Fifth-grade elementary school perception of STEM

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Abstract. This study aims to determine the early perception of fifth grade of students about STEM (Science Technology Engineering Mathematics). The method used in this research is descriptive-qualitative method with the participant amounted to 34 fifth graders in one of elementary school in Bandung city. The instrument used in this study is a questionnaire of students’ perceptions about STEM which amounted to 49 items. The results of data analysis collected showed that the students’ early perception of STEM was quite high with an average of 78%, which 66% in terms of interest, 63% in terms of difficulty, 80% in terms of ability, 69% in terms of readiness, 76% in terms of influence, 78% in terms of career and 75% in terms of benefit. This is because students’ much interest in STEM subjects such as Science and Mathematics is much greater even though it has not become the main choice subject. Therefore, it is necessary to do further research related STEM implementation in learning process at elementary school which is to see student perception after applied this approach.

1. Introduction
STEM is an acronym of Science, Technology, Engineering and Mathematics [1]. STEM is one of science learning approach is being discussed in the world of education globally, especially in facing the 21st century this time [2, 3]. STEM education aims to develop students who are aware of the importance of STEM so that they have the attitude, knowledge and skills in identifying problems in life which is based on STEM issues, understanding the characteristics of STEM as a form of knowledge, inquiry and design initiated by humans, forming a material, intellectual and cultural environment as well as engaging in the study of STEM issues as concerned citizens using the ideas of science, technology, engineering and mathematics [4].

STEM is a learning or work in science, technology, engineering and mathematics areas[5, 6]. Some studies and reports in the United States even show that the progress and prosperity in America especially in the United States depends on developing the next generation of professionals in the STEM area [7]. STEM is able to increase the mastery of knowledge, apply knowledge for solving
some problems and encourage students to create something, so STEM isn’t only for increasing
students interest in learning but now it’s more expanded[8].

In general, the application of STEM in learning is only carried out in junior and senior high
schools. This is due to the limited ability of students who are still in elementary schools, especially in
terms of designing and making a product. However, according to one of the studies, STEM skills
should be prepared since early stage to face global competition which is more inclined toward
competition in the field of industry which of course involves the ability of science, technology,
engineering and mathematics [6]. This STEM approach is very important applied in elementary
school. The understanding of science and math especially, are more easily stimulated at young age and
build skill at this stage too. It could help students to be better prepared for more difficult subjects at the
next level [1]. Applying STEM at an earlier school level will have an impact on the sustainability of a
country in the face of global challenges in the future[9].

Therefore, it is necessary to conduct a research related to the application of STEM in elementary
school by first knowing the students' early perception in terms of their interest, difficulty, ability,
readiness, influence, career and benefit related to STEM itself. The focus of this study is only on the
early perception of STEM-related students to illustrate how students' perception about interest,
difficulty, ability, readiness, influence, career and benefit regarding STEM are further considered for
researchers or teachers in applying STEM to elementary school learning.

2. Method
Type of research used in this research is descriptive research type with qualitative approach.
According to Arikunto [10] descriptive research is a research conducted to investigate the
condition, condition or other things without giving treatment to the object or area which is
studied and then presented in the form of research reports. This study is considered suitable
because the researchers will only record the problems that arise during the STEM-related research
process through a questionnaire given to students without giving treatment to subject to be
studied.

As for, the subject of this research was the 5th grader of Sukajadi Primary School Number 076
Bandung, West Java, amounted to 39 students with 14 male and 20 female (10-11 years old).
The instrument used in data acquisition in the field is STEM-related questionnaire consisting of 49
statement items. Questionnaire used in the form of Likert scale questionnaire with alternative
response Strongly Disagree (SD) = 1, Disagree (D) = 2, Neutral (N) = 3, Agree (A) = 4 and Strongly Agree
(SA) = 5. The results of the questionnaire were then analyzed per item for subsequent insertion into
the STEM's interest, difficulty, ability, readiness, influence, career and benefit categories.

3. Result and Discussion
There are seven categories used in classifying early perception of elementary school students related
to STEM. For more details can be seen in table 1.

