Identification of Creative Thinking Ability of Malay Ethnic Students in Archimedes Law with Rasch Analysis Model (RAM): A Case Study

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Abstract. This study aims to identify the creative thinking skills of vocational school students with Malay ethnicity in solving problems regarding Archimedes law. Creative thinking skill is skill that students must have in the 21st century. Therefore, this skill must be trained through the learning process. This research was conducted on 21 students of class X DPIB with 12 men, 9 women and 15 of them are ethnic Malay, the rest are settled migrants. This research is a case study research. The data obtained were analysed with Rasch Analysis Model (RAM). From the analysis results it was found that the ability of Malay students' creative thinking was still low. The tendency of respondent's ability to work on problems is smaller than the level of difficulty of the questions. There are differences in the level of creative thinking ability of Malay ethnic and non-Malay ethnic students.

1. Introduction

21st century education requires schools to be able to provide learning that can hone their students' creative thinking skills. Creative thinking skills are skills to bring up and develop new ideas. Creative thinking is an ability possessed by someone in responding to a thing that is different from other individuals and is able to produce problem solving [1-4]. A student is required to be able to think creatively in answering questions given related to physics material. In fact, students' creative thinking skills are still low as seen from the acquisition of Indonesian students at the PISA and TIMS [5].

When discussing creativity, we often get caught up in big scientific discoveries or famous works of art. Whereas creativity places more emphasis on solving problems by adding new ideas to new ones. Creativity is the result of the creative thinking process. The ability to think creatively is a complex process of individual relationships, processes, products and social culture [6-7]. Creative thinking will lead someone to think thoroughly, fundamentally and be able to choose which answers are correct in a physics problem [8-10]. It has been known for generations that the personality of Malays has been shaped by Malay customs and Islam. These two elements are the most dominant form of character so that it becomes an inherent personality. Malay personality can be seen from the way of thinking and behaving. Malays are famous for their hospitality, generous and concerned with social life. But Malays are reluctant to face conflicts that require a lot of energy. This attitude arose after the Malay state passed through its heyday during the Siak Sri Indrapura kingdom. Prosperity at this time caused the community to stand idly by only enjoying the results that already existed. This attitude turns out to
be unconsciously inherited to children and grandchildren so that their children (school age), including students who are relaxed compared to other children from different tribes.

Reluctance to face the conflict in question that they are still lazy to think creatively to bring up something new. Not yet using his creative thinking skills to solve life's problems that come in the way. Yet the challenges of the 21st century require all people to be creative so they can survive. This skill is needed so that it must be trained to students in learning in class [11].

Planting creative thinking skills in learning physics has been done a lot. Such as the development of students' creative thinking skills on static fluid material with virtual media [12-13], but only provides an explanation of the classical creative thinking skills indicators. Development of creative thinking skills to foster students' science process skills [14]. Creative thinking skills are strongly influenced by the state of students dealing directly with phenomena for example in experiments [15]. Sihaloho [16] states that the problem-based learning model can improve students' creative thinking skills and problem solving. However, it does not explain student responses to each indicator of creative thinking skills. And all of them did the analysis with N-gain pre and post statistical values for the control class and the experimental class. Here the writer wants to identify how the creative thinking ability of Malay students in the Archimedes legal material with the Rasch model analysis.

We found many physical phenomena in Archimedes' law in everyday life. From the phenomena that are raised, it is expected that students will be able to think about the completion of their physical material.

![Figure 1. Physical phenomena in life.](image)

From Figure 1, many creative thinking skills can be raised. And the teacher's job is to train these creative thinking skills for students in learning. The ability of students in creative thinking is seen from the results of teacher assessments not only on the cognitive domain but also affective and psychomotor [17-18]. According to Sener [19] the involvement of creative thinking skills will help students improve their problem solving abilities in Archimedes' legal material. Students who have low creative thinking ability are partly due to limited access to get a lot of information so that it can stimulate their ability to move [20].

Research data will be analyzed using Rasch analysis model. One of the highlights of the Rasch analysis model is not only paying attention to the raw score in assessing the respondents' ability but also paying attention to the respondent's answer patterns and the difficulty level of the questions [21-22]. Here, researchers want to identify students' creative thinking abilities by differentiating ethnicity and gender. And then the analysis that can do is Rasch model analysis. From the explanation above, this research was conducted to identify the creative thinking skills of vocational students, especially those with Malay ethnicity on Archimedes law concept using Rasch analysis model.
2. Methods
2.1 Participants
The participants were grade X DPIB students in one of the SMKN in Siak-Riau Regency. Consisting of 21 students with 12 men and 9 women aged around 15-16 years. From 21 students, there are 15 Malay ethnic, namely the native tribe in Siak district.

![Figure 2. Map of the school area.](image)

2.2 Instrument
This instrument consists of 5 questions, each question included in the indicator of creative thinking skills to measure students' creative thinking abilities towards Archimedes Law material. Tests on the ability to think creatively can be seen in Figure:

![Figure 3. Test questions of creative thinking skills](image)
2.3 Research Design

This design uses more than one type of analysis such as quantitative or qualitative as well as other types of analysis that can be useful in sub-units [23].

2.4 Data Analysis

After collecting data, the data were analyzed using the Rasch Analysis Model. The Rasch analysis model was chosen because of the various advantages that were presented in the introduction. To support the analysis, a software called ministep 4.4.5 is used. To identify the creative thinking abilities of Malay ethnic students in this class, we will analyze each item and the respondent. From the results of statistical calculations obtained alpha cronbach 0.28 (bad), person-reliability 0.14 (weak) and item-reliability 0.93 (excellent).

