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Use of The Rasch Model for Analysis of Test Instruments in Class V Science Subjects State 38 Primary School Manado

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ABSTRACT

This research was conducted to analyze the test instruments used to measure students' abilities in science and science subjects in Class V of SD Negeri 38 Manado. The students consisted of 40 students. The questions given were in the form of 5-point description questions related to the material of light and its properties. The Rasch model is used to obtain fit test items. This analysis was carried out with the help of Winsteps software. From the output of the Winsteps program, the results obtained were 4 questions according to the Rasch model with an average Outfit MNSQ value for each person and an item of 0.99 each. Meanwhile, the Outfit ZSTD values for people and items are -0.10 and -0.29 respectively. Meanwhile, the reliability of the instrument expressed in Cronbach's alpha is 0.18.

Keywords: IPAS, RASCH Model, Test Instrument

INTRODUCTION

The process of evaluating and assessing students' abilities in the subjects taught is very important in learning in the school environment. So that students' abilities can be measured correctly, the evaluation process must be carried out correctly. Good test tools are also needed for effective evaluation. Teachers can assess their learning outcomes, which is an important step towards improving the learning process. This can also serve to improve the quality of student learning. The evaluation

process must be carried out systematically, gradually, and continuously so that the goals can be achieved.

So far, learning assessments carried out by teachers are mainly related to the process of acquiring or collecting ability data. Learning assessment can also be used to determine teacher success in teaching. In practice, tests can be used to measure certain competencies during the learning process. It is hoped that appropriate test methods can accurately measure students' abilities. This research uses a test instrument to measure students' abilities in the material Light and Its Properties in the Class V Science subject. The test instrument was designed by considering the construct and descriptive components. The construct component is that the question items must indicate the answer that will be given, from the low stage to the high stage. In this research, the questions will produce answers that show a certain qualitative range, namely two choices, wrong or right. Then it became known as the dichotomous response pattern. The second component is the descriptive part, which means providing a detailed explanation of a particular aspect. Students' ability to understand light material and its properties is an important element in this research. After the science and science subject was given to Class V students at SD Negeri 38 Manado, the Rasch model was used to analyze.

Next, the Rasch model is used to analyze test results in the form of scores. This model is part of item response theory and can classify the counts of items and people in distribution maps. Two principles determine the Rasch model. The first principle is a subject ability, namely the student's ability to answer questions using several factors known as traits. Traits are aspects of a person's abilities which can include psychomotor, verbal, and cognitive skills. The second principle explains the relationship between student abilities. Item characteristic curves can be used to describe the relationship between students' abilities in a task or question and their different abilities (Hambleton, et al, 1991). In the Rasch model, students with high abilities should have a greater probability of answering questions correctly than other students. Conversely, students are less likely to answer more difficult questions correctly (Sumintono & Widhiarso, 2015). The Rasch model method considers response and correlation aspects other than items (Ardiyanti, 2016). Rasch modeling has advantages compared to other methods, especially classical test theory. This is the ability to make predictions on missing or missing data, which is based on systematic response patterns (Aziz, 2015).

A test tool is considered good if it can provide accurate information about students' abilities in the competency being tested. Susongko conducted research in 2016 on the test question validation model, Messick validity, which consists of external, consequential, structural, substantive, and content aspects. The Winsteps tool was used to check this validity using Rasch models. Qualitative analysis is used to determine the characteristics of the tests tested in terms of material, construction, and language. Ministep software is a computational tool for the Rasch model that is used to analyze scores produced from test instruments. This tool identifies MNSQ Outfit, ZSTD Outfit, Item Fit, Point Measure Correlation, and Cornbach's Alpha, which are very important for evaluating the fit of the data to the model used. The expected average square value is one (one). If the mean square value of the infit is greater than one, then the instrument variation is greater than the Rasch model predicts. Conversely, if the mean square value in the infit is less than one, then the instrument variation is less than the Rasch model predicts.

In this research, researchers want to know the quality of the test instruments used to measure students' abilities in light materials and their properties using the Rasch model. The quality of the instrument is measured through several indicators, including question items that comply with the Rasch model and the reliability of the test items. To achieve this goal, a test instrument is designed, and then questions that fit the Rasch model are identified. Apart from that, the Crobach alpha value will be determined with the help of Winstep software to determine the reliability of the questions.

LITERATURE REVIEW

Test Instrument

Instruments are tools used to do something (such as tools used by engineering workers, medical, optical, and chemical tools), tools, and research facilities (in the form of a set of tests and so on) to collect data as processing material. The definition of this instrument is broader in scope, not only concerning the field of education but also in other fields of work. In essence, instruments based on this definition are tools that assist in data collection.

In the Indonesian Dictionary (KBBI) instruments are tools used to do something (such as tools used by engineering workers, medical, optical, and chemical tools), tools, research facilities (in the form of a set of tests and so on) to collect data as processing material. The definition of this instrument is broader in scope, not only concerning the field of education but also in other fields of work. In essence, instruments based on this definition are tools that assist in data collection. A test is a technique or method used to carry out measurement activities, in which there are various questions, statements, or a series of tasks that must be done or answered by students to measure aspects of student behavior.

