Profile of Pre-Service Science Teachers Based on STEM Career Interest Survey

N Winarno1, 2*, A Widodo3, D Rusdiana4, D Rochintaniawati2 and R M A Afifah5

1Postgraduate School, Universitas Pendidikan Indonesia, Bandung, Indonesia
2Department of Science Education, Universitas Pendidikan Indonesia, Bandung, Indonesia
3Department of Biology Education, Universitas Pendidikan Indonesia, Bandung, Indonesia
4Department of Physics Education, Universitas Pendidikan Indonesia, Bandung, Indonesia
5Taruna Bakti School, Bandung, Indonesia

*E-mail: nanang_winarno@upi.edu

Abstract. This study aims to investigate the profile of pre-service science teachers based on STEM (Science, Technology, Engineering, and Mathematics) Career Interest Survey. The study uses descriptive survey method as the research design. Samples collected from 66 pre-service science teachers in a university located in Bandung, Indonesia. The results of the study are the profile of pre-service science teachers based on STEM Career Interest Survey shows that the average number of career interest in the field of technology is 4.08, in science 3.80, mathematics 3.39 and engineering 3.30. Pre-service science teachers are found to have interests in the STEM career fields. This research is necessary as there are many instances of people choosing majors or studies that are not in accordance with their interests and talents. The recommendation of this study is to develop learning in pre-service science teachers by using STEM approach.

1. Introduction

STEM education is an approach that aims to integrate four different disciplines that includes science, technology, engineering and mathematics [1]. Science and technology are developing rapidly. Many studies that are related to STEM education is needed to be conducted in order to provide students with skills for their future [2]. STEM can be a pioneer in innovation and increase the economy growth, but many students are less interested on major and career in the field of STEM [3]. Based on the previous studies, STEM is used as an approach in learning and integrating with learning models such as project based learning [4], project based inquiry learning [5] and problem based learning [6]. STEM is also used as a learning approach to measure student’s achievement [7], high school student perceptions [8], science teacher’s perceptions [9] and student’s attitude [10].

There are also some studies related to STEM Career Institute Survey (STEM-CIS) that some of them describes the low socioeconomic status student’s STEM Career Interest [11] and related also with student perceptions of STEM content and careers [12]. Another study discusses about educational research and development (R&D) in the field of STEM Career Interest Survey that aims in developing and validating the instruments [13-14]. Even though there has been a study in the field of STEM...
Career Interest Survey, there is still no study that discusses about pre-service science teacher based on STEM Career Interest Survey. On this study, the intention will be more on investigating about career interest from pre-service science teachers for their future, while the previous study only focuses on samples from teachers and students in school. Moreover, the results of this study are described in details in each field of science, technology, engineering and mathematics. These findings also equipped with explanations about the dominant interest of career field, explaining and sort the average number into ranks based on each fields from the highest to the smallest and testing the difference from each of the four fields by statistics test.

2. Method
The research design to conduct this study is by using descriptive survey method [16]. The samples were taken from pre-service teachers in a university located in Bandung, Indonesia. The samples of the research were 66 pre-service science teachers that include 60 female and 6 male. These samples come from 4 classes, the 1st class (class of 2016), 2nd class (class of 2015), 3rd class (class of 2014) and 4th class (class of 2013). The data collection was conducted in March – April 2017. The age of the samples ranges from 17 – 22 years of age. The data sample that is used in this study listed in the table 1.

| Field of Science | N  | Min | Max | Average | Rank | Sd   |
|------------------|----|-----|-----|---------|------|------|
| S1               |    |     |     |         |      |      |
| S2               |    |     |     |         |      |      |
| S3               |    |     |     |         |      |      |
| S4               |    |     |     |         |      |      |
| S5               |    |     |     |         |      |      |

Instrument test in this study is an adaptation from Kier [15]. The instrument consists of 4 fields of study: science, technology, engineering and mathematics. Each field of study consists of 11 question items with the total of 44 question items. Sections that are used on each question by choosing one among the five answer choices are: Strongly Disagree (1), Disagree (2), Neutral (3), Agree (4), Strongly Agree (5). This instrument is given to pre-service science teachers to answer the questions and later the result will be analyzed. The result of the analysis is to investigate the profile from pre-service science teacher according to STEM Career Interest Survey.