<table>
<thead>
<tr>
<th>Categories</th>
<th>Number of Items</th>
<th>Items Number</th>
<th>Proportion of Items (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Interest</td>
<td>11</td>
<td>1, 5, 8, 9, 10, 24, 25, 26, 27, 46, 47</td>
<td>22.45</td>
</tr>
<tr>
<td>Difficulty</td>
<td>4</td>
<td>2, 4, 34, 35</td>
<td>8.17</td>
</tr>
<tr>
<td>Ability</td>
<td>2</td>
<td>6, 33</td>
<td>4.08</td>
</tr>
<tr>
<td>Readiness</td>
<td>2</td>
<td>7, 45</td>
<td>4.08</td>
</tr>
<tr>
<td>Influence</td>
<td>14</td>
<td>11, 12, 14, 15, 16</td>
<td>28.57</td>
</tr>
</tbody>
</table>
Table 1 shows the grouping of students' initial perceptions based on a STEM-related questionnaire consisting of 17.45%, difficulty totaling 4 items or 8.17%, ability and preparedness of 2 items or 4.08%, the effect amounted to 14 items or 28.57%, career amounted to 7 items or 14.28% and benefits 9 items or 18.37%. For the average percentage of students' initial perceptions per category can be seen in figure 1.

<table>
<thead>
<tr>
<th>Category</th>
<th>Number of Items</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Career</td>
<td>7</td>
<td>14.28</td>
</tr>
<tr>
<td>Benefit</td>
<td>9</td>
<td>18.37</td>
</tr>
<tr>
<td>Total</td>
<td>49</td>
<td>100</td>
</tr>
</tbody>
</table>

Table 1 shows the grouping of students' initial perceptions based on a STEM-related questionnaire consisting of 17.45%, difficulty totaling 4 items or 8.17%, ability and preparedness of 2 items or 4.08%, the effect amounted to 14 items or 28.57%, career amounted to 7 items or 14.28% and benefits 9 items or 18.37%. For the average percentage of students' initial perceptions per category can be seen in figure 1.

**Figure 1.** Average Percentage of Early Perception of Students from Several Related Aspects of STEM

From Figure 1 above, it can be seen that the average perception of students in terms of interest, difficulty, ability, readiness, influence, and career-related STEM are 66.42%, 62.79%, 80.29%, 69.12%, 76.18% and 77.65%. And the most prominent is the perception of "ability" of the students associated with the STEM with an average percentage of 80.29%. The following will explain further about the students' early perception of STEM-based on each aspect:

**3.1. Interest**

Figure 1 shows that students' early perception of STEM from the aspect of interest is 66.42% or 66%. This can be seen from the most dominant student responses found in items 8 and 46 which can be seen in table 2.

**Table 2.** Item questionnaire number 8 and 46

<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>8</td>
<td>I showed good achievement in STEM-related subjects (Science and Mathematics) at school.</td>
</tr>
<tr>
<td>46</td>
<td>I love studying STEM-related subjects (Science</td>
</tr>
</tbody>
</table>
In items 8 and 48 (see Table 2) can be seen one that makes students’ attitudes well enough to STEM especially in this subject science and mathematics related STEM is because half of the students show their satisfactory achievement on the subject and they interest to study STEM-related subjects.

3.2. Difficulty
Early perceptions of students viewed from the aspects of difficulty subjects STEM-related is 62.79% or 63%. Students’ difficulties perceptions of the STEM can be seen based on the questionnaire data obtained mainly on items 34 and 35:

**Table 3.** Item questionnaire number 34 and 35

<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>34</td>
<td>The STEM course was not challenging for me</td>
</tr>
<tr>
<td>35</td>
<td>I feel comfortable learning STEM related lessons</td>
</tr>
</tbody>
</table>

From table 3 above, we can see that most of the students feel no difficulty in learning STEM, especially on science and mathematics subjects because it is not challenging and students feel comfortable learning STEM-related subjects.

3.3. Ability
In figure 1, it can be seen that the STEM-related subjects in school is 80.29% or 80%. This is supported by the student response on items 6 and 33 in Table 4.

