach certain objectives. Pre-service teachers, should adopt the act of researching throughout their professional lives as a

lifestyle. The teachers are the ones who will raise a culture of research amongst students. Therefore, pre-service teachers are expected to gain the basic knowledge and skills within the scope of the course on Scientific Research Methods.

The culture of research, which is recognized as one of the basic characteristics of modern community, can be developed in individuals through education (Buyukozturk, 1997). It is of great importance to provide individuals with necessary knowledge and skills in order to help them conduct research. It is also necessary to ensure that individuals have positive attitude towards scientific research. Even though it is the main condition for individuals to have positive attitude towards research as well the above-mentioned research knowledge and skills, it is not yet sufficient for conducting successful research. According to Buyukozturk (1997), the individual's interest in the research field, the individual's values, and whether the individual considers the process as a threat to her/himself also affect the individual's researching. If the individual considers the process as a threat to himself, this reasons him to have a negative attitude towards the act of research. This negative attitude derives from a state of fear felt against the act of research (Buyukozturk, 1997).

When the literature is reviewed, some studies are found regarding the anxiety of research (e.g., Kracker, 2002; Kracker & Wang, 2002). Fear is a natural emotion, and it is different from anxiety (Yilmaz & Cokluk, 2010). According to Basaran (2005), anxiety is a complex emotion with an uncertain source.

Cokluk-Bokeoglu and Yilmaz (2005) defined the research anxiety as avoiding conducting research unless it is necessary, and feeling bored and uneasy when it is necessary to conduct research. They further stated that the situation may arise from becoming uneasy even due to the feeling of having to conduct research, and from lack of self-confidence for conducting research (Cokluk-Bokeoglu & Yilmaz, 2005).

According to Bandura (1982, p.122), research self-efficacy can be defined as the individual's belief in himself regarding whether he has the ability to do a scientific research (cited in Montcalm, 1999). According to Synder and Lopez (2002), self-efficacy is the inherent belief of an individual regarding whether he can perform the observed skills, not the perceived ones (cited Tuncer & Ozeren, 2012). According to Bieschke, Bishop, & Herbert (1995), this belief affects the research performance of the individual (cited in Bard, Bieschke, Herbert, & Eberz, 2000).

If the pre-service teachers do not adopt the understanding of research-based teaching, then the course on Scientific Research Methods, which they take during the undergraduate program, will be of no use to them (Tomakin, 2007). While the concept of researcher-teacher was first mentioned by Stenhouse (1975), the impacts of action research are seen in the development of this concept. With the action research, the teachers research whether the lectures they teach at schools are understood, the impact of course materials on learning process, the effectiveness of methods utilized, and the reasons of absenteeism by students (Tomakin, 2007).

## **The Purpose of the Study**

The most important reason of the recent progresses made in the field of science and technology is the scientific research (Korkmaz, Sahin, & Yesil, 2011). The educational institutions of the modern societies are expected to educate individuals that think scientifically, do research, ask questions, generate information, and share the information they generated (Demirbas & Yagbasan, 2005). The teachers working in contemporary society are expected to have sufficient knowledge and skills regarding scientific research and have a positive attitude towards scientific research as well (Korkmaz, Sahin, & Yesil, 2011). For this

reason, this study tries to ascertain whether the basic knowledge and skills are attained within the scope of the course on Scientific Research Methods. In addition, the impact of the procedure, which is followed while implementing the course, on the students' anxiety and attitude towards the course is examined. Besides, the study also tries to determine the pre-service teachers' beliefs regarding their self-efficacy in terms of doing a scientific research.

## Methodology

According to Cepni (2007), two action research models are known. In the first model, the research is done first, and the research results are implemented afterwards. In the second model, the implementation is made first and its results are supported by research afterwards. The first one is called the '*research action*', and second one is called the '*action research*' (Akbulut, 2010). The study takes the action research design as the basis. Action research is the process of thinking, reflecting, researching and acting carried out by individuals who want to be knowledgeable concerning their own occupational practices (Frost, 2002; p.25). In this study, action research was set as the research method because the researcher as a participant used his own class to define the problem, to make planning and implementation, and to evaluate the efficiency of the implementation. Research environment revealed whether pre-service teachers have gained basic knowledge and skills within the scope of Scientific Research Methods, and also indicated their anxiety levels and their attitudes towards the class. At the planning process to solve the problem, opinions were taken from faculty members who taught this course before, and we benefited from their lecture notes and teaching methods. The course was designed and carried out to be practical rather than theoretical. At the stage of evaluating the results, the researcher benefited from his own work environment.

## Sample of the Study

The sample of the study consisted of 27 pre-service teachers. They were in the third grade of the undergraduate program of Elementary Science Education in the fall semester of the school year of 2013-2014 in a state university in the northwest of Turkey, and they received the course on "Scientific Research Methods". The participants were selected through convenience sampling. For convenience sampling, individuals or groups who can participate more easily or who can be more easily contacted are preferred (Johnson & Christensen, 2004). All pre-service teachers that participated in the study were volunteers.

