STEM-based science learning implementation to identify student’s personal intelligences profiles

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Abstract. Science and technology are rapidly developing needs to be balanced with the human resources that have the qualified ability. Not only cognitive ability, but also have the soft skills that support 21st century skills. Science, Technology, Engineering, and Mathematics (STEM) Education is a solution to improve the quality of learning and prepare students may be able to trained 21st century skills. This study aims to analyse the implementation of STEM-based science learning on Newton’s law of motion by identifying the personal intelligences profile junior high school students. The method used in this research is pre experiment with the design of the study one group pre-test post-test. Samples in this study were 26 junior high school students taken using Convenience Sampling. Students personal intelligences profile after learning STEM-based science uses two instruments, self-assessment and peer assessment. Intrapersonal intelligence profile based self-assessment and peer assessment are respectively 69.38; and 64.08. As for interpersonal intelligence for self-assessment instrument is 73 and the peer assessment is 60.23.

1. Introduction
In life, human beings do not depend only on knowledge, but also depend on other ability or skills to survive. Science and technology are rapidly developing needs to be balanced with the human resources that have the qualified ability. Not only cognitive ability, but also have the soft skills that support 21st century skills. There are three important skills that must be mastered by students, that are life and career skills; learning and innovation skills; and information media and technology skills. The most important skill that must be mastered by students is learning and innovation skills that include critical thinking skill, problem solving, and higher order thinking; communication and collaboration skills; and creativity and innovation. This 21st century skill reveals a mix of cognitive abilities, social skills, personal motivation, conceptual knowledge and problem-solving skills. The challenge of being able to train and develop the skills that students must have in the 21st century in STEM program, which includes scientific inquiry, technological innovation, and mathematical computation [1-3].

Today, the world views the STEM, but we cannot ignore the other abilities of knowledge and practice [4-6]. If you look at 21st century skills, National Research Council (NRC) [7,8] pursed back into three core clusters, cognitive, intrapersonal and interpersonal skills. Intrapersonal and interpersonal are the two intelligences of the eight intelligences of the Multiple Intelligences theory coined in 1983.
2. Methods
This research uses a pre-experimental method with a one group pretest posttest design. The research flow shows in Figure 1. Although in Figure 1 there is concept mastery, but in this article will only be discussed the personal intelligence obtained using the instrument self-assessment and peer assessment.

![Figure 1. Research Design](image)

First meeting, students are given a pretest for understanding the concept of Newton's law of motion. Students were introduced to the project by invited them to become a race car engineer. Students were invited to visit the manufacture of sports cars in Italy and tire factory for the race in the videos. From their knowledge of what factors affecting race cars, they are led to be able to create racing cars designs and prototypes.

Students are divided into 8 groups, each consisting of 4 to 5 students, each group develops a range of possible solutions to the given problem. After obtaining the solutions, the most promising solution is taken. The solutions were made in a design by describing their sketch and materials needed. After the design phase is completed, students make their prototype car. Students tested the cars prototype to be able to evaluate their prototype deficiencies. After knowing what are the deficiencies of their cars, students redesign their prototype for better prototype. At the end of the project series, students communicate their findings to other groups and discuss to improve their prototype in the future.

Participant in this research 26 chosen students by convenience sampling. Convenience sampling is a non-probability sampling technique where subjects are selected because of their convenient accessibility and proximity to the researcher. Many researchers prefer this sampling technique because it is fast, inexpensive, easy and the subjects are readily available. Personal intelligences’ profiles obtain by using two instruments, self-assessment and peer assessment. Both instruments contain 10 statements that related to intrapersonal and interpersonal intelligences [9].

3. Results and Discussion
Personal intelligence is the intelligence that every human being possesses as a character. This intelligence consists of two intelligences, intrapersonal intelligence and interpersonal intelligence. Intrapersonal intelligence is the intelligence associated with self-awareness which includes self-knowing, self-reflection, emotional process, metacognition [9]. Interpersonal intelligence is the intelligence associated with relationships with other human beings or also called social intelligence which includes the process of empathy, giving feedback, listening to others, forming team / group, inquiry and asking question [9].