IPAS

In the Merdeka Curriculum, science and social studies subjects are combined into Natural and Social Sciences (IPAS) subjects, with the hope of triggering children to be able to manage the natural and social environment in one unit. In KTSP and several of its predecessor curricula, there are science and social studies subjects. Science is a subject that in the process of studying requires students' critical and analytical thinking skills to solve problems that arise in their daily lives. The science learning process carried out can maximize student involvement in learning activities so that it can support students to understand the concept of science learning and the learning process experienced becomes more meaningful. Social studies subjects emphasize more on the skills that students must have in solving problems, both problems within their scope to very complex problems (Supardi, 2011). These two subjects are taught separately. However, in the 2013 Curriculum, both subjects are taught simultaneously (holistically) in certain learning themes. The assessment is only carried out separately. In the new paradigm curriculum, natural sciences and social sciences subjects in higher-grade elementary schools are taught simultaneously under the name of social natural sciences (IPAS) subjects. In the independent curriculum, science and social sciences are merged into one subject, namely sciences.

RASCH

The Rasch model is used to analyze test results in the form of scores. This model is part of item response theory and can classify item and person counts in distribution maps (Rozeha, et al, 2007). Two principles determine the Rasch model. The first principle is a subject ability, namely the student's ability to answer questions using several factors known as traits. Traits are aspects of a person's abilities which can include psychomotor, verbal, and cognitive skills. The second principle explains the relationship between student abilities. Item characteristic curves can be used to describe the relationship between students' abilities in a task or question and their different abilities (Hambleton, et all, 1991). In the Rasch model, students with high abilities should have a greater probability of answering questions correctly than other students. Conversely, students are less likely to answer more difficult questions correctly (Sumintono & Widhiarso, 2015). The Rasch model method considers response and correlation aspects other than items (Ardiyanti, 2016). Rasch modeling has advantages compared to other methods, especially classical test theory. This is the ability to make predictions on missing or missing data, which is based on systematic response patterns (Aziz, 2015).

METHODS

In quantitative research, the data analysis techniques used are clear, namely directed at answering the problem formulation that has been formulated in the proposal. Because the data is quantitative, the data analysis technique uses readily available statistical methods (Sugiyono, 2015). The data that will be analyzed in this research is quantitative in the form of problem-solving ability test results. The test results in the form of scores will then be analyzed using the Rasch model. Data processing was carried out with the help of Rasch modeling using Ministep (Winstep) software. This Rasch modeling uses Ministep (Winstep) software which can carry out all analyses quickly and the result is good quality and informative measurement information (Sumintono & Widhiarso, 2015). According to Rozeha, et al (in Wahyuningsih, 2020), the Rasch model is a modern assessment theory that can classify item and person calculations in a distribution map. Using the Rasch model, it is possible to determine the feasibility of the question items that researchers develop.

RESULTS AND DISCUSSION

Based on data analysis using Winsteps software, 4 items fit the Rasch model and 1 other item does not fit the Rasch model. These results are presented in full in Table 1.

Table 1. Summary Statistics

	Information	Value
Logit		0.94
Reliabilities	Person Reliability	0.26

	Item Reliability	0.86
	Alpha Cronbach	0.18
Outfit MNSQ	Person	0.99
	Item	0.99
Outfit ZSTD	Person	-0.10
	Item	-0.29

In Table 1, it is shown that the logit person measure value is 0.94 and the item measure value is 0, which means the person measure value is greater than the item measure. It can be stated that students' abilities tend to be higher than the level of difficulty of the questions. In other words, there is a possibility that all questions can be answered correctly by students. So that students who have the highest ability can answer the most difficult questions correctly. Meanwhile, item reliability is 0.86, Person Reliability is 0.26 and Cronbach's Alpha value is 0.18. From these values, it can be stated that the level of consistency of students' answers is quite high, and the quality of the questions on the test instruments used has quite good reliability. Apart from that, the value of Cronbach's Alpha which shows the interaction between person and item is quite good overall.

Another quantity shown in Table 1 is the Outfit Mean Squared Value (Outfit MNSQ) of 0.99 in both the person and item columns. The value 0.99 is included in the fit criteria, namely, it is located between the interval 0.5<MNSQ<ZSTD<2.0, which can be interpreted as the data having the possibility of a rational value. This means that overall the questions or items are by the Rasch model and can be used as an achievement test instrument on the material Light and its Properties.

The distribution of question items that are considered misfit or do not fit the model can be seen in Table 2. The item limit is considered to be fit for the model if it meets one or both of the following conditions. In the first condition, the Outfit MNSQ value is between 0.5 to 1.5; the Outfit ZSTD value lies between -2.0 to 2.0; and the item correlation value with the total score (point measure correlation) lies between 0.4 to 0.85 (Sumintono & Widhiarso, 2014).

