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Assessing Students' Higher Order Thinking Skills in Geometry: A Rasch Analysis

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ABSTRAK

Kemampuan Berpikir Tingkat Tinggi merupakan tantangan penting bagi siswa di abad ke-21. Dalam sepuluh tahun terakhir, banyak penelitian nasional dan internasional telah dilakukan untuk mengidentifikasi kesulitan dan meningkatkan HOTS siswa, khususnya dalam Geometri. Tujuan dari studi ini adalah untuk mempelajari lebih lanjut tentang HOTS Geometri di kalangan siswa SMA Palembang menggunakan analisis Rasch. Data untuk studi ini dikumpulkan melalui tes tertulis 18 pertanyaan Geometri HOTS yang diujikan pada 75 siswa kelas X salah satu SMA di Pelembang. Model Rasch digunakan untuk menganalisis data hasil tes secara deskriptif. Hasil analisis data menunjukkan bahwa kemampuan HOTS siswa dalam Geometri masih kurang. Skor logit rata-rata HOTS siswa adalah -0,18. Selain itu, beberapa respons siswa tidak sesuai dengan pola model Rasch. Akibatnya, penelitian lebih lanjut diperlukan untuk meningkatkan HOTS siswa dalam Geometri.

Kata Kunci: Kemampuan berpikir tingkat tinggi; Geometri; Analisis Rasch.

ABSTRACT

Higher Order Thinking Skills (HOTS) is an important challenge for students in the twenty-first century. In the last ten years, many national and international studies have been conducted to identify difficulties and improve students' HOTS, particularly in Geometry. The purpose of this study is to learn more about HOTS students' Geometry among Palembang senior high school students using Rasch analysis. The data for this study were gathered using a description test of 18 HOTS Geometry questions which was tested on 73 class X students at one of the high schools in Pelembang. The Rasch model was used to analyze the test result data descriptively. Data analysis results show that students' HOTS ability in Geometry is still lacking. Students' HOTS average logit score is -0.18. Furthermore, some students' responses did not match the pattern of the Rasch model. As a result, future research is required to improve students' HOTS in Geometry.

Keywords: Higher order thinking skills; Geometry; Rasch Analysis.

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1. INTRODUCTION

The Indonesian government stated there are 3 (three) points in the revised 2013 curriculum, which is used as a learning guide to prepare student units in 21-st century. The first is an adaptive curriculum; the second is a learning model that can develop collaborative, interactive, creative, and innovative abilities; and the third is a meaningful assessment, specifically one that can develop higher-order thinking skills, abbreviated as HOTS (Kristanto & Setiawan, 2020; Murwanto, Qohar, & Sa' dijah, 2022).

According to Brookhart (Muslim et al., 2018), HOTS are a transfer process (the ability of students to apply what they have learned into new situations without direction or guidance from educators or other people). HOTS stands for critical thinking (forming students who can think logically, reflectively, and make decisions independently). HOTS-based assessment includes the three highest Bloom's Taxonomy assessments, namely C4-analysis, C5-evaluation, and C6-creation. This ability will develop when a person encounters unusual problems, conditions, or phenomena that they have never seen before.

Learning mathematics can improve students' HOTS. Geometry is a branch of mathematics that students study from elementary school to college. (Clements & Battista, 1992) stated, geometry is a collection of linked concepts, reasoning, and representation systems used to explore and analyze shapes and spaces. Furthermore, Geometry is a unique mathematical concept with a level of complexity, according to Jones and Al (Yurniwati & Utomo, 2020), because solving problems in Geometry involves physical activity (such as using various tools/instruments, manipulating and modeling), visualization, and language. It benefits students in their everyday lives because it is related to creativity, problem-solving, spatial understanding, and shape (Gagatsis & Geitona, 2021). According to this (Siregar & Siregar, 2020; Septia & Wahyu, 2023), Geometry learning generally aims to: 1) increase confidence and think logically 2) be able to solve problems, 3) improve spatial intuition, 4) improve reasoning, 5) critical thinking, and 6) boost students' creativity.

These learning objectives, however, are not easily attained. Students' HOTS, particularly in Geometry, remains low (Afhami, 2022; Ali, Lestari, & Rahayu, 2023). This is evidenced by students' poor performance in the Geometry domain in international mathematics assessments such as PISA and TIMSS (Kim & Md-Ali, 2017). Many Indonesian students struggle to answer HOTS questions for this material (Muslim et al., 2018; Safrida et al., 2021).

