Quality Of Algebra Questions to Measure Mathematical Literacy Ability Using Partial Credit Model

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Abstract

Mathematical literacy skills require someone to understand, analyze, interpret, evaluate, and synthesize knowledge obtained from the problems faced by modeling them into appropriate solutions in solving a problem effectively. The need to develop questions according to students' daily problems can familiarize students with mathematical literacy. The research developed mathematical literacy test questions on tobacco farming in the Puger Jember area to measure students' mathematics literacy abilities at the high school level. The research method used is Research and Development (R&D) using the Thiagarajan model, which is modified into three stages: definition, planning, and development. Field trial results were analyzed using Ministep software with Rasch modeling using the Partial Credit Model (PCM) method. The results obtained from the ten questions developed can be said to be fit; with the reliability of 139 interactions between students and the question items, the quality is still poor, and 75 students' interactions between students and the question items are of good quality. The item reliability of the literacy questions developed was 0.80 in the first 75 samples, 0.95 in the following 75 samples, and 0.89 in the last 64 samples, indicating that the questions developed were excellent and could measure students' abilities well.

Keywords:

Algebra Literacy Problems, Mathematical Literacy Skills, Partial Credit Model

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INTRODUCTION

Mathematical literacy is the ability of each individual to reason mathematically to formulate, use, and interpret mathematical knowledge related to problems in everyday life (Dinni, 2018; OECD, 2021). Mathematical literacy is an idea or notion that defines part of the mathematical knowledge and competencies needed in personal and social life to participate in the community as citizens who can apply, reflect, and contribute (Geiger & Dole, 2012). Mathematical literacy is the ability of each individual to reason mathematically to formulate, use, and interpret mathematical knowledge related to problems in everyday life (Fajriyah, 2018; OECD, 2021). Every individual can use literacy skills to face problems related to mathematics using appropriate strategy selection (Muslimah & Pujiastuti, 2020; Maharani, 2022). Mathematical literacy is about assigning material and using reasoning, concepts, facts, and mathematical tools to solve everyday problems (Genc & Erbas, 2019; Moschkovich, 2015; Sari, 2015; Sitopu et al, 2024). Someone who understands sorting out mathematical concepts relevant to the problems will have good mathematical literacy (Setiawan et al., 2014; Kusumawardani et al., 2018). In this case, the government supports education development for the benefit of the nation and state in the future by involving countries in taking literacy skills tests.

As a member country of the OECD, Indonesia has participated in establishing PISA since 2000 (Stacey, 2011). The latest data on the average score of the 2018 PISA test in the field of science shows that Indonesian students obtained an average score of 379, which is down from the previous one in the fifth round in 2015 was 402 (Balitbang, 2018). Indonesia is at the lowest level among several participating countries in the world. One of the reasons is students' limitations regarding literacy questions; they rarely give similar questions (Ate & Lede, 2022). Research conducted by Kurniati shows that students' ability to solve PISA questions shows that out of 30 students across several junior high schools in Jember Regency, 18 could carry out logical reasoning, analysis, evaluation, and creation well. The researcher suggests adding literacy questions at school, and it is also challenging to create instruments related to mathematical literacy (Kurniati et al., 2016).

The development of literacy questions in this research questions on algebra material, a branch of mathematics that studies structure, relationship, and quantity as a means of simplification and as a tool that helps solve problems (Hidayani, 2021). The development of questions in this research uses an agricultural theme around the students' environment, in line with Mardiyah's opinion that the use of themes found in real life allows students to find meaningful relationships with abstract ideas and their application to real-life problems (Mardiyah et al., 2021). Considering that there are still no students' mathematical literacy questions on algebra material on the theme of tobacco farming that can measure students' mathematical literacy abilities, Technology, and science are developing very rapidly, accompanied by information processing in such a way that it is causing changes in human lifestyle which is the third wave (Cintamulya, 2012)

The theme of tobacco farming in the Puger Jember area is the current conditions of society and can cause problems in real life (Bakker, 2018). The theme of tobacco farming is related to the mathematical literacy context, namely societal, with material that will be developed in the test questions, namely algebra, as part of the mathematical literacy content, namely change and relationship with competencies using the three different clusters according to PISA. Based on the description above, it can be seen that there is a need to develop mathematical literacy questions to measure students' literacy abilities. The development of questions in this research is aimed at upper-secondary students. Using the partial credit model, the questions that have been prepared can explain the quality of the questions, which can later be used to measure students' mathematical literacy abilities.