3. Result and Discussion
STEM Career Interest Survey divided into four field of study: science, engineering, technology and mathematics. Each field of study consists of 11 question items. The profile from pre-service science teachers based on STEM Career Interest Survey in the field of study: science listed on table 2, engineering on table 3 and technology on table 4.
### Table 3. Pre-service science teachers profile based on STEM career interest survey in the field of technology

| Field of Science | N  | Min | Max | Average | Rank | Sd   |
|------------------|----|-----|-----|---------|------|------|
| S6               | 66 | 1   | 5   | 3.97    | 4    | 11.71|
| S7               | 66 | 1   | 5   | 3.63    | 7    | 12.26|
| S8               | 66 | 1   | 5   | 3.98    | 3    | 13.42|
| S9               | 66 | 1   | 5   | 3.53    | 9    | 10.76|
| S10              | 66 | 1   | 5   | 3.62    | 8    | 12.15|
| S11              | 66 | 1   | 5   | 3.33    | 11   | 08.07|
| **AVERAGE**      |    |     |      | 3.80    |      | 12.15|

| Field of Technology | N  | Min | Max | Average | Rank | Sd   |
|---------------------|----|-----|-----|---------|------|------|
| T1                  | 66 | 1   | 5   | 3.92    | 7    | 13.18|
| T2                  | 66 | 1   | 5   | 4.20    | 4    | 13.88|
| T3                  | 66 | 1   | 5   | 4.40    | 3    | 12.54|
| T4                  | 66 | 1   | 5   | 4.52    | 2    | 13.05|
| T5                  | 66 | 1   | 5   | 4.57    | 1    | 13.20|
| T6                  | 66 | 1   | 5   | 3.67    | 10   | 16.41|
| T7                  | 66 | 1   | 5   | 4.17    | 5    | 13.31|
| T8                  | 66 | 1   | 5   | 4.12    | 6    | 15.45|
| T9                  | 66 | 1   | 5   | 3.78    | 9    | 11.78|
| T10                 | 66 | 1   | 5   | 3.92    | 8    | 13.59|
| T11                 | 66 | 1   | 5   | 3.65    | 11   | 08.35|
| **AVERAGE**         |    |     |      | 4.08    |      | 13.16|
Table 4. Pre-service science teachers profile based on STEM career interest survey in the field of engineering

| Field of Engineering | N   | Min | Max | Average | Rank | Sd   |
|----------------------|-----|-----|-----|---------|------|------|
| E1                   | 66  | 1   | 5   | 3.18    | 9    | 13.31|
| E2                   | 66  | 1   | 5   | 3.35    | 5    | 13.95|
| E3                   | 66  | 1   | 5   | 3.18    | 6    | 15.13|
| E4                   | 66  | 1   | 5   | 3.38    | 4    | 13.03|
| E5                   | 66  | 1   | 5   | 3.57    | 2    | 11.61|
| E6                   | 66  | 1   | 5   | 3.18    | 8    | 12.87|
| E7                   | 66  | 1   | 5   | 3.03    | 11   | 12.85|
| E8                   | 66  | 1   | 5   | 3.18    | 7    | 12.15|
| E9                   | 66  | 1   | 5   | 3.12    | 10   | 12.62|
| E10                  | 66  | 1   | 5   | 3.45    | 3    | 11.65|
| E11                  | 66  | 1   | 5   | 3.67    | 1    | 07.43|
| **AVERAGE**          |     |     |     | 3.30    |      | 12.42|

Table 5. Profile of pre-service science teachers based on STEM career interest survey in the field of mathematics

| Field of Mathematics | N   | Min | Max | Average | Rank | Sd   |
|----------------------|-----|-----|-----|---------|------|------|
| M1                   | 66  | 1   | 5   | 3.27    | 7    | 12.32|
| M2                   | 66  | 1   | 5   | 3.55    | 3    | 12.76|
| M3                   | 66  | 1   | 5   | 3.30    | 5    | 11.28|
| M4                   | 66  | 1   | 5   | 3.92    | 2    | 12.56|
| M5                   | 66  | 1   | 5   | 4.05    | 1    | 13.52|
| M6                   | 66  | 1   | 5   | 3.40    | 4    | 16.24|
| M7                   | 66  | 1   | 5   | 3.23    | 8    | 10.89|
| M8                   | 66  | 1   | 5   | 3.28    | 6    | 12.89|
| M9                   | 66  | 1   | 5   | 3.12    | 9    | 09.20|
When I talk to people who work in the field of mathematics I feel comfortable

