Challenges in science technology engineering and math (STEM) learning in elementary schools based on literacy of social science

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Abstract. Learning based on Science Technology Engineering and Mathematics (STEM) strongly supports the current era of educational development. One of the components that support the success of STEM learning is the ability of students literacy in the field of science. This study aims to reveal the proficiency profile of science literacy that supports the achievement of the STEM. The method used is qualitative participatory where the participant is the students of grade 6 primary school in Bandung as much as 40 students. The instruments used are scientific literacy and triangulation literature by using technical interviews. The results of the study showed that: (1) science literacy skills supporting STEM varied by sex and average grade of achievement in the previous class, (2) the majority of the students still had low STEM literacy skills, and (3) students rely on compulsory textbooks as a source of scientific literacy as well as STEM. This study concludes that the skills of science and STEM literacy in basic school students in Bandung are still low. It is necessary to study and apply the appropriate STEM learning strategies based on authentic children's data and social literacy.

1. Introduction
The skills of Science Technology Engineering and Math (STEM) of elementary students in various of the world in the 21st century is very important. STEM skills that are owned earlier, besides helping students to deal with various challenges in the future, also provide certainty of the basic skills for the citizens of the world that suggested by UNESCO. That is why STEM is an important program that must exist in the curriculum. The existence of STEM content in the school curriculum provides certainty to citizens in obtaining various skills both in scientific literacy skills, technology literacy, and mathematical literacy. But in various countries, including in Indonesia, the achievement of scientific, mathematical and technological literacy is still difficult to achieve optimally. These low abilities are caused by various academic factors and social factors. These factors affected the achievement of STEM. These academic and social factors are necessary. Internal social factors such as self-motivation factors, habit factors and social interactions in the family also external factors such as social interaction in the neighborhood environment. So that the problem of how is the relationship between initial STEM skills and social literacy skills of students in basic education will come up.

Students could be motivated in which they grappled with STEM concepts and activities, and could verbalize specific program elements that motivated them [1]. There were several studies on the application of STEM in elementary school. The application of STEM in the learning process in the higher class of elementary school is influenced by the prior knowledge of students [2]. The prior knowledge of students is reflected in their ability to overcome master learning materials. Besides learning materials, the skills of participants about STEM is also determined by technology products that they recognize or use in their daily lives. Students are often disinterested in science and math when they
learn in an isolated and disjointed manner missing connections to crosscutting concepts and real-world applications [3]. It is known that the interaction of students with technology products such as cell phones, refrigerators, and television gives the different experience of STEM. There are students who are more familiar with television because television is more often watched and followed, compared to other products. While many students are more often associated with cellphones because the technology products are used at any time to communicate with family or other people. However, often times students can only use the technology products without knowing the scientific concepts used in them [4]. Seems like the student ability to applying the science concept to understand technology products still weak. In addition to aspects of understanding technology products, students are also influenced by their thinking patterns and social relationships [5]. With regard to social relations, every student has a level of awareness of technology products. Especially at the time of use and effect of technological products on themselves, their families and those around them. Another consequence of the impact of technology is interpersonal relationships with others. The existence of technology can provide better skills of social relations, can also reduce the quantity and quality of relationships between individuals and someone with others. The skills or social literacy among students associated with this technology has not been widely studied. Though this problem is an important part in increasing the success of STEM programs in the society, the study of the relationship between the initial literacy skills and students’ social skills is very important [6]. Therefore this research is directed to get an overview of the initial of STEM skills and its relation to social literacy skills.

2. Methods
This study uses a mixed method with pre-participatory exploratory techniques. The participants of this study were the fifth-grade students as many as 25 people from elementary schools in Bandung. The instrument used was in the form of initial STEM tests and 8 social literacy questions and the type of test is free entry. An example of an instrument is as follows:

![Research Instruments](https://example.com/instruments.png)

Figure 1. Research instruments.
Based on figure 1 and 2, the instrument explains the questions that must be filled by students. The question is in the form of technology, mathematics, science, and machine questions. The instrument also contains questions about students' social behavior in relation to the use of technological tools around their homes.

After obtaining the data and analyzing it, then triangulating people from several participants. The purpose of triangulation in this study is to explore the answers from the instruments of some students. This research is divided into several stages, that is: (1) collecting STEM test results data; (2) describe in the form of tables and graphs; (3) triangulate to the participants of superior and lower groups; and (4) analyzing, interpreting and concluding and making recommendations.