## Data Collection Tools

The study data was collected with the help of a questionnaire including nine open-ended questions in order to identify the opinions of the pre-service teachers about the course on Scientific Research Methods. While forming this questionnaire, the questionnaire forms utilized by Sozbilir, (2007) and Akgun (2012) were used. Questionnaire was administered to pre-service teachers at the end of 14 weeks. Pre-service teachers answered the questionnaire in writing. A concept success test including short-answer, true-false, multiple-choice and open-ended questions are used in order to determine whether the course content was learnt by pre-service teachers. The validity of the questionnaire (including nine open-ended questions) and concept success test were consulted by instructors who are experts in the field. Some modifications were made in terms of language and in the design of the questionnaire and

concept success test. Each item in the questionnaire and concept success test is included in data analysis section.

### **Procedure**

The implementation of the course continued for 14 weeks with 2 hours a week. The pre-service teachers that successfully complete this course are expected to access following gains:

- i. They can define the scope and basics of scientific research and the roles of researchers in this field.
- ii. They can define the terms and concepts frequently used in research along with the research types, design, methods and techniques.
- iii. They can access the research done, and they can benefit from them effectively.
- iv. They can examine a problem about education that can be the topic of a scientific research, and they can choose and design the proper research type, design method, and techniques.
- v. They can use data collection tools, and they can analyze the collected data on a basic level.
- vi. They can write a research report that complies with the research objectives and research questions in terms of content and that complies with APA writing rules in terms of form.
- vii. In addition, the pre-service teachers that successfully complete the course on Scientific Research Methods are expected to define validity, reliability and ethics in scientific research.

In the first week of the course on Scientific Research Methods, the students were informed on the course objective, content and gains. The content of the 14-week course on Scientific Research Methods contained such sections as:

- i. Science and basic concepts related to science (phenomenon, information, absolute, accurate, inaccurate, universal knowledge etc.),
- ii. Basic information regarding the history of science,
- iii. Structure of a scientific research,
- iv. Access to scientific knowledge,
- v. What is a research problem? How is it determined?,
- vi. Research approach design and types,
- vii. Universe and sampling,
- viii. Collecting data and data collection methods (qualitative and quantitative data collection techniques),
- ix. Recording data,
- x. Analyzing data,
- xi. Validity and reliability in a scientific research,
- xii. Interpreting and reporting data, and
- xiii. Scientific ethics and research ethics.

Within the 14-week process, the pre-service teachers were advised to read certain texts from the relevant literature so that they could come to the weekly classes prepared (e.g., Balci, 2009; Buyukozturk et al., 2010; Karasar, 2000; 2008; Yildirim & Simsek, 2006). Pre-

service teachers were asked to read those texts, come to the class prepared and participate in the discussions regarding the concepts mentioned in class. In addition, the pre-service teachers were asked to successfully complete six tasks during the implementation and prepare homework by the end of course. The pre-service teachers were told about how to access scientific knowledge in the third week. After that, the pre-service teachers were asked to review the existing scientific journals in the library or a peer-reviewed journal on internet, find two published articles on a topic related to science education, examine them in terms of form and content, and identify the main sections of the articles and the characteristics of each section (Task 1). In this way, the pre-service teachers were made to find out the general structure of a scientific article.

The pre-service teachers were informed about; What is a research problem? How is it determined? by the researcher. Then, they were asked to identify a problematic case that can be discussed in a research regarding science education and write a research question/s. They were advised to explain the justification for the research question (Task 2). The pre-service teachers were told about the data collection tools, and they were asked to identify the data collection tools suitable for the research problems for the research topics they wrote for Task 2 (Task 3). They were informed about universe and sampling, and they were asked to identify the universe and sampling suitable for the research problems for which they can collect data for their research topics (Task 4). After the pre-service teachers are informed about data analysis, they were asked to design how they would analyze the data that they would collect within the scope of the research (Task 5). After the topics of validity and reliability in scientific research were mentioned, the pre-service teachers were asked to identify how they would ensure the validity and reliability of their research (Task 6). Lastly, they were asked to prepare a research proposal by combining the above-mentioned tasks, which they carried out during the semester (Homework 1). It has been requested to pay attention that the research proposal involves introduction (definition of the problem, reason, survey questions and objective), literature review (compilation of literature), method (method, sample and selection process, data collection, analysis, reliability-validity, time planning), conclusion and discussion, and references (in the APA style).