I know that there is someone in my family who uses mathematics in his career

Based on these data, the comparisons between the field of science, technology, engineering, and mathematics can be illustrated with a diagram. The diagram showing the profile of pre-service science teachers based on STEM Interest Career Survey can be seen in Figure 1.

![Diagram showing the profile of pre-service science teachers based on STEM Interest Career Survey](image)

**Figure 1.** Profile of pre-service science teacher based on STEM career interest survey

This study aims to investigate the profile of pre-service science teachers based on STEM Career Interest Survey. STEM Career Interest Survey is a survey used to detect which career a person will choose for his future, especially in the fields of science, technology, engineering, and mathematics. The instrument used in this study was adapted from Kier [13]. Currently there have been several studies related to the STEM Career Interest Survey which among others is to describe low socioeconomic status students' STEM Career interest [11] and relate to student perceptions of STEM content and careers [12]. The advantages of both studies describe the survey results in each field of science, technology, engineering, and mathematics. However, the survey instrument used in five fields consists of 5 items of questions only, with 25 items of questions in total [11], even one of these studies only used 5 items of questions and only in one field of STEM.

There is also educational research and development (R & D) in the field of STEM Career Interest Survey which aims to develop the instrument. The instrument was developed in five fields, each consisting of 5 question items, 25 items of questions in total [13]. In addition, there are studies that develop the instrument from STEM Career Interest Survey with four areas of science, technology, engineering, and mathematics [14]. The advantages of this research produce a valid instrument with the number of questions per field 11 items in total, so the total of all questions for the four fields is 44 question items. The instrument is more focused and more detailed in each field due to the number of questions in each field. However, the weakness of this research is to focus only on instrument development and not to explain the survey results in each field.
Although there have been studies published in the STEM Career Interest Survey, there has been no research related to pre-service science teachers based on STEM Career Interest Survey. It aims to investigate the interests of pre-service teachers of the future careers, whereas previous researches were mostly conducted on students and teachers in schools. In addition, in this study the instrument test used consists of four fields and each field consists of 11 items of questions so that the total is 44 items of questions. The test instrument was adapted from Kier's study [14]. Kier study did not explain the survey results for each field, but this study explained the survey results in four fields of science, technology, engineering, and mathematics. In addition, the survey results in this study are described in more details. This is because the explanation also comes with the most highest or the lowest career field, with the ranking of the mean of each question item in each field from the highest to the lowest, and with testing the differences from those four fields by using statistical tests.

Figure 1 shows the profile of pre-service science teachers based on STEM Career Interest Survey in science, technology, engineering, and mathematics. The survey results show that the average career interest rate of pre-service science teachers based on STEM Career Interest Survey from highest to lowest is in the field of technology of 4.08, the field of science of 3.80, the field of mathematics of 3.39, and the field of engineering of 3.30. Based on the averages, obtained the value between each field from 3.30 to 4.08 with a maximum scale of 5.00, indicating that there is a tendency in pre-service science teachers to be interested in the field of STEM. The results are in line with previous studies that describe the field in accordance with STEM Career Interest Survey [11-12]. The data in each of these fields will be explained in more details to get the highest score and the lowest score in each field. The field of science is described in Table 2, the field of technology is described in Table 3, the field of engineering is described in Table 4, and the field of mathematics is described in Table 5.

The field of science in Table 2 shows that the question item with the highest average score of 4.30 is the question (S5) that is "my career in the future can be sustained if I do well in science class" and the question item with the lowest average score of 3.33 is the question (S11) that is "I know that there is someone in my family who uses science in his/her career". This shows that there is a high confidence from pre-service science teachers to work hard and to be the best in science class because they believe success in learning science is very influential on the success of their careers in the future. In addition, the families of pre-service science teachers are not likely to work in science.