3. Results and discussion

The following is the result of the analysis of the research data consisting of profiles of technology products that are most frequently used and recognized around students' homes and initial STEM skills and social literacy skills.

3.1. Technology product profile that students recognize

From the various types of technology products presented, students choose the products they know most (around the house and their level of use), which can be described in the following Figure 3.
Figure 3 shows the technology products most often referred to by students around them are mobile phones (22), television (22), and refrigerators (19). While the technology product that is the least mentioned is air conditioner (1). All technology products that are presented as an option have the opportunity to be chosen.

As for the many technology products selected, students have been able to describe the product. There are only 4 (four) technology products that are chosen as an illustration of the object, which can be shown in Figure 4 below.

Figure 4 shows the technology products chosen by students to draw on the answer paper. From the 17 types of technology products presented, only 4 types of technology products were selected by students to draw. Sequentially, the technology products chosen by students are Mobile and Television (9), Refrigerator (7), and Hair Dryer (1). So the type of technology that is most drawn is Mobile and Television.

Based on the description of pictures 3 and 4, it is illustrated that all types of technology products presented can be chosen by students. But only 4 (four) types of technology products they can choose and describe. Allegedly, the type of cell-phone, television, refrigerator and hair dryer are the most
commonly used types of technology. Besides that, this type of product is easier to visualize by students. Visualization of a product makes it easy for children to imitate or describe [7]. Besides that the more often an object or product is the technology used, the more familiar that is [8,9].

3.2. Early STEM skills and social literacy
The Science Technology Engineering and Math skills of students on fifth grade can be shown in Figure 5.

Figure 5. Profile of the fifth-grade students' initial STEM skills.

Figure 5 shows the profile of the initial STEM skills of the fifth-grade students. The highest score was obtained by JAF, KFA, MFA (28 each). While the lowest score is by MGP, NRM, and RES (21 each). The average score of the initial STEM skills in the fifth grade is 25.04 (78.25%).

If analyzed from the average score of acquisition of STEM skills with social skills can be obtained as shown in figure 6 below.

Figure 6. Comparison profile of initial STEM and social skills.
Figure 6 shows the average score of all fifth-grade students on the initial component of STEM skills and Social Literacy skills. All students have average initial STEM skills of 3.6 and social literacy skills of 3.5. The relationship between the initial of STEM skills and with social literacy skills using non-parametric was 0.54 or in the moderate category.

The description of the initial STEM skills in fifth-grade students who reached 78.25% shows that students can recognize the technology around their homes well. Similarly, the average initial STEM skills and high social literacy (3.5 and 3.6 at a maximum score of 4.0). The fifth-grade students who recognize and use technology products have a concern for the process and the impact of using technology products. The qualitative description of students’ social literacy skills can be illustrated through table 1 below.

Table 1. Results of Interviews with Students.

| What do you and your family feel with the tools (mention the tools)? | Superior Group: My family and I can find out about the area, bring entertainment and can synchronize information from one area to the community |
|---|---|
| Lower group: Happy to be entertained |

| Is there any effect, impact or effect caused by the tools on your neighbors and how do you behave? | Superior Group: If the TV volume is too large, it disturbs the neighbor and will apologize |
|---|---|
| Lower group: There is no |

Table 1 shows that through interviews with students from superior groups answer the what they feel about the presence of technology products at home. They can answer more fully than the lower group. Likewise, when they are asked about the effects and effects of technology products used on other people or their neighbors, the superior group can be more comprehensive than the lower group.

Based on the description of Figures 5 and 6 and Table 1, qualitatively there is a connection between the Initial STEM skills and social literacy skills of fifth grade [10]. The STEM skills affect a person's attitude towards themselves, others and their neighbourhood [11,12]. Positioning visual representations as epistemic objects of scientific practices, science education can bring a renewed focus on how visualization contributes to knowledge formation in science from the learners’ perspective [13]. Representation within one's STEM sub-discipline, namely biology versus the physical sciences, impacts the sense of belonging for women [14]. The study supports research indicating young learners’ potential for early engineering. Students can engage in design and redesign processes, applying their STEM disciplinary knowledge in doing so [15].

4. Conclusion

Initial STEM skills in elementary school students are influenced by the proximity of technology products and the frequency of use of these products. Likewise, students who better understand the characteristics and functions and usefulness of technology products will be more concerned and aware of the benefits and impacts of these technology products [5,16].

This study recommends that the introduction of technology products as an initial understanding of STEM should begin at the elementary school level both directly and through examples of the application of scientific concepts in learning [2,3,17].

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