METHODS

Mathematical literacy questions on algebra material were tested on 214 research subjects. Research on students was carried out because they had studied algebra material. The selected research subjects had various levels of mathematical literacy abilities. The first step in using the Partial Credit Model (PCM) is a summary. Prepare raw data from algebra test results with different maximum scores. Then, the raw data from Excel will be formatted into prn. Next, the data will be explained using the Ministep application. The final step is to interpret the quality of the algebra mathematical literacy question instrument. The following summary of the research method can be seen in the figure 1.

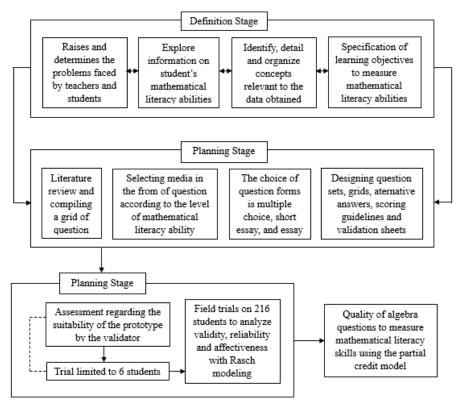


Figure 1. Research Procedure

Measure

Items are checked based on the following conditions.

- 1) OutfitMean Square (MNSQ) value received 0.5 < MNSQ < 1.5;
- valueAccepted Outf it Z-Standardcarrefour -2,0 < ZSTD < +2,0;Point Meaure correlfourn value 0you4 < Pt Measure < 0,85.
 (Bambang Sumintono, 2015)

Statistical Analysis

The test questions in this study were evaluated based on reliability, validity, descriptive statistics, and the Rasch modeling index. The assessment focuses on checking items by considering the ease of identifying sources of anxiety during measurement (Harvani et al., 2023). Literacy test questions were examined based on Cronbach's alpha value, item reliability, and separation index. By looking at Cronbach's alpha value, item reliability, and person reliability, information can be obtained that shows the quality of the instrument's reliability. ZSTD Clothing, MNSQ Score Clothing, and Pt Mean Coor will indicate the validity of the test instrument. The results of measuring mathematical literacy abilities can be seen through the separation value.

RESULTS & DISCUSSION

Activities began with limited trials and field trials. Limited trials were tested on a limited basis on 6 class XI students of SMA Negeri 1 Kencong, and field trials were carried

out on 216 class XI students of SMA Negeri 1 Kencong. The purpose of conducting limited trials is to measure the readability of the questions.

Meanwhile, field trials aim to measure the reliability and validity of the questions and their effectiveness. The ten questions are arranged according to indicators of students' level of mathematical literacy abilities. The problems in this test are presented by students' daily problems around tobacco farming. The developing agricultural theme requires students to know the importance of literacy skills for their future progress. What they need to know about making cigars made from Puger Jember tobacco leaves includes the planting process, land area, fertilizer required, workers, overall costs, and sales in the form of algebraic mathematics, which is very useful for them in the future.

Raw scores will be processed according to scoring guidelines. The student scores obtained will be input and processed with the help of Ministep software to predict students' mathematical literacy abilities in completing the given agricultural theme literacy test. This program will analyze using Rasch modeling. The Summary Statistics table displays all information related to the quality of the instruments used and the subjects' quality.

Validity Analysis

Field trial results were analyzed using Ministep software with Rasch modeling and the Partial Credit Model (PCM) method. Validity analysis is the first carried out; three questions meet the three validity criteria. The rest only meet two and one criterion, but the items can still be said to be fit because they meet one criterion. The following is information about the fit of a question item.