The field of technology in table 3 shows that the question item with the highest average score of 4.57 is the question (T5) that is "I can do different types of careers well when I learned a lot about technology" and the question item with the lowest average score of 3.33 is the question (T11) that is "I know that there is someone in my family who uses technology in his career". This shows that there is a high confidence in pre-service science teachers to learn a lot about technology because they believe that learning a lot of technology will affect the success of their future careers. In addition, there are not many families of pre-service science teachers who work in the field of technology.

The field of Engineering in Table 4 shows that the question item with the highest average score of 3.67 is the question (E11) that is "I know that there is someone in my family who is an engineer" and the question item that got the lowest average score of 3.03 is the question (E7) that is "I am interested in engineering-related careers". This indicates that the families of pre-service science teachers mostly work in engineering, but they are not interested in engineering work.

The field of Mathematics in Table 5 shows that the question item with the highest average score of 4.05 is the question (M5) that is "My career in the future can be sustained if I do well in the math class" and the question item with the lowest average score of 3.07 is the question (M10) that is "When I chat with people who work in the field of mathematics I feel comfortable". This suggests that there is a high confidence in pre-service science teachers to master the field of mathematics because they believe that learning a lot of mathematics will affect the success of their careers in the future. In addition, there is the discomfort of pre-service science teachers when chatting with people who work in the field of mathematics because, based on interviews of several samples, people's characters in this field tend to be more serious compared to other fields. Based on these data, it can be concluded that pre-service science teachers believe that their careers in the future can be successful if they master science, technology, engineering, and mathematics.
Based on the data in table 2, table 3, table 4, table 5 and figure 1, it shows the profile of pre-service science teachers based on STEM Career Interest Survey in science, technology, engineering, and mathematics. However, the data is not able to explain whether there are differences between the four fields so that this study employed different test by using F test (One Way Anova). Statistical test data can be seen in table 6.

**Table 6. F test (One Way Anova) between the fields of Science, Technology, Engineering, and Mathematics**

| Field   | Average | F       | Sig. | Note                              |
|---------|---------|---------|------|-----------------------------------|
| Science | 3.80    |         |      |                                   |
| Technology | 4.08  | 16.875  | .000 | There is a significant difference |
| Engineering | 3.30  |         |      |                                   |
| Mathematics | 3.39  |         |      |                                   |

Table 6 shows that F-test results between science, technology, engineering, and mathematics were obtained (sig. <.05). This shows that there are significant differences between science, technology, engineering, and mathematics. However, the test is not able to explain which one is significantly different between the four fields. So this study continues by employing the Post Hoc test. Post Hoc test data can be seen in table 7.

**Table 7. Post Hoc Test using Benferroni**

| Field      | Field     | Sig. | Note                   |
|------------|-----------|------|------------------------|
| Science    | Technology| .160 | No significant difference |
|            | Engineering| .002 | There is a significant difference |
|            | Math      | .015 | There is a significant difference |
| Technology | Science   | .160 | No significant difference |
|            | Engineering| .000 | There is a significant difference |
|            | Math      | .000 | There is a significant difference |
| Engineering| Science   | .002 | There is a significant difference |
|            | Technology| .000 | There is a significant difference |
|            | Math      | 1.000 | No significant difference |
| Math       | Science   | .015 | There is a significant difference |
|            | Technology| .000 | There is a significant difference |
|            | Engineering| 1.000 | No significant difference |

Based on Table 7, the data illustrate that there is no significant difference in career interest in pre-service science teachers between the fields of science and technology as well as the areas of mathematics and engineering. There are, however, significant differences between the fields of science and engineering, science and mathematics, technology and engineering, technology and mathematics, also engineering and mathematics. Therefore, it can be concluded that pre-service science teachers do have interests in the STEM fields. The highest interest is found in the fields of technology and science. As a result, there is suitability between career interests with the majors taken on their studies.
4. Conclusion
Profile of pre-service of science teachers based on STEM Career Interest Survey shows that the average value of career interest in technology is 4.08, in science is 3.80, in math is 3.39, and in engineering is 3.30. Pre-service science teachers are found to have interests in the STEM career fields. This research is beneficial to see the illustration of one’s career interest based on STEM as there are many instances of people choosing majors or studies that are not in accordance with their interests and talents.

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