Many studies, both national and international, have been conducted in the last ten years to identify difficulties and improve students' HOTS, particularly in Geometry. Previous research, for example, has found that students can improve their HOTS skills by learning to use the HOTS Geometry Module (Ibrahim et al., 2019). Furthermore, visual representation is the first step that students must master in order to understand geometry (Rittle-Johnson & Koedinger, 2005).

This evaluation and assessment study of the Geometry learning process is expected to provide a comprehensive picture of the difficulties or misconceptions that students encounter. This assessment is expected to provide feedback for future learning improvement. Assessing students with HOTS Geometry questions is also useful for training students so that they are familiar with HOTS questions (Antara et al., 2020).

Assessment is defined as the process of assessing something in accordance with a predetermined goal. Mok and Wright (Sumintono, 2019) stated, that a good educational assessment must meet five criteria: (1) provide a linear measure with equal intervals, (2) carry out an appropriate estimation process, (3) find inappropriate or unusual test items, (4) overcome inaccurate or missing data, and (5) yield an independent measure. An assessment that meets these five criteria is one that employs Rasch modeling.

These days, the Rasch analysis is a popular assessment model. In the 1950s, Dr. Georg Rasch proposed the Rasch model. Students with a higher level of ability, according to this model, have a better chance of answering one item correctly. Similarly, difficult items will limit your ability to respond to a student. Based on the responses provided, it can identify the relationships between students' ability, item difficulties, and the likelihood of success in answering the item tests. It can also forecast missing data. It has the advantage of yielding more accurate information results (Sumintono & Widhiarso, 2015). As a result, it is commonly used in classroom assessment (Aziz et al., 2013; Azizah & Wahyuningsih, 2020; Chan et al., 2014; Dwinata, 2019; Hamdu et al., 2020; Herwin et al., 2019; Lukitasari et al., 2020; Maat & Rosli, 2016; Mahmud et al., 2013; Syadiah & Hamdu, 2020).

Previously, Rasch analysis was used to assess learning mathematics. In 2015, analysis PISA problems in Geometry with Rasch Model was carried out at one of SMPN in Jember, East Java, Indonesia (Purnomo, 2015). According to this study, students' ability to solve PISA problems is still low. The current situation in Palembang, South Sumatera, Indonesia, on the other hand, is unknown. Thus, the purpose of this study is to learn more about HOTS students' Geometry abilities among Palembang senior high school students using Rasch analysis.

2. METHOD

The descriptive method was used in this study to collect information on HOTS in Geometry among Palembang senior high school students. This research was carried out in October of 2021. There are 75 grade X students from one of SMAN in Palembang took part. The HOTS Geometry test was administered to students during a mathematics lesson in the classroom. The students were given 100 minutes to complete the problems.

The HOTS Geometry test questions are made up of 18 essay questions that have been proven to be empirically valid and reliable. The Geometry topic used in this test is limited to two-dimensional Geometry. The example of problems can be seen in Figure 1.

> A rectangle-shaped photograph is pasted on cardboard. The photo measures 10 cm long by 25 cm wide. The photo is 2 cm away from the cardboard's top, right, and left edges. The photo and the cardboard are both congruent. What do you think if Ahmad says the distance between the photo and the bottom edge of the cardboard is 5cm? Explain!

Figure 1. The example of HOTS in Geometry

Figure 1 shows an example question with indicators of competency achievement, namely students' ability to analyze real-world problems based on observations related to the application of similarity to rectangles. This question is part of level C5, evaluating. This problem prompts that students be able to solve problems by comparing their opinions to those of others. Students have to use the concept of congruent to solve it. The maximum score for a correct answer is 4, 3 = correct answer but not the complete one, 2 = almost correct, 1 = wrong answer, and 0 = did not give the answer.

Furthermore, the Ministep application is used to process student test results (Winstep Rasch). The purpose of this data processing is to estimate students' HOTS on Geometry topic. The Partial Credit Model (PCM) was used in the Rasch analysis because it is applicable to the data essay (Sumintono & Widhiarso, 2015). In this study, the following two items are included in the Rasch analysis: (1) Person-item map analysis, and (2) students' HOTS profiling were performed.

3. RESULT AND DISCUSSION

a. Person-item-map analysis

The HOTS geometry ability of 75 students in grade X of senior high school in Rasch modeling is comprehensively depicted on the Wright map (Person-item-map), as shown in Figure 2. Person-Item-Map shows the distribution of student abilities on the left and item difficulty levels on the right. In Figure 2, the distance between M-S-T (Mean, 1SD, and 2SD) indicates the level of ability and difficulty of the questions. Students' ability and item difficult are on the same logit scale. Students' individual logitability reveals their level of ability. Logit 0 means that students have 50:50 in solving the tests (Aziz et al., 2013). The greater the logit value, the greater the ability of the students (Sumintono & Widhiarso, 2015).