## **Data analysis**

A descriptive analysis was conducted for the data obtained from the nine open-ended questions posed in order to identify the opinions of the pre-service teachers about the course on Scientific Research Methods. For this reason, a framework was formed for data analysis based on the nine open-ended questions; the data was organized according to the thematic framework that was formed; the organized data was defined; and the defined findings were announced (Yildirim & Simsek, 2006). Research data were organized and defined under specific themes (survey questions were used as themes) for readers. Descriptions were tried to be enriched by including direct quotations taken from the participants interviewed. In such an approach, it was ensured that the reader was provided with a descriptive approach through the obtained information, and the results were organized under specific themes. Frequency and percentage tables were formed by identifying the ratios of correct answers given by the pre-service teachers to the questions included in the concept success test, which was conducted to identify their level of understanding with respect to the concepts mentioned during the course on Scientific Research Methods. In addition, the answers were analyzed according to the categories of 'insufficient, partially sufficient, sufficient' while evaluating the open-ended questions 18 and 19, which were included in the concept success test.

## Results

### Results of the Questionnaire for Identifying the Students' Opinions about the Course on Scientific Research Methods

The data obtained from the answers given by each pre-service teacher to the open-ended questions seeking their opinions about the course on Scientific Research Methods were subjected to descriptive analysis, and tables were formed. The first question of the questionnaire determined whether the pre-service teachers experienced a state of anxiety at the start/middle/end of the course on Scientific Research Methods, and if so, what type of anxiety they experienced. Table 1 was formed in line with the answers of 27 participants. According to Table 1, majority of the pre-service teachers (70.3%) were more anxious in the middle of the implementation.

| Within the implementation process | f  | %    |
|-----------------------------------|----|------|
| At the start of the course        | 16 | 59.2 |
| In the middle of the course       | 19 | 70.3 |
| End of the course                 | 13 | 48.1 |

**Table 1: States of anxiety**

The matrix regarding whether each pre-service teacher experienced a state of anxiety at the start, middle and end of the course indicates: Seven pre-service teachers developed anxiety at the end of the course while they had none at the start, 12 pre-service teachers, who had anxiety at the start, had less anxiety towards the end of the course. In addition, with the help of this matrix, it is seen that six pre-service teachers were continually anxious during the course, and two pre-service teachers did not answer this question.

Regarding the reasons for feeling anxiety at the start of the course, the pre-service teachers stated that the course was a verbally lectured course, they did not know how the research would be done, they had no information on articles, they have never written articles, they had difficulty in finding topics for the homework, and they feared failing the course. For this situation, P<sub>4</sub>'s (Participant-4) opinion can be given as an example: *'The lecture seemed very complex at the start. Especially the homework was very difficult. I had a difficulty even in coming up with a topic for the homework I would prepare at the start'*.

In the middle of the course, as the course topics mounted, each topic brought some responsibilities for the pre-service teachers, and majority of the pre-service teachers interpreted this situation as the main reason for the increase in their anxiety. For example, after the lecture on data collection tools, the pre-service teachers had to decide which data collection tools they would use in their own project proposals and this created anxiety in them. Among the other reasons of anxiety experienced by the pre-service teachers in the middle of the course include: which statistical methods would be used for data analysis, how to analyze data in the SPSS 18.0 statistics program, getting closer to the time of article writing, being unable to decide on what to do exactly, and as a result, the concern of failing the course. For this situation, P<sub>8</sub>'s words can be given as an example: *'I was concerned that the questionnaire questions might be insufficient. I was afraid that I might have difficulties in using the SPSS program'*.

Towards the end of the course, the pre-service teachers started to understand that there was nothing to anxiety about as they learned the topics better and they understood what they were supposed to do exactly. For this situation, the examples are P<sub>6</sub>'s opinion *'I did not have anxiety because I learned the topics'* and P<sub>4</sub>'s opinion *'Towards the end of the course, since*

*the topic of my homework became very clear, I actually started to like it. I thought that the only problem at the start was not thinking simple”.*

The second question of the questionnaire asked which gains were attained through the analysis of two scientific articles during the course on Scientific Research Methods. In response to this question, 77.7% of pre-service teachers (21 participants) stated that they gained information on the sections of an article (abstract, introduction, the purpose of research, research questions, method, sampling, data collection tools, data analysis, findings, result-discussion, references and appendix). For this situation, the opinions of the following pre-service teachers can be given as examples: *I had never read articles before. I only heard the name of the article. I had no information regarding the content of an article. With the help of the analysis of two articles, I learned what the sections of an article are and what kind of statements were there in those sections (P<sub>18</sub>). I had no information regarding the sections of an article or the structure of an article before reviewing the articles. After the review, I gained information on articles (P<sub>5</sub>).*

The third question of the questionnaire tried to identify whether difficulties were experienced at the start and at the end of the course on Scientific Research Methods. Table 2 was formed in line with the answers of the pre-service teachers.

| <b>Within the implementation process</b> | <b>f</b> | <b>%</b> |
|------------------------------------------|----------|----------|
| At the start of the course               | 14       | 51.8     |
| End of the course                        | 16       | 59.2     |

**Table 2: States of difficulty**

The matrix regarding whether each pre-service teacher experienced any difficulties at the start and at the end of the course indicates that seven pre-service teachers experienced difficulties at the start but they did not have difficulty at the end. Nine pre-service teachers did not have difficulty at the start but they had difficulty at the end and seven pre-service teachers had difficulty both at the start and at the end of the course. And four pre-service teachers did not answer this question. The difficulties experienced at the start of the course were expressed as: not understanding the lecture (getting confused because the concepts mentioned in the course were verbal) and thus feeling bored of the lecture, not knowing what to do within the course and not being able to decide on the research topic. For this situation, the examples are P<sub>8</sub>'s opinion *'I had difficulty in deciding what I want to research. All in all, I wanted to have some ideas about the topic I would research'* and P<sub>18</sub>'s opinion *"The concepts of theoretical knowledge were very close to each other. I was afraid of confusing those concepts and I had difficulty in grasping those concepts"*.