3. Results and discussion

In Rasch model analysis there are three types of reliability values, namely overall reliability (cronbach alpha), student reliability (person-reliability) and item reliability (item-reliability). As shown in the picture:

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**Figure 4.** Research Design case study

**Figure 5.** Reliability Test
From Figure 5, the overall reliability (Cronbach alpha) is 0.28, student reliability (person-reliability) is 0.14 and item reliability (item-reliability) is 0.93. The mean measure of person is -0.39, which shows the low level of students' abilities compared to the level of difficulty of the questions. The average value is more than logit 0.0 indicates the tendency of respondents to answer more correctly on various item items [24]. This means that here the student's ability is still low.

Person-reliability and item-reliability values have a very wide range. This shows the consistency of answers from respondents (students) is weak, even though the quality of the item items in the instrument is very good. To calculate the quality of the instrument, you can use the value of separation of item-separation with the equation $H = \frac{(4 \times \text{separation}) + 1}{3} = \frac{(4 \times 3.58) + 1}{3}$ ie 5.1 rounded to 5. While the value of separation on person-separation with the equation $H = \frac{(4 \times \text{separation}) + 1}{3} = \frac{(4 \times 0.41) + 1}{3}$ which is 0.88 rounded up to 1 (the instrument is only able to measure students' creative thinking skills in the low category). The greater the separation value, the better the quality of the instrument in terms of items and person.

The reliability value of this instrument was also weak due to the respondent's performance at the time of the test. They were not told in advance about the test concept. Only test sheets were given about the material they had learned (Archimedes' law). As well as the test time before midday break (conditions are hungry).

3.1 Identification of difficulty items
The level of difficulty of the problem according to the pattern of creative thinking skills can be seen from the picture below:

![Figure 6. The level of difficulty of the questions](image)

The lowest value of the four indicators of creative thinking skills is in the originality section, and the value of Malay students is slightly lower than non-Malay students. Likewise for indicator number 5 (elaboration).

Another important part of evaluating question items or instruments is unidimensionality. Instrument unidimensionality is an important measure to find out whether the developed instrument is able to measure what should be measured, namely the students' creative thinking abilities.
Figure 7. Unidimensionality of creative thinking skills instrumens.

Based on figure 7, it can be seen the results of the measurement of raw variance data is 51.1%. This shows that the minimum unidimensionality requirement of 20% is fulfilled; if the value is more than 40%, it means better.

Identification of respondents who misfits or outliers is by looking at the criteria: (1). Outfit Mean Square (MNSQ) value received: 0.5 < MNSQ < 1.5 (2). Outfit Z-Standard (ZSTD) value received: -2.0 < ZSTD < +2.0 (3). Point Measure Correlation (Pt Mean Corr) Value: 0.4 < Pt Mean Corr < 0.85 [24]. In the results of this study respondents who included misfits are 11PN and 04LM. Also can be seen from the following scalogram image:

Figure 8. Respondents who misfit
From the figure 8, can be seen that 11FN students (female students number 11 and non-Malay) get higher scores for the most difficult questions but the scores are low for the previous easier questions. Likewise with respondent 04MM (student number 04 male and Malay). From the whole instrument of creative thinking skills test there is no question of bias, either to gender or ethnicity.

3.2 Identification of students’ creative thinking abilities
The ability of students in answering questions can be seen from the following table 1:

| Person  | Measure (score) |
|---------|-----------------|
| 03MN    | 1.12 (11)       |
| 17FM    | 1.07 (14)       |
| 21MM    | 1.07 (14)       |
| 06MM    | 0.29 (13)       |
| 10FN    | 0.29 (13)       |
| 12FM    | 0.29 (13)       |
| 13MM    | 0.29 (13)       |
| 18FN    | 0.29 (13)       |
| 19MM    | 0.29 (13)       |
| 01FM    | -0.44 (12)      |
| 07FM    | -0.44 (12)      |
| 08MM    | -0.44 (12)      |
| 14MM    | -0.44 (12)      |
| 16MN    | -0.44 (12)      |
| 20MM    | -0.44 (12)      |
| 05FM    | -1.14 (11)      |
| 09MM    | -1.14 (11)      |
| 15MN    | -1.14 (11)      |
| 04MM    | -1.88 (10)      |
| 02FM    | -2.59 (8)       |
| 11FN    | -2.69 (9)       |

From the table 1, the person column shows the order of students from the highest level of ability to the lowest level. Students who have the highest level of creative thinking ability are 03MN (student serial number 3, male and non-Malay) with a logit of 1.12 even though the total score is smaller than 17FM students. This score is smaller because he does not answer questions in the easy category, but he can answer correctly about the difficult category. In Rasch’s analysis, the missing data is still acknowledged, so he gets a bigger logit. Likewise, with the 11FN person, the total score is greater than 02FM but the logitic value is lower.

4. Conclusion
The creative thinking skills test instrument that was tested on grade X vocational high school students produced weak reliability. The tendency of respondent's ability to work on problems is smaller than
the level of difficulty of the questions. There are differences in the level of creative thinking ability of Malay and non-Malay students on Originality and Elaboration indicators.

In general students' creative thinking skills for the four indicators are still low. Students are still not able to express various reasons in response to a physical phenomenon. Not yet consistent in building knowledge "what, why and how" a physical phenomenon occurs.

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