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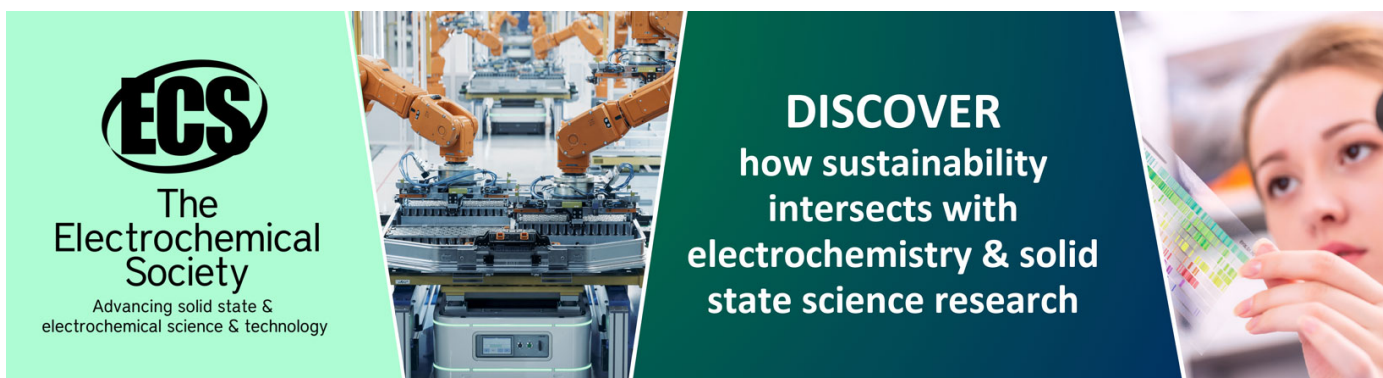
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Analysis of problem solving skills in work and energy material using the RASCH model

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Abstract. The purpose of this study was to analyze students' problem solving skills in work and energy material using the RACH model. The method in this study was a descriptive method using survey techniques. The instrument used is a problem solving test. Tests were given to 253 students from eighth grade in junior high schools in Banjarmasin randomly selected. The RASCH model was used as a processing stage of data from raw data into logit numbers that provided information related to infit, outfit and unidimensionality using a winstep program to achieve this goal. This study investigated the quality of person measure, person reliability, and variable map. The results of the analysis are based on the RASCH model with the Mean Square Statistics (MNSQ) value is 0.95, Z Standard (ZSTD) is 0.0, pearson reliability is 0.77, and cronbach alpha (KR-20) person raw score test reliability is 0.86. Lower logits manifests students with lower ability. This proved that the students' problem solving skills was absolutely poor. Students' problem solving skills need to be improved through classroom learning in future research.

1. Introduction

Research in the last five years shows that students from high school to university level in problem solving skills [1-5] are in the low category. In fact, one of the goals of learning physics is to create people who can solve complex problems by applying their knowledge and understanding to everyday situations [2]. Problem solving requires expertise in developing appropriate procedures in order to solve a problem [6]. The problem-solving method is a method that expects students to actively think, communicate, search, and process data to draw conclusions [7]. Amrita et al. stated that students' problem-solving abilities could be assessed based on students' abilities when completing questions in the form of essays by completing using prescribed steps [8]. In using problem solving methods, subject matter must be arranged based on problems. This method is very suitable to be applied to the subject of energy and effort in class VIII so that students dig more information about the concept.

Based on the description, it is necessary to have an effort to improve students' problem solving skills, especially on business materials and energy. Before upgrading problem-solving skills, it is necessary to first examine students' problem solving skills so that the teacher can take appropriate actions according to students' abilities. Previous research has identified problem solving skills of students at senior high school to university level, but not at junior high school level. However, from previous research on problem solving, the analysis used the Ttest [9-10], Kruskal Wallis test and rubric [11] and N-gain for each troubleshooting step [12], had not used Item Response Theory (IRT). This study employs IRT in conjunction with Rasch measurement model. IRT is regarded as the best techniques to determine students' achievement from time to time among the test-equating procedures [9]. This study aimed to



analyze students' problem solving skills in work and energy materials using the RACH model. Educators can prepare and design appropriate learning to train and improve problem solving skills.

2. Method

The design in this study was a descriptive method using survey techniques. The instrument used is a problem solving test. The data collection techniques were in the form of tests. The test used essay questions. Tests were given to 253 students from eighth grade in junior high schools in Banjarmasin randomly selected. Problem solving skills tests were given to students who have studied material business and energy in physics lessons in class. Students were given 90 minutes to answer the test. The result of the test were then utilized as data in this study.

The validity analysis of the questions was carried out using the Rasch program. At this stage, whether or not an item or respondent is fit depends on the value of acceptable MNSQ ($0.5 > \text{MNSQ} < 1.5$) and the acceptable value of ZSTD ($-2 < \text{ZSTD} < +2$). In general, to measure the reliability of the test in the form of a description with Rasch modeling shown by the value of individual separation and separation of items and the value of alpha Cronbach. The criteria for interpreting the minimum item separation values are sufficiently located between 0.67 - 0.80 [14]. Cronbach's alpha value is used to measure interactions between individuals and whole items. The value obtained can be interpreted by using a minimum enough criteria which are located between 0.6 - 0.7 [14]. The variable map demonstrates the distribution of students' ability and item difficulty on a same logit scale. The ability of students is listed on the right side of the map while the item difficulty is on the left side of the map. Logits 0 is set as average of test items. Higher logits represents students with higher ability and more difficult items [15].

3. Results and discussion

Furthermore, for the aspect of reliability the assessment instruments developed can be seen in Table 1.