At the end of the course, the pre-service teachers stated that they had difficulties in: doing research, forming data collection tools, analyzing the obtained data (the use of SPSS program), forming the findings section, writing the article and interpreting the results. For this situation, P<sub>15</sub>'s opinion can be given as an example. *"It is very difficult to write an article because we have no interaction such as reading or writing with articles before. It is really very difficult to make an analysis in SPSS"*.

Table 3 is formed with the answers given to the fourth question of the questionnaire. This question tried to identify how the pre-service teachers' opinions about doing graduate studies were affected by the course on Scientific Research Methods.

| <b>At the start of the course</b> | <b>End of the course</b> | <b>f</b> | <b>%</b> |
|-----------------------------------|--------------------------|----------|----------|
| Negative                          | Positive                 | 10       | 37.0     |
| Positive                          | Negative                 | 4        | 14.8     |
| Negative                          | Negative                 | 6        | 22.2     |



|             |          |   |      |
|-------------|----------|---|------|
| Positive    | Positive | 1 | 3.7  |
| Unspecified |          | 6 | 22.2 |

**Table 3: Opinions for getting graduate education**

Table 3 indicates that the negative attitude towards doing graduate studies turned into a positive one in 37% of pre-service teachers. For this situation, P<sub>1</sub>'s opinion can be given as an example: *“Taking the course on Scientific Research Methods has changed my perspective about doing graduate studies. That is, I did not want to bother with graduate studies because I thought it was difficult to handle such articles, thesis etc. studies. After taking this course, I learned that it was easy to write an article. This course has affected me in a way enabling me to write an article on any matter”*.

It was found that the initial positive attitude towards doing graduate studies turned into a negative one in 14.8% of pre-service teachers. For this situation, P<sub>3</sub>'s opinion can be given as an example: *‘Taking the course on Scientific Research Methods has changed my perspective about getting graduate education. I was thinking about getting graduate education. Now I am definitely not considering it’*. It was found that the initial negative attitude towards doing graduate studies did not change in 22.2%, and the initial positive attitude towards doing graduate studies did not change in 3.7%. 22.2% of participants did not express an opinion.

The fifth question of the questionnaire was ‘Do you think that the course on Scientific Research Methods is important and necessary?’ In response to that question, the majority (88.8%) of the pre-service teachers stated that it was important and necessary. The pre-service teachers (11.2%) did not express an opinion on this matter. 48.1% of the pre-service teachers, who considered the course important and necessary, expressed that this course was important and necessary for the people who would consider getting a graduate education or having an academic career.

Table 4 was formed in line with the answers of the pre-service teachers to the question ‘Which studies do you consider are the least/the most useful ones among the studies you carried out within the scope of the course on Scientific Research Methods?’ Table 4 indicates that 59.2% of the pre-service teachers found article writing useful, 44.4% found article analysis useful and 29.6% found literature review useful.

| Categories                                | The least |      | The most |      |
|-------------------------------------------|-----------|------|----------|------|
|                                           | f         | %    | f        | %    |
| Article writing                           | 2         | 7.4  | 16       | 59.2 |
| Course content (slides), book information | 3         | 11.1 | 3        | 11.1 |
| SPSS                                      | 1         | 3.7  | 1        | 3.7  |
| Article comparison                        | 2         | 7.4  | 7        | 25.9 |
| Collect the data                          | 1         | 3.7  | 3        | 11.1 |
| Literature review                         | 3         | 11.1 | 8        | 29.6 |
| Data collection tools                     | ---       | ---  | 2        | 7.4  |
| Data analysis                             | ---       | ---  | 4        | 14.8 |
| Results and discussion                    | ---       | ---  | 1        | 3.7  |
| No                                        | 15        | 55.5 | ---      | ---  |
| Article analysis                          | ---       | ---  | 12       | 44.4 |

**Table 4: Studies considered the least/the most useful**

The seventh question of the questionnaire was “Which knowledge and skills that you learned in this course, do you think, you can use in your professional life? Why?” Table 5 was formed in line with the answers of the pre-service teachers.