TABLE 13 INPUT: 7			tem REPO			rson 1	10 Ite	em 2 (NISTER			
Person:	REAL SE	P.: .00	REL.: .	ee	Item:								
	Item S	TATISTI	CS: MEAS	URE OR	DER								
ENTRY	TOTAL	TOTAL	JMLE	MODEL	I	VFIT	Ιουτ	FIT	PTMEAS	UR-AL	EXACT	MATCH	1
NUMBER	SCORE	COUNT	MEASURE	S.E.	MNSQ	ZSTD	MNSQ	ZSTD	CORR.	EXP.	OBS%	EXP%	Item
3	1	75	67.51										
6	1	75	67.51	11.26	1.33	.63	.32	20	.27	.29	97.1	97.1	S6
7	1	75	67.51	11.26	1.33	.63	.32	20	.27	.29	97.1	97.1	S7
9	1	75	67.51	11.26	.40	63	.05	87	.44	.29	97.1	97.1	S9
10	1	75	67.51	11.26	.40	63	.05	87	.44	.29	97.1	97.1	S10
1	4	75	48.33	6.04	.96	.05	1.19	.49	.45	.45	91.4	90.5	S1
8	5	75	45.01	5.48	1.06	.28	1.62	1.09	.42	.48	88.6	87.8	S8
2	13	75									74.3	73.3	S2
4	14	75	27.20	3.89	.79	-1.28	.71	-1.09	.72	.64	71.4	71.7	S4
5	23	74	13.17	3.96	1.17	1.20	1.59	1.19	.68	.74	67.6	67.8	S5
j										4		÷	i
MEAN	6.4	74.9	50.00	7.96	.99	.10	.76	01			87.9	87.6	i
P.SD	7.3	.3	19.72	3.36	.35	.72	.55	.75		i	11.4	11.4	i i

Figure 2. Suitability of Question Items

- Questions S1, S2, and S4 meet the criteria for Outfit MNSQ, Oufit ZSTD, and Pt Mean Corr
- 2) Question S3 meets the criteria for Outfit MNSQ and Oufit ZSTD
- 3) Questions S5, S8, S9 and S10 meet the Oufit ZSTD and Pt Mean Corr criteria
- 4) Questions S6 and S7 meet the Oufit ZSTD criteria

So, all the questions are categorized as fit questions, and no questions need to be changed or replaced.

Reliability Analysis

Reliability shows that the value for the first 75 students is 0.61; this shows that the interaction between students and the questions is still poor. The next 75 students showed a value of 0.81, which means that the quality of the interaction between students and the questions was excellent. In comparison, the following 64 students had a value of <0.5, which shows that the quality of the interaction between students and the questions was still poor. The following is a summary of field trial statistics.

TOTAL MODEL INFIT OUT SCORE COUNT MEASURE S.E. MNSQ ZSTD MNSQ IEAN 1.8 10.0 23.15 11.16 .97 06 .75 SEM .2 .0 2.03 .22 .11 .17 .18	ZST
IEAN 1.8 10.0 23.15 11.16 .9706 .75	
IEAN 1.8 10.0 23.15 11.16 .9706 .75	
CEM 2 A 2 A2 22 11 17 10	.00
JEPI 12 10 2103 122 11 1/ 10	.13
2.SD 1.2 .2 11.82 1.30 .64 1.01 1.08	.78
SD 1.2 .2 11.99 1.32 .65 1.03 1.09	.79
IAX. 7.0 10.0 65.86 12.30 3.07 2.66 5.01	2.87
IIN. 1.0 9.0 13.92 8.13 .32 -1.52 .15	80

Person RAW SCORE-TO-MEASURE CORRELATION = .98 (approximate due to missing data) CRONBACH ALPHA (KR-20) Person RAW SCORE "TEST" RELIABILITY = .61 SEM = .77 STANDARDIZED (50 ITEM) RELIABILITY = .00

SUMMARY (DF 10	MEASURED (NON-EXTREME) Item
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	TOTAL			MODEL	IN	FIT	OUTR	TI
	SCORE	COUNT	MEASURE	S.E.	MNSQ	ZSTD	MNSQ	ZSTD
MEAN	6.4	74.9	50.00	7.96	.99	.10	.76	01
SEM	2.4	.1	6.57	1.12	.12	.24	.18	.25
P.SD	7.3	.3	19.72	3.36	.35	.72	.55	.75
S.SD	7.7	.3	20.79	3.54	.37	.76	.58	.80
MAX.	23.0	75.0	67.51	11.26	1.46	1.20	1.62	1.19
MIN.	1.0	74.0	13.17	3.89	.40	-1.28	.05	-1.09
REAL RM	ISE 9.45	TRUE SD	17.32 SEP	ARATION	1.83 Ite	m REL	IABILIT	(.77
ODEL RM	ISE 8.64	TRUE SD	17.73 SEP	ARATION	2.05 Ite	m REL	IABILITY	r .81
S.E. OF	Item MEAN	N = 6.57						