Based on Figure 2, the classification of students' HOTS can be devided into 4 category, high, medium, low, and very low (see Table 1).

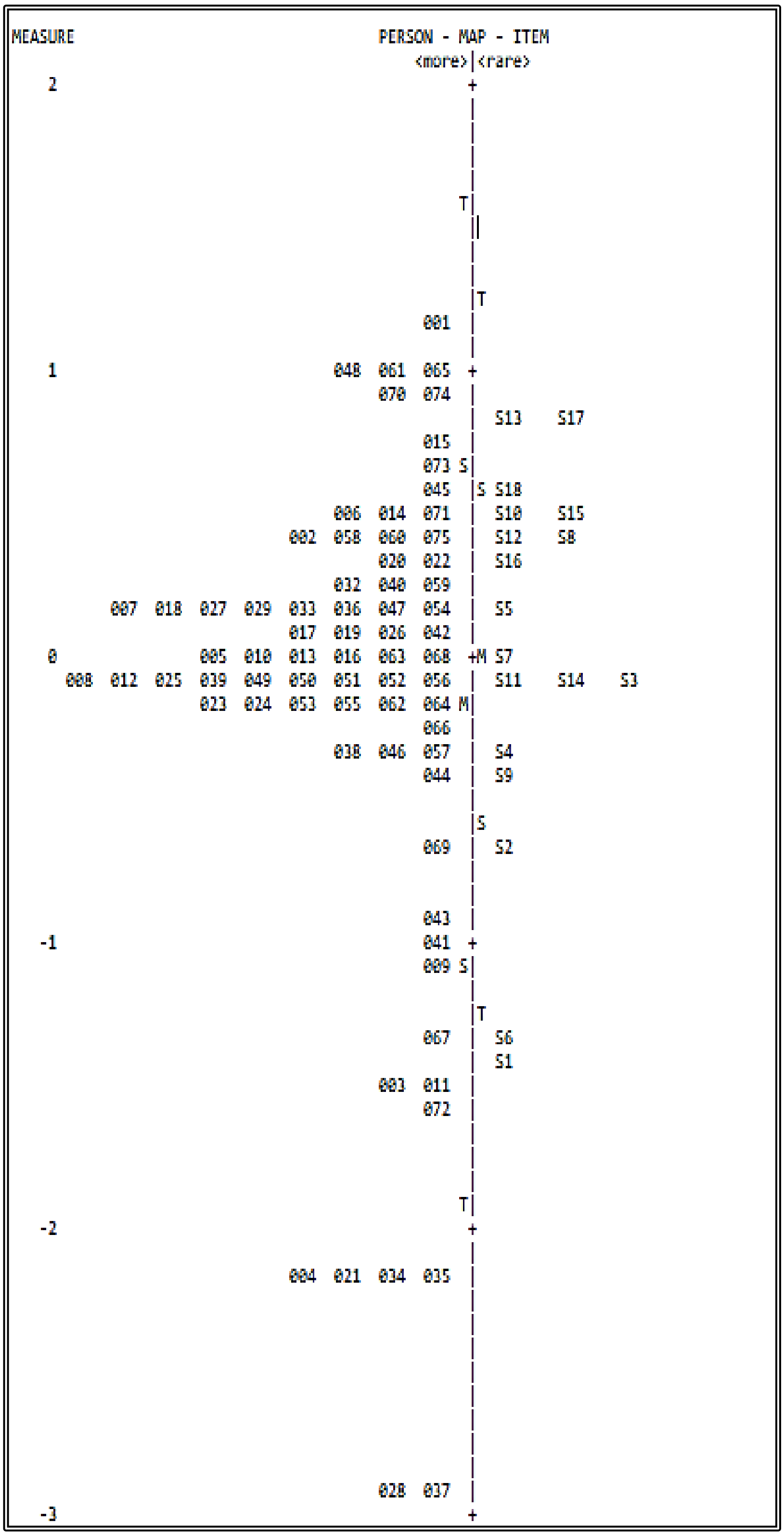


Figure 2. Person Item Map

Table 1. Students' HOTS classification

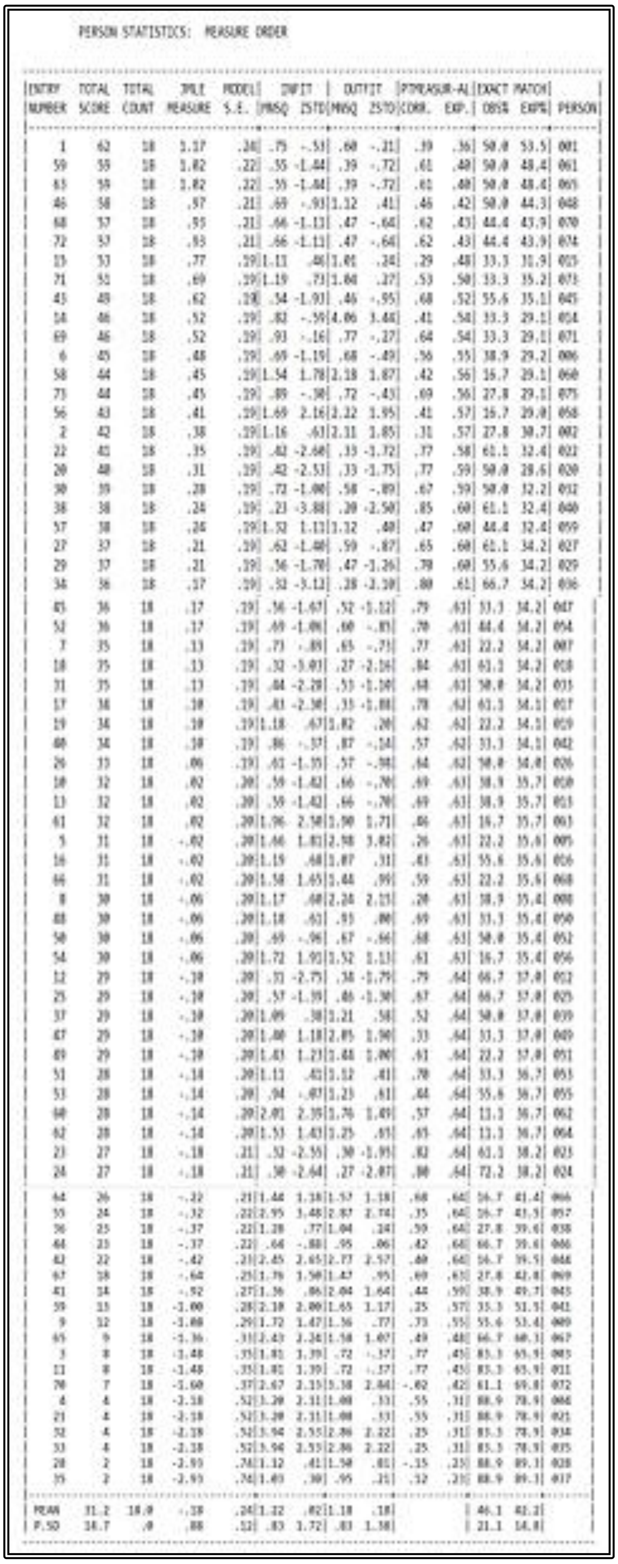
Rasch Output	Curve Norm Formula	Number of respondents	Classification	Percentage
Mean = -0.18	Data ⩾ Mean + SD	8	High	10.95%
	Mean-SD<Data<Mean+SD	55	Medium	75%
SD = 0.88	Mean-2SD<Data ⩽ Mean-SD	4	Low	5.48%
	Data ⩽ Mean-2SD	6	Very Low	8.21%

Based on Table 1 and the Person-Item-Map analysis are description below: 1) The mean person measure = -0.18 logit. This means that students' ability to solve HOTS Geometry questions is still lacking. In this case means that students' chances to solve the problems correctly is low. It is in line with (Purnomo, 2015). 2) There are 6 (six) students with exceptional abilities (001, 048, 061, 065, 070, and 074). They have a higher level of ability than the difficulty of the questions presented (S13, and S17). 3) Students 015 and 073 were unable to answer the S13 and S17 questions but were able to answer the S18 questions. The same logit scale on the map shows that Student 045 has the ability with the same level of difficulty as the S18 question. 4) There are 10 students who cannot solve the problem with the least amount of difficulty (S1). Among these 10 students, 6 students (004, 021, 034, 035, 028, and 037) are exceed from T boundary. It is indicated that these students are the lowest ability. 5) On the right side of the map, it is known that 18 questions vary in their level of difficulty, ranging from S13 and S17, which are the most difficult, to S1, which is the easiest. This indicates that the questions are good because they can reveal students' abilities and are not all collected at the same level of ability. 6) The distance between the average (M), one standard deviation (1SD), and two standard deviations (2SD) is compared, it is clear that the distribution of students' ability levels is wider than the distribution of question difficulty. This demonstrates that 73 students have varying levels of HOTS ability. 7) The average of person ability logit is lower than item difficult logit (0.0 logit). Its mean that students' ability is lower than item difficulties.