| Categories                                | f  | %    |
|-------------------------------------------|----|------|
| Literature review                         | 10 | 37.0 |
| Data analysis                             | 6  | 22.2 |
| Graduate                                  | 6  | 22.2 |
| Article writing                           | 3  | 11.1 |
| SPSS                                      | 3  | 11.1 |
| Article comparison                        | 3  | 11.1 |
| Data collection tools                     | 2  | 7.4  |
| Results and discussion                    | 2  | 7.4  |
| Article analysis                          | 2  | 7.4  |
| I do not think                            | 2  | 7.4  |
| Course content (slides), book information | 1  | 3.7  |

**Table 5: Knowledge and skills that can be used in the professional life**

Table 5 indicates that the pre-service teachers expressed that they could use the literature review skill, which they gained in this course, in their professional lives. For this situation, the following opinions of the pre-service teachers can be given as examples: *“Searching articles, studying them and researching a topic will be very useful for us in the future. The topics taught in the course will contribute to us”* P<sub>15</sub>. *“I can identify the success levels of the students in the future by using the methods and analyses I learned in this course. I think that I can research and implement the topic of how to increase success”* P<sub>4</sub>. *“It will only be useful and helpful if I get a graduate education”* P<sub>7</sub>.

The eighth question of the questionnaire aiming at identifying the opinions of the pre-service teachers was *“How do you assess the state of having the opportunity to review the work of others, as a person who both teaches and research, when you become a teacher?”* The answers to this question indicated that 59.2% of pre-service teachers think that following the work of others would be useful for them. For this situation, P<sub>7</sub>'s opinion can be given as an example: *“Considering that someone else might know better, we can learn the things that we are misinformed or not informed about by reviewing the work of other teachers”*.

The last question of the questionnaire aiming at identifying the opinions of the pre-service teachers sought to detect the attitudes of the pre-service teachers towards the course on Scientific Research Methods in the aftermath of the implementation. It was found that 48.1% of pre-service teachers had a positive attitude towards the course. For this situation, P<sub>19</sub>'s opinion can be given as an example *“I had a positive attitude because I learned the topics I had not known”*. On the other hand, 3.4% of the pre-service teachers had negative attitudes, and 40.7% had both positive and negative attitudes. P<sub>2</sub>'s opinion *“It developed my research skill. I learned how to write an article”*, indicates a positive attitude while his opinion *“There was not much time left for the other courses because we spent a lot of time with this”* indicates a negative attitude. 7.4% of the pre-service teachers did not express an opinion on this matter.

### Results of the Concept Success Test

After the implementation, a concept success test was applied in order to identify the knowledge level of the pre-service teachers regarding the concepts mentioned during the course on Scientific Research Methods. This test included one short-answer question, one true-false question, 15 multiple-choices and two open-ended questions amounting to a total of 19 questions. The findings obtained by analyzing the answers given by the 27 pre-service teachers to those questions are presented below.

**Results Regarding the Short-Answer Questions**

In the concept success test, one short-answer question inquired whether the pre-service teachers knew of eight concepts. Table 6 is formed in line with the answers given by the pre-service teachers to the questions in this section.

| Correct answers                                                                         | Questions                                                                                                                               | f  | %    |
|-----------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------|----|------|
| a) Structured interviews<br>b) Semi-structured interviews<br>c) Unstructured interviews | There are three types of interviews based on the structuring of the interview. Those are:                                               | 17 | 62.9 |
| Questionnaire                                                                           | _____, one of its strong aspects is that it enables collecting data from big samplings.                                                 | 19 | 70.3 |
| Universe                                                                                | The big group for which the research results will be valid for is defined as _____                                                      | 22 | 81.4 |
| Classification                                                                          | _____ scale is used to group the people, events or other objects that share the same features.                                          | 22 | 81.4 |
| Ranking                                                                                 | _____ scale is ranking the objects or individuals from the highest to the lowest according to the extent of their having a feature.     | 22 | 81.4 |
| Content                                                                                 | _____ analysis requires the in-depth analysis of collected data, and it enables revealing the previously unclear themes and dimensions. | 9  | 33.3 |
| Reliability                                                                             | _____ is related to the repeatability of research results.                                                                              | 6  | 22.2 |
| Document review                                                                         | _____ covers the analysis of written materials including information on the phenomenon/s to be researched.                              | 7  | 25.9 |

**Table 6: Results regarding the short-answer questions**

Table 6 indicates that the first question seeks short answers for the eight concepts it asks. It also indicates that the ratios of correct answers given by the pre-service teachers vary between 22.2% and 81.4%.

**Results Regarding the True-False Questions**

The second question of the concept success test is a true-false question, and it includes five statements. Table 7 is formed in line with the answers given by the pre-service teachers to the questions in this section.

| Correct answers | Questions                                                                                                                                                      | f  | %    |
|-----------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------|----|------|
| True            | One of the sources of error that decreases the questionnaire's power is the sampling error.                                                                    | 25 | 92.5 |
| False           | T-test compares the average scores from three different groups.                                                                                                | 17 | 62.9 |
| True            | Descriptive analysis frequently allows for direct quotations in order to reflect the opinions of the interviewed or observed individuals in a striking manner. | 24 | 88.8 |
| False           | Observation is an investigation carried out in order to receive the information, experiences and thoughts of various people about a problem.                   | 19 | 70.3 |
| True            | Research design is a plan developed by the researcher for the purpose of answering the research questions or testing the hypotheses of the research.           | 26 | 96.2 |

**Table 7: Results regarding the true-false questions**

Table 7 indicates that the second question, which is a true-false question, includes five statements. It also indicates that the ratios of correct answers given by the pre-service teachers for those five statements vary between 62.9% and 96.2%.