Table 2. Data Distribution of Misfit or Unfit Questions with the Rasch Model

ENTRY NUMBER	TOTAL SCORE	TOTAL COUNT	MEASURE	MODEL S.E.	INFIT MNSQ	INFIT ZSTD	OUTFIT MNSQ	OUTFIT ZSTD	PTMEASUR-AL CORR.	PTMEASUR-AL EXP.	EXACT MATCH OBS%	EXACT MATCH EXP%	Person
4	95	5	.17	.11	1.06	.31	1.09	.36	.96	.48	20.0	10.4	0 4
8	95	5	.17	.11	.12	-2.11	.13	-1.94	.97	.48	20.0	10.4	0 8
14	95	5	.17	.11	.86	-.01	.69	-.27	.81	.48	20.0	10.4	1 4
25	95	5	.17	.11	1.17	.46	1.20	.51	.88	.48	20.0	10.4	2 5
26	95	5	.17	.11	.96	.15	.75	-.16	.75	.48	.0	10.4	2 6
1	90	5	.11	.11	.09	-2.10	.09	-2.04	.92	.46	20.0	12.0	0 1
3	90	5	.11	.11	.09	-2.10	.09	-2.04	.92	.46	20.0	12.0	0 3
5	90	5	.11	.11	.09	-2.10	.09	-2.04	.92	.46	20.0	12.0	0 5
6	90	5	.11	.11	.60	-.43	.78	-.09	.70	.46	.0	12.0	0 6
7	90	5	.11	.11	2.38	1.65	2.55	1.76	.96	.46	.0	12.0	0 7
18	90	5	.11	.11	.35	-1.00	.30	-1.11	.84	.46	20.0	12.0	1 8
20	90	5	.11	.11	.09	-2.10	.09	-2.04	.92	.46	20.0	12.0	2 0
21	90	5	.11	.11	.44	-.76	.38	-.90	.75	.46	20.0	12.0	2 1
27	90	5	.11	.11	.61	-.41	.68	-.26	.99	.46	.0	12.0	2 7
19	85	5	.04	.12	.14	-1.64	.15	-1.64	.81	.44	60.0	34.2	1 9
22	85	5	.04	.12	.14	-1.64	.15	-1.64	.81	.44	60.0	34.2	2 2
12	80	5	-.03	.12	1.47	.80	1.31	.63	-.14	.43	20.0	11.9	1 2
17	80	5	-.03	.12	1.47	.80	1.31	.63	-.14	.43	20.0	11.9	1 7
23	80	5	-.03	.12	.41	-.77	.42	-.77	.90	.43	20.0	11.9	2 3
24	80	5	-.03	.12	1.38	.70	1.32	.64	.51	.43	20.0	11.9	2 4
30	80	5	-.03	.12	1.38	.70	1.32	.64	.51	.43	20.0	11.9	2 0
15	75	5	-.11	.13	1.23	.54	1.20	.51	-.25	.43	20.0	11.9	1 5
28	75	5	-.11	.13	.94	.15	.98	.21	.10	.43	.0	11.9	2 8
2	70	5	-.19	.13	1.22	.54	1.28	.61	.67	.44	.0	23.9	0 2
11	70	5	-.19	.13	.92	.10	.93	.12	-.69	.44	40.0	23.9	1 1
13	70	5	-.19	.13	1.22	.54	1.26	.58	.14	.44	.0	23.9	1 3
16	70	5	-.19	.13	2.78	2.06	2.89	2.12	-.51	.44	20.0	23.9	1 6
29	65	5	-.26	.12	2.23	1.69	2.37	1.79	-.69	.45	.0	21.5	2 9
9	60	5	-.34	.12	1.37	.76	1.37	.76	-.92	.46	.0	21.4	0 9
10	60	5	-.34	.12	2.42	1.94	2.53	2.02	-.84	.46	.0	21.4	1 0
MEAN	82.3	5.0	.00	.12	.99	-.1	.99	-.1			16.7	15.7	
P.SD	10.6	.0	.16	.01	.74	1.3	.77	1.2			15.6	6.9	

Based on the results of the analysis of the achievement test instrument using the WinSteps version 4.4.5 program in Table 2, 1 question item was found to be a misfit, and 4 questions were fit so that a final instrument of 4 items was obtained.

CONCLUSION

The test instrument used for Class V Science and Science subjects at SD Negeri 38 Manado on the material Light and its Properties with the Rasch model. This is indicated by an item score (item reliability) of 0.86, person reliability of 0.43, and a Cronbach's alpha value of 0.18, while the Outfit Mean Square Statistics (Outfit MNSQ) value is 0.99 in both the person and item columns. The Outfit Z Standard (Outfit ZSTD) value is -0.10 in the person table and -0.29 for the item table. Meanwhile, the number of fit questions was 4, while the number of questions that were not fit was 1 question.

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