The HOTS geometry ability of 75 students in grade X of senior high school in Rasch modeling is comprehensively depicted on the Wright map (Person-item-map), as shown in Figure 2. Person-Item-Map shows the distribution of student abilities on the left and item difficulty levels on the right. In Figure 2, the distance between M-S-T (Mean, 1SD, and 2SD) indicates the level of ability and difficulty of the questions. Students' ability and item difficult are on the same logit scale. Students' individual logitability reveals their level of ability. Logit 0 means that students have 50:50 in solving the tests (Aziz et al., 2013). The greater the logit value, the greater the ability of the students (Sumintono & Widhiarso, 2015).

b. Students' HOTS Profiling

The level of ability of students' HOTS in Geometry was determined through an analysis of their ability. The profile of each individual's ability can be seen in Person Measure (Sumintono & Widhiarso, 2015), in Figure 3.



PERSON STATISTICS: MEASURE ORDER

ENTRY NUMBER	TOTAL SCORE	TOTAL COUNT	JMLE 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
1	62	18	1.17	.24	.75	-.53	.60	-.21	.39	.36	50.0	53.5	001
59	55	18	1.02	.22	.35	-1.44	.39	-.72	.61	.40	50.0	48.4	061
63	55	18	1.02	.22	.35	-1.44	.39	-.72	.61	.40	50.0	48.4	065
46	58	18	.97	.21	.69	-.93	1.12	.41	.46	.42	50.0	44.3	048
68	57	18	.95	.21	.66	-1.13	.47	-.64	.62	.43	44.4	43.9	070
72	57	18	.93	.21	.66	-1.11	.47	-.64	.62	.43	44.4	43.9	074
15	53	18	.77	.19	1.11	.46	1.01	.24	.29	.48	33.3	31.9	015
71	51	18	.69	.19	1.19	.73	1.04	.27	.53	.50	33.3	35.2	073
43	49	18	.62	.19	.54	-1.93	.46	-.95	.68	.52	55.6	35.1	045
14	46	18	.52	.19	.82	-.59	4.06	3.44	.41	.54	33.3	29.1	054
69	46	18	.52	.19	.93	-.16	.77	-.27	.64	.54	33.3	29.1	071
6	45	18	.48	.19	.65	-1.19	.68	-.49	.56	.55	38.9	29.2	006
58	44	18	.45	.19	1.54	1.78	2.18	1.87	.42	.56	16.7	29.1	060
73	44	18	.45	.19	.89	-.38	.72	-.43	.69	.56	27.8	29.1	075
56	43	18	.41	.19	1.69	2.16	2.22	1.95	.41	.57	16.7	29.0	058
2	42	18	.38	.19	1.16	.63	2.11	1.85	.31	.57	27.8	30.7	002
22	41	18	.35	.19	.42	-2.60	.33	-1.72	.77	.58	61.1	32.4	022
20	40	18	.31	.19	.42	-2.53	.33	-1.75	.77	.59	50.0	28.6	020
30	39	18	.28	.19	.72	-1.00	.58	-.89	.67	.59	50.0	32.2	032
38	38	18	.24	.19	.23	-3.88	.20	-2.50	.85	.60	61.1	32.4	040
57	38	18	.24	.19	1.32	1.13	1.12	.40	.47	.60	44.4	32.4	059
27	37	18	.21	.19	.62	-1.40	.59	-.87	.65	.60	61.1	34.2	027
29	37	18	.21	.19	.56	-1.70	.47	-1.26	.78	.60	55.6	34.2	029
34	36	18	.17	.19	.32	-3.12	.28	-2.30	.80	.61	66.7	34.2	036
45	36	18	.17	.19	.56	-1.67	.52	-1.12	.79	.61	33.3	34.2	047
52	36	18	.17	.19	.69	-1.06	.60	-.85	.70	.61	44.4	34.2	054
7	35	18	.13	.19	.73	-.89	.65	-.73	.77	.61	22.2	34.2	007
18	35	18	.13	.19	.32	-3.03	.27	-2.16	.84	.61	61.1	34.2	018