**Results Regarding the Multiple-Choice Questions**

A total of 15 questions, which are given between the 3-17<sup>th</sup> questions in the concept success test, are multiple-choice questions. Table 8 indicates the ratios of correct answers given to each question in line with the answers of pre-service teachers to the questions in this section.

|   | Q3   | Q4   | Q5   | Q6   | Q7   | Q8   | Q9   | Q10  | Q11  | Q12  | Q13  | Q14  | Q15  | Q16  | Q17  |
|---|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|
| f | 25   | 16   | 21   | 21   | 23   | 12   | 10   | 17   | 11   | 20   | 17   | 18   | 13   | 10   | 17   |
| % | 92.5 | 59.2 | 77.7 | 77.7 | 85.1 | 44.4 | 37.0 | 62.9 | 40.7 | 74.0 | 62.9 | 66.6 | 48.1 | 37.0 | 62.9 |

**Table 8: Results regarding the multiple-choice questions**

Table 8 indicates that the ratios of correct answers given to multiple-choice questions vary between 37.0% and 92.5%.

It is seen that the majority of pre-service teachers gave the correct answer to the third question, which asked “*the dependent variable (scientific method process skills) in a research where a teacher examines the impact of using the performance evaluation approach during science education on the scientific method process skills of students*” (92.5%). One pre-service teacher (3.4%) replied that the dependent variable is teacher and one pre-service teacher (3.4%) replied that the dependent variable is performance evaluation. On the other hand, the seventh question is a similar question about variables. It reads as “*A class teacher wants to research whether the social and club activities at school (sports club, theater society etc.) have an impact on the students’ fondness (attitude) of the school. What kind of variable is students’ fondness in this study?*”? The majority of the pre-service teachers gave the correct answer (dependent variable) to this question (85.1%). The pre-service teachers (14.9%) replied this question as independent variable.

The concept success test included two questions inquiring whether the pre-service teachers know the research approaches (question 4 and 8). The fourth question was “*Which one of those below is not a type of mixed research?*” 59.2% of the pre-service teachers replied this correctly (descriptive). Pre-service teachers (7.4%) marked exploratory, 7.4% marked triangulation, 11.1% marked embedded design, and 14.8% marked explanatory-confirmative, which were all wrong answers. The eighth question was “*Which one of those below is not one of the interactive qualitative research designs?*” 44.4% of the pre-service teachers replied this correctly (historical research). Pre-service teachers (7.4%) marked culture analysis, 11.1% marked phenomenology study, 18.5% marked case study, and 18.5% marked grounded theory, which were all wrong answers.

The pre-service teachers (77.7%) gave the correct answer (necessary plan and actions to conduct a study) to the fifth question, which asked, “*What does a research design or method explain/present in a study?*” While answering this question 7.4% of the pre-service teachers marked the statistical analysis of data, 7.4% marked the justifications for the study based on previous studies, and 7.4% marked the intention of the researcher, which were all wrong answers. The sixth question asked, “*Which of the given statements is true for the data collection and analysis in quantitative research*”, and 77.7% of the pre-service teachers gave the correct answer (data is defined statistically). While answering this question, 3.4% of the pre-service teachers marked prior data source is the data obtained from observations, 7.4%

marked data is rather in the form of words and sentences and 7.4% marked data sources include documents, which were all wrong answers. The 16<sup>th</sup> question of the concept success test was “*Which one of those below is not one of the planning stages for the quantitative research?*”, and 37% of the pre-service teachers gave the correct answer (data coding). 18.5% of the pre-service teachers marked reporting, 22.2% marked selecting the problem and 22.2% marked interpreting data, which were all wrong answers.

The concept success test included two questions aiming at identifying whether the pre-service teachers knew that hypothesis is a proposition, which is asserted to be tested for explaining the observations made in a scientific research, of which limits are clearly drawn, and which are open to verification or falsification. The 10<sup>th</sup> question asked, “*Which of the given statements is false for hypothesis*”, and 62.9% of the pre-service teachers gave the correct answer (It increases partiality in research). The pre-service teachers (7.4%) marked it systematizes data collection, 7.4% marked it ensures that the opinions and concepts are tested, and 18.5% marked it is a temporary means of solution for the problem, which were all wrong answers. On the other hand, the 15<sup>th</sup> question of the concept success test was “*Which one of the following concepts does the statement: Students in Group A, who took the course on Scientific Research Methods, are more successful than the students in Group B*”. The pre-service teachers (48.1%) gave the correct answer (research hypothesis). The pre-service teachers (3.4%) marked a problem, and 48.1% marked statistical hypothesis, which were wrong answers.