Profile of students' personal intelligence from the results of this study. Personal intelligence profile data generated from both instruments can be seen from Table 1.
Table 1. Personal Intelligences Profile

| Instrument  | Intrapersonal Score | Category     | Interpersonal Score | Category     |
|-------------|---------------------|--------------|---------------------|--------------|
| Self Assessment | 69,38               | Intermediate | 73,00               | Advanced     |
| Peer Assessment  | 64,08               | Intermediate | 60,23               | Advanced     |

Self-assessment instrument consists of 10 statements of intrapersonal and interpersonal intelligence. This instrument is filled by students to assess themselves. Peer assessment instrument has the same statement as the self-assessment but the subject is judged to be their friends in the same group. This instrument is filled by students to assess their group's friends. The resulting profile of self-assessment and peer assessment is illustrated in Figure 2 and Figure 3.

Figure 2. Intrapersonal intelligences profile resulting from self-assessment and peer-assessment

Figure 3. Interpersonal intelligences profile resulting from self-assessment and peer-assessment
The results of self-assessment (black) and peer assessment (gray) of students' interpersonal and intrapersonal intelligence, there is a tendency for differences outcomes from both instruments data. Some data looks quite prominent differences. For example, students named ANA have interpersonal intelligence results 78 according to self-assessment results, whereas according to their friends, they have 32 interpersonal intelligences. If the scores of the self-assessment instruments and peer assessment assessed by their peers differ considerably. The possibility of this is because there is no guarantee that the group's friends know themselves well. Although they belong to the same group, two times meeting are not enough to get to know the whole person. In addition, the views of one person against another vary, everyone has a particular view of a person [10]. Therefore it is not strange that the results of self-assessment and peer assessment have different results. This also occurs in other data on self-assessment and peer assessment results of intrapersonal and interpersonal intelligence. There is still a side that students do not understand about themselves. Of course, this is still as an assumption that feels to be one of the most likely factors to answer the problem earlier. Limited access and the difficulty of obtaining relevant sources make the analysis of these issues become less profound. However, these assumptions can still be taken into consideration to explain the phenomena occurring in this study.

There are several research results that lead to a complete profile of multiple intelligences that is deemed to be of relevance to this research. Although the research that has been done is a smaller part of the existing research, that is only see the intrapersonal and interpersonal intelligence only. The profile of intrapersonal and interpersonal intelligence of junior high school students was 93.2 with very advanced category and 78.75 with very advanced category [11]. The score is the result of a conversion because the range of scores used is different. In addition, the students' intrapersonal and interpersonal intelligence profiles are in the scores of 66.4 and 60.61 with both intermediate advanced categories [12]. Compared with this study with students' personal intelligence profile after STEM-based science lessons for intrapersonal intelligence from self-assessment instruments, and peer assessment were 69.38; and 64.08. While for interpersonal intelligence for self-assessment instrument is 73.00; and the peer assessment instrument is 60.23. The intrapersonal and interpersonal intelligence profile of the self-assessment instrument, and the fourth peer assessment are intermediate advanced.

The differences that occur from the personal intelligence profile of some research are due to different subjects. Research conducted was done to junior high school students in Makassar [2] and conducted research on junior high school students in Cikarang and this research was done in Bandung [12]. Different subjects and research locations will produce different data that each individual has a different dominant intelligence [13].

4. Conclusion
Student's personal intelligence profile after STEM-based science lessons for intrapersonal intelligence from self-assessment instruments, and peer assessment were 69.38; and 64.08, each of which is categorized as intermediate advanced. While for interpersonal intelligence for self-assessment instrument is 73.00 with intermediate advanced category; and peer assessment instrument is 60.23 with intermediate advanced category.

5. References
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