31	35	18	.13	.19	.44	-2.28	.53	-1.10	.68	.61	50.0	34.2	033
17	34	18	.10	.19	.43	-2.30	.35	-1.88	.78	.62	61.1	34.1	017
19	34	18	.10	.19	1.18	.67	1.02	.20	.62	.62	22.2	34.1	019
40	34	18	.10	.19	.86	-.37	.87	-.14	.57	.62	33.3	34.1	042
26	33	18	.06	.19	.63	-1.35	.57	-.98	.64	.62	50.0	34.0	026
10	32	18	.02	.20	.59	-1.42	.66	-.70	.69	.63	38.9	35.7	010
13	32	18	.02	.20	.59	-1.42	.66	-.70	.69	.63	38.9	35.7	013
61	32	18	.02	.20	1.96	2.50	1.90	1.71	.06	.63	16.7	35.7	063
5	31	18	-.02	.20	1.66	1.81	2.98	3.02	.26	.63	22.2	35.6	005
16	31	18	-.02	.20	1.15	.60	1.07	.31	.43	.63	55.6	35.6	016
66	31	18	-.02	.20	1.58	1.65	1.44	.99	.59	.63	22.2	35.6	068
8	30	18	-.06	.20	1.17	.60	2.24	2.13	.20	.63	38.9	35.4	008
48	30	18	-.06	.20	1.18	.63	.93	.00	.69	.63	33.3	35.4	050
50	30	18	-.06	.20	.69	-.96	.67	-.66	.68	.63	50.0	35.4	052
54	30	18	-.06	.20	1.72	1.93	1.52	1.13	.61	.63	16.7	35.4	056
12	29	18	-.10	.20	.31	-2.75	.34	-1.79	.79	.64	66.7	37.0	012
25	29	18	-.10	.20	.57	-1.39	.46	-1.30	.67	.64	66.7	37.0	025
37	29	18	-.10	.20	1.05	.30	1.21	.58	.52	.64	50.0	37.0	039
47	29	18	-.10	.20	1.40	1.18	2.05	1.90	.33	.64	33.3	37.0	049
49	29	18	-.10	.20	1.43	1.23	1.44	1.00	.61	.64	22.2	37.0	051
51	28	18	-.14	.20	1.13	.42	1.12	.41	.70	.64	33.3	36.7	053
53	28	18	-.14	.20	.94	-.07	1.23	.61	.44	.64	55.6	36.7	055
60	28	18	-.14	.20	2.01	2.35	1.76	1.49	.57	.64	11.1	36.7	062
62	28	18	-.14	.20	1.53	1.43	1.25	.65	.65	.64	11.1	36.7	064
23	27	18	-.18	.21	.32	-2.55	.30	-1.95	.82	.64	61.1	38.2	023
24	27	18	-.18	.21	.30	-2.64	.27	-2.07	.80	.64	72.2	38.2	024
64	26	18	-.22	.21	1.44	1.18	1.57	1.18	.68	.64	16.7	41.4	066
55	24	18	-.32	.22	2.95	3.48	2.87	2.74	.35	.64	16.7	41.3	057
36	23	18	-.37	.22	1.28	.77	1.04	.24	.59	.64	27.8	39.6	038
44	23	18	-.37	.22	.64	-.88	.95	.06	.42	.64	66.7	39.6	046
42	22	18	-.42	.23	2.45	2.65	2.77	2.57	.40	.64	16.7	39.5	044
67	18	18	-.64	.25	1.76	1.50	1.47	.95	.69	.63	27.8	42.8	069
41	14	18	-.92	.27	1.36	.86	2.04	1.64	.44	.59	38.9	49.7	043
39	13	18	-1.00	.28	2.10	2.00	1.65	1.17	.25	.57	33.3	51.5	041
9	12	18	-1.08	.29	1.72	1.47	1.36	.77	.73	.55	55.6	53.4	009
65	9	18	-1.36	.31	2.43	2.24	1.58	1.07	.49	.48	66.7	60.1	067
3	8	18	-1.48	.35	1.81	1.39	.72	-.37	.77	.45	83.3	65.9	003
11	8	18	-1.48	.35	1.81	1.39	.72	-.37	.77	.45	83.3	65.9	011
70	7	18	-1.60	.37	2.67	2.15	5.38	2.84	-.02	.42	61.1	69.8	072
4	4	18	-2.18	.52	3.20	2.31	1.08	.33	.55	.31	88.9	78.9	004
21	4	18	-2.18	.52	3.20	2.31	1.08	.33	.55	.31	88.9	78.9	021
32	4	18	-2.18	.52	3.94	2.55	2.86	2.22	.25	.31	83.3	78.9	034
33	4	18	-2.18	.52	3.94	2.55	2.86	2.22	.25	.31	83.3	78.9	035
28	2	18	-2.93	.74	1.12	.41	1.50	.81	-.15	.25	88.9	89.1	028
35	2	18	-2.93	.74	1.03	.30	.95	.21	.32	.25	88.9	89.1	037
MEAN	31.2	18.0	-.10	.24	1.22	.02	1.18	.18			46.1	42.2	
P.SD	14.7	.0	.88	.12	.83	1.72	.83	1.38			21.1	14.8	