The 11<sup>th</sup> question of the test asked, “*What is the name of the process of selecting, by any method, the cluster of units in a universe that are fit-for-purpose and that can represent the universe*”, and 40.7% of the pre-service teachers gave the correct answer (sampling). The pre-service teachers (3.4%) marked study universe, and 51.8% marked sample, which were wrong answers. On the other hand, the 13<sup>th</sup> question of the concept success test asked about “*the study universe of a researcher, who was working at Bartin University and who wanted to make a research on the female students in the undergraduate program of science teaching in the school year of 2013-2014*”, and 62.9% of the pre-service teachers gave the correct answer.

The 14<sup>th</sup> question of the test asked, “*What is the name of the section in the research report, where the differences and similarities between the obtained research findings and the findings of similar research are presented.*”, and 66.6% of the pre-service teachers gave the correct answer (discussion). For this question, 7.4% of the pre-service teachers marked method, 11.1% marked introduction, and 14.8% marked findings, which were all wrong answers. The 17<sup>th</sup> question of the concept success test asked, “*Which one of the following concepts does the statement: In the research, there was no significant difference between teachers’ genders and their computer self-efficacy*”. The pre-service teachers (62.9%) gave the correct answer (finding). The pre-service teachers (3.4%) marked data, 3.4% marked hypothesis, and 29.6% marked report, which were all wrong answers.

The ninth question of the test asked, “*What is the name of the act of using the sentences of another author in exactly the same way, without quotation marks or without making a reference*”, and 37% of the pre-service teachers gave the correct answer (plagiarism). The pre-service teachers (48.1%) marked citation, and 14.8% marked cited. Lastly, the 12<sup>th</sup> question of the test asked, “*According the APA rules, which of those below is not included while citing a source in reference?*”, and 74.0% of the pre-service teachers gave the correct answer (author’s degree). The pre-service teachers (22.2%) marked the place of publication, and 3.7% marked the name of the publication, which were wrong answers.

**Results Regarding the Open-Ended Questions**

There were two open-ended questions in the concept success test. One of those questions was ‘*What is literature review? Please explain how literature review is done in a research by stating the possible types of information sources for a scientific research to be made (literature review).*’. The pre-service teachers’ answers to this question were scored as follows: insufficient-0 point, partially sufficient-1 point, and sufficient-2 points. Table 9 was formed in line with the answers of the pre-service teachers.

| Categories                                   | Insufficient (0) |      | Partially sufficient (1) |      | Sufficient (2) |      | Total |     |
|----------------------------------------------|------------------|------|--------------------------|------|----------------|------|-------|-----|
|                                              | f                | %    | f                        | %    | f              | %    | f     | %   |
| Literature review                            | 5                | 18.5 | 5                        | 18.5 | 17             | 62.9 | 27    | 100 |
| Information sources                          | 8                | 29.6 | 18                       | 66.6 | 1              | 3.4  | 27    | 100 |
| How literature review is done in a research? | 14               | 51.8 | 8                        | 29.6 | 5              | 18.5 | 27    | 100 |

**Table 9: Results of the literature review**

The final question of the concept success test asked pre-service teachers to write a research proposal. The following case was fictionalized regarding the research proposal that they were asked to write: *Suppose that you work as a Science and Technology teacher in the Hendekyanı Secondary School. You teach Science and Technology in two different classes (Classes 6A and 6B). You teach the topic of Granular Structure of Matter, which is taught to the 6 graders, through the Problem-Based Learning Method to the students in Class 6A and through the Conventional Teaching Method to the students in Class 6B. You wonder how those two learning/teaching methods affect your students’ level of understanding the concepts lectured under the topic of Granular Structure of Matter and their attitude towards the Science and Technology class. As a researcher-teacher, you decide to carry out a research. How would you implement this research? While writing your research proposal, consider the following subtitles and make sure that the subtitles comply with each other. [Subtitles: objective sentence for the study, research questions or hypothesis in the study (at least two), research methods and the rationale for selecting this method, data collection tools and content, sample for the study, the rationale for using the selected type of sampling, analyzing data, validity and reliability of the research].* The pre-service teachers’ answers to this question were scored as follows: insufficient-0 point, partially sufficient-1 point, and sufficient-2 points. Table 10 was formed in line with the answers of the pre-service teachers.