**Table 4.** Item questionnaire number 6 and 33

<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>6</td>
<td>I was able to study STEM related subjects (Science and Mathematics) at school</td>
</tr>
<tr>
<td>33</td>
<td>I am confident in STEM-related subjects (Science and Mathematics)</td>
</tr>
</tbody>
</table>

Based on student questionnaires, items 6 and 33 (see table 4) show that in terms of ability, students feel capable and confident in learning STEM-related lessons, especially science and math subjects in schools.

3.4. Readiness
From the aspect of readiness, students' perception related to STEM is 69.12% or 69%. These results were obtained based on questionnaires that students answered on items number 7 and 45:

**Table 5.** Item questionnaire number 7 and 45

<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>7</td>
<td>I am ready to study STEM-related subjects (Science and Mathematics)</td>
</tr>
<tr>
<td>45</td>
<td>I care about the development of STEM</td>
</tr>
</tbody>
</table>
Table 5 above shows that the average student is ready to study STEM related subjects even care about the development of STEM education in school in this case related to science and mathematics subjects.

3.5. Influence
Early perceptions of students from the aspect of people who affect their views on STEM are 76.18% or 76%. This result is supported by the prominent student responses on items 11 and 14:

Table 6. Item questionnaire number 11 and 14

<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>11</td>
<td>My teacher encourage me to study STEM-related subjects (Science and Mathematics)</td>
</tr>
<tr>
<td>14</td>
<td>My parents encouraged me to take STEM related subjects (Science and Mathematics)</td>
</tr>
</tbody>
</table>

Based on items 11 and 14 that have the answers to their teachers and their parents encourage them in studying STEM-related subjects especially science and math subjects.

3.6. Career
Early perception of students from STEM career aspect in the future is 77.65% or 78%. This can be seen from the questionnaire items that have the most number of scores answered by students are item number 13 and 19:

Table 7. Item questionnaire number 13 and 19

<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>13</td>
<td>Many successful people choose STEM (Science and Mathematics) as a work option</td>
</tr>
<tr>
<td>19</td>
<td>Knowledge gained from STEM (Science and Mathematics) education is essential for career development</td>
</tr>
</tbody>
</table>

Of the items most frequently answered by the students indicate that many student agrees that people who choose STEM fields or subjects in the STEM field have a brilliant career in the future. This is in line with some STEM-related studies undertaken to provide future student skills[11].

3.7. Benefit
In figure 1 it can be seen that from STEM benefit aspect, students’ early perception is 75.03% or 75%. This result is supported by the most dominant student responses seen in items 21 and 48:

Table 8. Item questionnaire 21 and 48

<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>21</td>
<td>STEM education will produce innovators (people who produce new works)</td>
</tr>
<tr>
<td>48</td>
<td>Understanding STEM related subjects gives me satisfaction</td>
</tr>
</tbody>
</table>
Based on table 8 above, we can see that half of the students agree that by studying STEM-related subjects can provide benefits such as generating innovators or people who produce new works and give them their own satisfaction when studying STEM-related subjects. This is in line with Milahturrahmah's opinion [9] that with STEM-based theme learning in elementary school it is expected that students can produce designs and products. So that with such learning is expected later on the students will be the candidates for innovator of new works in the future.

4. Conclusion

Early perception of elementary school students related to STEM where in this case related to science and mathematics subjects has good. The results showed that the percentage of students' early perception as a whole is 78% with each percentage of 66% in terms of interest, 63% in terms of difficulty, 80% in terms of ability, 69% in terms of readiness, 76 % in terms of influence, 78% in terms of career and 75% in terms of benefit.

This indicates that the average student is interested in studying subjects related STEM especially Science and Mathematics. Based on the results of this study can be concluded that elementary school students are "capable" and "prepared" to receive learning or STEM education in the classroom.

Therefore it can be conducted for further research of STEM implementation in elementary school to know students' perceptions after applied STEM in the classroom and to know if STEM can be applied not only from junior or high school but since elementary school.

5. Acknowledgments

The researcher would like to thank all those who have supported in this research. Especially to teachers and 5th grader of Sukajadi Primary School Number 076.

6. References

[2] Lachapelle C P and Cunningham C M 2014 Engineering in Pre-College Setting chapter 4 p 61 - 87