Figure 3. Pearson Measure

Based on Person measure Figure 3, it can be seen that: (a) students 001 has the highest score. Score maximum ideal for this test is 72, student 001 reach total score 62, and the logit scale is +1.17. (b) There are two students in second place, 061 and 063, both of them have the same logit +1.02. (c) The third place is students 048 with logit +0.97. (d) Person in the bottom show that there are 6 (six) have logit score in outlier category. The standar deviation (SD = 0.88) means that the lowest logit score in norm distribution is limited in 2SD = -1.76. They have the logit score below from -2SD. From the total score, they cannot solve even one question correctly. Students with low ability levels require a different approach.

Furthermore, the analysis was performed to determine whether there were any students whose answer patterns did not relate to the ideal model. This can be useful for teachers who want to learn more about their students' inconsistent ways of thinking. Inconsistency in responding to this question could be the result of fraud or other external factors (Hamdu et al., 2020).

According to Boone et al (Saidi & Siew, 2019), this disparity in student response patterns can be measured by examining the value of the outfit table using the following criteria: (a) Value of Outfit Means Square (MNSQ): 0.5<MNSQ<1.5, (b) Z-Standard Value of the Outfit: −2.0<ZSTD<+2.0, (c) Value of Point Measure Correlation (Pt Mean Corr): 0.4<PT Mean Corr<0.85. The Person Fit Order table in Figure 4, shows the results of this discrepancy.

ENTRY	TOTAL	TOTAL	JMLE	MODEL	INFIT		OUTFIT		PTMEASUR-AL		EXACT MATCH		
NUMBER	SCORE	COUNT	MEASURE	S.E.	MNSQ	ZSTD	MNSQ	ZSTD	CORR.	EXP.	OBS%	EXP%	PERSON
14	46	18	.52	.19	.82	-.59	4.06	3.44	A .41	.54	33.3	29.1	014
32	4	18	-2.18	.52	3.94	2.53	2.86	2.22	B .25	.31	83.3	78.9	034
33	4	18	-2.18	.52	3.94	2.53	2.86	2.22	C .25	.31	83.3	78.9	035
70	7	18	-1.60	.37	2.67	2.13	3.38	2.84	D-.02	.42	61.1	69.8	072
4	4	18	-2.18	.52	3.20	2.11	1.08	.33	E .55	.31	88.9	78.9	004
21	4	18	-2.18	.52	3.20	2.11	1.08	.33	F .55	.31	88.9	78.9	021
5	31	18	-.02	.20	1.66	1.81	2.98	3.02	G .26	.63	22.2	35.6	005
55	24	18	-.32	.22	2.95	3.48	2.87	2.74	H .35	.64	16.7	43.5	057
42	22	18	-.42	.23	2.45	2.65	2.77	2.57	I .40	.64	16.7	39.5	044
65	9	18	-1.36	.33	2.43	2.24	1.58	1.07	J .49	.48	66.7	60.3	067
8	30	18	-.06	.20	1.17	.60	2.24	2.15	K .20	.63	38.9	35.4	008
56	43	18	.41	.19	1.69	2.16	2.22	1.95	L .41	.57	16.7	29.0	058
58	44	18	.45	.19	1.54	1.78	2.18	1.87	M .42	.56	16.7	29.1	060
2	42	18	.38	.19	1.16	.63	2.11	1.85	N .31	.57	27.8	30.7	002
39	13	18	-1.00	.28	2.10	2.00	1.65	1.17	O .25	.57	33.3	51.5	041
47	29	18	-.10	.20	1.40	1.18	2.05	1.90	P .33	.64	33.3	37.0	049
41	14	18	-.92	.27	1.36	.86	2.04	1.64	Q .44	.59	38.9	49.7	043
60	28	18	-.14	.20	2.01	2.39	1.76	1.49	R .57	.64	11.1	36.7	062
61	32	18	.02	.20	1.96	2.50	1.90	1.71	S .46	.63	16.7	35.7	063
3	8	18	-1.48	.35	1.81	1.39	.72	-.37	T .77	.45	83.3	65.9	003
11	8	18	-1.48	.35	1.81	1.39	.72	-.37	U .77	.45	83.3	65.9	011
67	18	18	-.64	.25	1.76	1.50	1.47	.95	V .69	.63	27.8	42.8	069
9	12	18	-1.08	.29	1.72	1.47	1.36	.77	W .73	.55	55.6	53.4	009
54	30	18	-.06	.20	1.72	1.91	1.52	1.13	X .61	.63	16.7	35.4	056
66	31	18	-.02	.20	1.58	1.65	1.44	.99	Y .59	.63	22.2	35.6	068

Figure 4. Person fit order

Based on Tabel Person Fit Order, there are some students who had e different patern respon. For example, student 014 has Outfit MNSQ = 4.86 and ZSTD = 3.44, both of which are significantly higher than the criteria. As a result, further examination of how students respond to each question is required.