| Categories                       | Insufficient (0) |      | Partially sufficient (1) |      | Sufficient (2) |      | Total |     |
|----------------------------------|------------------|------|--------------------------|------|----------------|------|-------|-----|
|                                  | f                | %    | f                        | %    | f              | %    | f     | %   |
| The purpose of the study         | 5                | 18.5 | 14                       | 51.8 | 8              | 29.6 | 27    | 100 |
| Research questions or hypothesis | 5                | 18.5 | 13                       | 48.1 | 9              | 33.3 | 27    | 100 |
| Method                           | 15               | 55.5 | 5                        | 18.5 | 7              | 25.9 | 27    | 100 |
| Data collection tools            | 3                | 11.1 | 20                       | 74.0 | 4              | 14.8 | 27    | 100 |
| Sample                           | 2                | 7.4  | 3                        | 11.1 | 22             | 81.4 | 27    | 100 |
| Data analysis                    | 6                | 22.2 | 16                       | 59.2 | 5              | 18.5 | 27    | 100 |
| Validity and reliability         | 16               | 59.2 | 11                       | 40.7 | ---            | ---  | 27    | 100 |

**Table 10: Results related to the sections of the research report**

Table 10 indicates that while forming the sections of the research report, the pre-service teachers were sufficient in the field of sampling (81.4%) at the most, and they were insufficient in the field of validity and reliability at the most.

## Discussion and Suggestions

In this study, opinions of the pre-service teachers about the course on Scientific Research Methods are identified. The opinions of the pre-service teachers are about: their anxiety levels related to the course, the difficulties they experienced in the process, their attitudes towards the course, and whether they considered this course important. In addition, it examined whether the course had an impact on the pre-service teachers' opinions about getting graduate education and the self-efficacy levels related to this course. According to the research results, the pre-service teachers that took this course had decreased levels of anxiety towards doing scientific research. In their study, Cokluk-Bokeoglu and Yilmaz (2005) found that whether the students participated in any research activity before students' does not make a difference in their research anxiety. It is also reported by Cokluk-Bokeoglu and Yilmaz (2005) that the students that participated in a research activity before had higher self-confidence scores. According to Yilmaz and Cokluk (2010), the research anxiety of the graduates of the science and literature faculties does not change based on gender, age, university, undergraduate program, the state of having taken statistics course and the state of having prepared an undergraduate project or thesis. It is also reported that a change occurs in anxiety based on the state of having taken a course related to scientific research methods. According to Buyukozturk (1997), the proof of the validity of the research anxiety scale, is that the anxiety state is lesser in graduate students, who took more research courses and who had the chance to carry out various research practices in their courses.

This study determined that the pre-service teachers have a medium-level attitude towards doing research. In addition, it was seen that the pre-service teachers experienced several difficulties from time to time within the scope of the course but they stated that this course was important and necessary. It was also found that the course raised a positive opinion in students towards getting graduate education, and it had a positive impact on their self-efficacy belief levels as well. It has been suggested that doing master's degree to follow educational research and improve the level of understanding and putting into practice, or becoming knowledgeable about scientific research processes and results through in-service training, and working in cooperation with researchers will contribute to teachers' research skills (Broekkamp & van Hout- Wolters, 2007; Vanderlinde & van Braak, 2010). In their study, Ayaydin and Kurtuldu (2010) found that the students of the Department of Fine Arts Education had a medium-level attitude towards the course on Scientific Research Methods. It was also reported that the students believed that the course was important and necessary. In their study, Kurt, Izmirli, Firat and Izmirli (2011) reported that compared to the male students, female students had a more positive opinion that the Course on Scientific Research Methods developed their problem solving and scientific thinking skills. In addition, it was also stated that compared to the male students, the female students had a more positive opinion regarding the importance of the course and of the knowledge provided in the course that would be useful to them. In their study, Tuncer and Ozeren (2012) developed a scale for detecting the self-efficacy levels of the students with respect to doing scientific research. This scale had a sub-dimension of literature self-efficacy, where a significant difference is detected between the male and female students in favor of the female students.

This study also tried to find out what kind of skills and knowledge the pre-service teachers gained within the scope of the course. It was found that this course ensured that the pre-service teachers gained some skills such as article writing, article review, and literature review. It was seen that they expressed that when they become teachers, they would use particularly the literature review skill, which they gained during their undergraduate studies. Moreover, it was seen that the majority of the pre-service teachers correctly answered several questions in the concept success test (dependent-independent variable, hypothesis, sampling,

discussion, finding, APA), and they had difficulties with some questions (content analysis, reliability, document analysis, plagiarism). Sozbilir (2007)'s study states that it is important for pre-service teachers to be able to prepare a scientific research project proposal, even in a small scale as a learning activity and be able to understand the important concepts related to research methodology.

It is of great importance that pre-service teachers meet scientific research throughout their teacher training and, carry out small-scale projects to develop their skills for following educational research, improving their level of understanding and putting into practice (Sozbilir, 2007). Scientific Research Methods course, which has been a compulsory course for the teacher training programs in Turkey, should be carried out as practical rather than theoretical. It must also be ensured that pre-service teachers have the understanding of teachers as researchers, and the importance of educational research must be emphasized at teacher training programs so that pre-service teachers could comprehend its importance and have positive attitudes towards educational research.

**Note:** P and Q for stand Participant and Questionnaire respectively.

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