Table 1. Summary of Statistics Responden

	Outfit	
	MNSQ	ZSTD
Mean	0,99	0,0
Separation	1,81	
Person Reliability	0,77	
Cronbach Alpha (KR-20)	0,86	

Rasyid and Mansur state that the reliability of a measuring instrument gives consistent and stable results if used repeatedly on the same object, as long as the material measured does not change [16]. For the reliability values of person can be seen in Table 1. Person reliability value is 0.77 with enough categories. Then for the separation value is 1,81, Then the value of the separation of the strata is 3, means that the instrument can group students(respondents) into 3 groups. This means that respondents are able into 3 groups of respondents, namely high, medium, and low. The interaction between person and question items as a whole is expressed with a value of 0.86 which means that it is very good. From these values indicate that the consistency of answers from students is sufficient. This is supported by the statement of Sumintono and Widhiarso the higher the value of grain separation, the better the measurements taken [14].

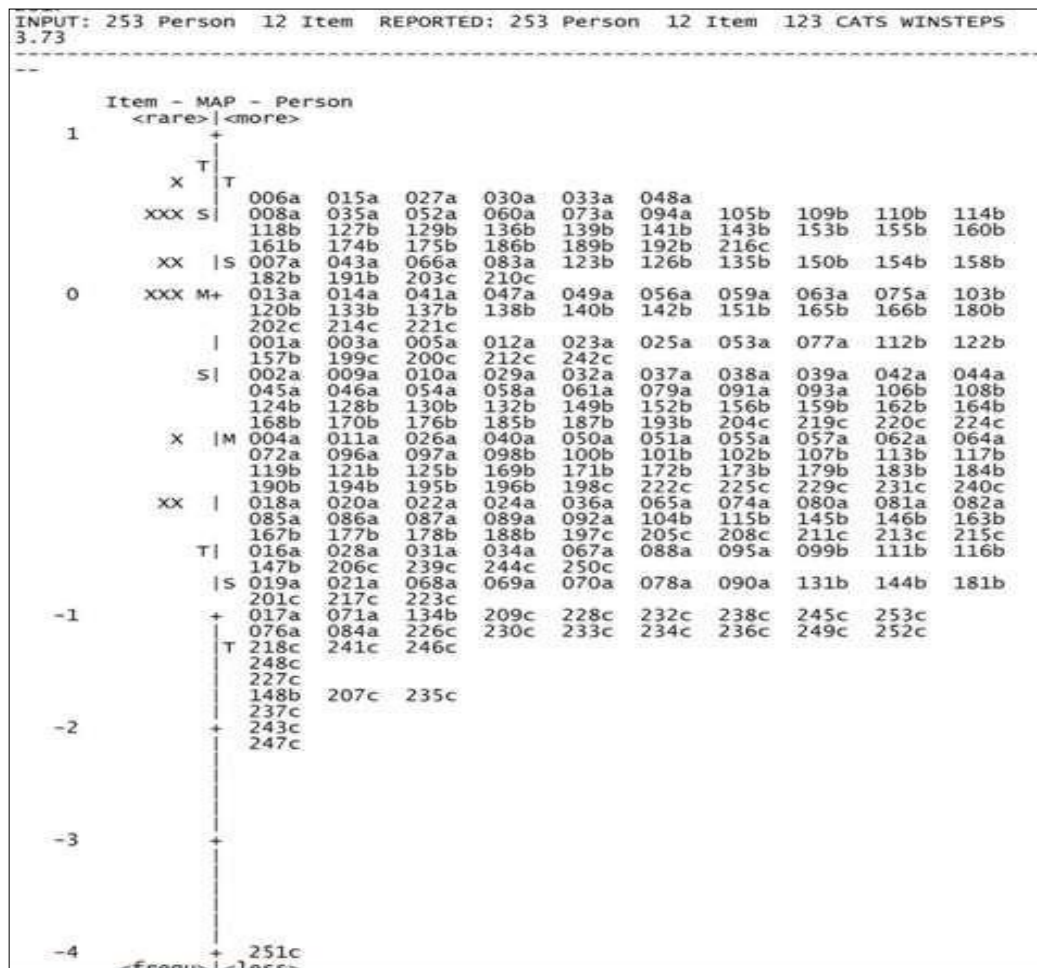


Figure 1. Student Ability Variable Maps

Variable maps show the distribution of student abilities and item difficulties. The right side shows the distribution of students' abilities in completing tests using problem solving skills. The right side shows the distribution of students' problem solving abilities by sorting students from highest to lowest ability. The left side shows the distribution of item difficulty by sorting the items from hardest to easiest. The higher logit represents students with higher abilities (right side) and more difficult items (left side) [17]. Logit 0 was set as the average test item [17]. From the variable map, we can see that most students are below average. Some students with higher abilities were above logit 0 and very many students were below average. Lower logits manifests students with lower ability. This proved that the students' problem solving skills was absolutely poor [13]. Thus, we can state that the students' problem solving abilities are still low because most students cannot solve the problems and the questions are quite difficult for them. For the problem with the highest difficulty level, almost all students cannot answer the item. This is because students are not familiar to answering tests with problem solving methods. This is in line with the research that lack of student problem-solving abilities which causes students to only work on routine questions or questions that are exactly the same as those given by the teacher, so that students are not used to working on non-routine questions which results in students experiencing errors in doing questions [18]. Instead the easiest problem is almost all students can answer it.

4. Conclusion

Based on the RASCH model with the Mean Square Statistics (MNSQ) value is 0.95, Z Standard (ZSTD) is 0.0, pearson reliability is 0.77, and cronbach alpha (KR-20) person raw score test reliability is 0.86. Lower logits manifests students with lower ability. This proved that the students' problem solving skills was absolutely poor. Students' problem solving skills need to be improved through classroom learning in future research.

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