In order to know what question that have been answered correctly or not, the analysis we use a scalogram analysis. A scalogram can be used to gain a better understanding of a student's ability. Scalograms can categorize the difficulty level of items in a systematic manner. Figure 5 depicts the results of the scalogram. This scalogram's results also show data on student responses that do not match the Rasch model.

```
GUTTMAN SCALOGRAM OF RESPONSES:
PERSON |ITEM
       |     1 1  1 111111
       |16294134756825083 7
       |-----------------
     1 +444444442344421334  001
    59 +444444444444142211  061
    63 +444444444444142211  065
    46 +444414444443432113  048
    68 +444444444444141111  070
    72 +444444444444141111  074
    15 +444341242143412334  015
    71 +444440444444014101  073
    43 +444444413421411211  045
    14 +144444332431032301  014
    69 +444444404404112101  071
     6 +444214224422302221  006
    58 +424444401404404010  060
    73 +444444444004101110  075
    56 +424444400404404010  058
     2 +324444042013212141  002
    22 +444344311421111111  022
    20 +444344211421111111  020
    30 +444414411141111111  032
    38 +444424232111111111  040
    57 +444114042014141111  059
    27 +441344211311131111  027
    29 +443441211141111211  029
    34 +442413233211111111  036
    45 +444441313203110010  047
    52 +444424211100411111  054
     7 +444244311410012000  007
    18 +444344121111111110  018
    31 +342423411211111121  033

    19 +444240031420400101  019
    40 +442431111140031112  042
    26 +341414331111111111  026
    10 +444131131111013021  010
    13 +444131131111013021  013
    61 +440440042000440200  063
     5 +044024303220301102  005
    16 +440304012211131121  016
    66 +444400401410040100  068
     8 +114431111133111111  008
    48 +444040412401101000  050
    50 +443411111140011111  052
    54 +440444042000400000  056
    12 +444121211111011211  012
    25 +441121411111112111  025
    37 +444120101040111311  039
    47 +404130143110101212  049
    49 +444040411100040200  051
    51 +443410141110400000  053
    53 +141414112111111111  055
    60 +444000444000400000  062
    62 +440444042000000200  064
    23 +443111321111011011  023
    24 +443111311111011111  024
    64 +444411400000004000  066
    55 +400440044000400000  057
    36 +440410014011001011  038
    44 +141121111111111121  046
    42 +440000044000004200  044
    67 +440400042000000000  069
    41 +420000013000020200  043
    39 +104010300101001100  041
     9 +440040000000000000  009
    65 +044000000000000001  067
     3 +440000000000000000  003
```

Figure 5. The Scalogram result

Based on Figure 5, it is fairly obvious that students' responses to each item follow a specific pattern. Students 001, 061 and 065 demonstrate the correct pattern. In this case, students perform well on easy questions but struggle with difficult questions. On the other hand, some students provide unique answer patterns that do not match the pattern.

Based on the scalogram results, it is known that several students have unique answers, indicating that the answers are outside the pattern or do not match the pattern from the Rasch model. For example, student 014, who did not succeed in answering the easiest questions, but the questions were well-solved. Student 002 was able to answer one difficult question, S13, but failed to answer an easy question S6. These students show the unconsisten skill. It also indicates that students did not have a good understanding (Hamdu et al., 2020).

Students who exhibit this pattern merit further investigation. What are the obstacles encountered, or is there a misunderstanding of concepts in problem-solving, or is it only a coincidence answer?

The findings of Reasch's analysis of students' HOTS abilities in Geometry are important information that teachers can use to plan their next lesson. Teachers can pay more attention to students who have limited or very limited abilities. Moreover, this analysis discovered questions that students perceived to be difficult, with only a few people being able to solve them.

4. CONCLUSION

According to the study's findings, the HOTS ability of high school students in Palembang on Geometry is still lacking. Students' average logit value is -0.18. Further to that, the questions with the highest level of difficulty are S13 and S17. Based on the study findings, the researchers recommend the following: Classroom instruction should be geared toward HOTS so that students become accustomed to thinking higher; For other researchers, the use of the Rasch analysis model in assessment is highly recommended because it provides a more comprehensive overview with a low error rate; and additional study of students in the misfit category is considered necessary.

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