 TABLE 3.1 DATA 76-150
 ZOU093WS.TXT
 Dec 13 2023 19:43

 INPUT: 75 Person 10 Item REPORTED: 75 Person 10 Item 2 CATS MINISTEP 5.6.3.0

SUMMARY OF 33 MEASURED Person

!	TOTAL			MODEL		FIT	OUT	
	SCORE	COUNT	MEASURE	S.E.	MNSQ	ZSTD	MNSQ	ZSTD
MEAN	1.9	10.0	36.85	17.27	.70	30	.52	32
SEM	.1	.0	3.78	.35	.28	.20	.30	.23
P.SD	.8	.0	21.36	1.95	1.57	1.15	1.72	1.32
S.SD	.8	.0	21.70	1.98	1.59	1.17	1.74	1.34
MAX.	3.0	10.0	64.52		7.52	4.86	9.90	6.76
MIN.	1.0	10.0	13.14	14.65	.13	94	.07	78
REAL	RMSE 20.23	TRUE SD	6.86 SE	PARATION	.34 Per	son REL		Y .10
MODEL	RMSE 17.38	TRUE SD	12.43 SE					
S.E.	OF Person M	EAN = 3.78						

Person RAW SCORE-TO-MEASURE CORRELATION = 1.00 CRONBACH ALPHA (KR-20) Person RAW SCORE "TEST" RELIABILITY = .57 SEM = .72 STANDARDIZED (50 ITEM) RELIABILITY = .85

SUMMARY OF 5 MEASURED Item

1	TOTAL				MODEL		TN	FIT	OUTF	тт
	SCORE	COUNT	MEASU		S.E.	М	NSQ	ZSTD		ZSTD
MEAN	12.6	75.0	50.		7.63		.93	29		
SEM	5.6	.0	17.	36	1.17		.12	.48	.69	.64
P.SD	11.3	.0	34.	72	2.33		.25	.95	1.38	1.29
S.SD	12.6	.0	38.	81	2.61		.28	1.06	1.54	1.44
MAX.	31.0	75.0	87.	14	10.26	1	.13	.43	3.41	1.58
MIN.	1.0	75.0			5.01				.31	
!	RMSE 8.39		33.69						LIABILITY	
	RMSE 7.98		33.79	SEPA	RATION	4.24	Ite	n REI	LIABILITY	.95
S.E.	OF Item MEA	N = 17.36								

 TABLE 3.1 DATA 151-214
 ZOU656WS.TXT
 Dec 15 2023 18:30

 INPUT: 64 Person 10 Item REPORTED: 64 Person 10 Item 2 CATS MINISTEP 5.6.3.0

SUMMARY OF 36 MEASURED (NON-EXTREME) Person

	TOTAL			MODEL	INF	TI	OUTF	IT
	SCORE	COUNT	MEASURE	S.E.	MNSQ	ZSTD	MNSQ	ZSTD
MEAN	1.1	10.0	30.43	20.68	1.01	19	.62	40
SEM	.0	.0	1.30	.36	.38	.18	.22	.14
P.SD	.3	.0	7.69	2.15	2.24	1.05	1.31	.85
S.SD	.3	.0	7.80	2.18	2.28	1.06	1.33	.87
MAX.	2.0	10.0	55.92	21.33	7.24	2.46	4.20	1.77
MIN.	1.0	10.0	28.11	13.54	.11	97	.07	79
REAL RM	SE 27.53	TRUE SD	.00 SEP/	ARATION	.00 Pers	on REL	IABILITY	.00
	SE 20.79 Person ME	TRUE SD EAN = 1.30	.00 SEP/	ARATION	.00 Pers	on RELI	IABILITY	.00

Person RAW SCORE-TO-MEASURE CORRELATION = 1.00 CRONBACH ALPHA (KR-20) Person RAW SCORE "TEST" RELIABILITY = .00 SEM = .58 STANDARDIZED (50 ITEM) RELIABILITY = .00

SUMMARY OF 4 MEASURED (NON-EXTREME) Item	SUMMARY	OF 4	MEASURED	(NON-EXTREME)) Item
--	---------	------	----------	---------------	--------

	TOTAL			MODEL		INFIT	r	OUTF:	IT
	SCORE	COUNT	MEASU	IRE S.E.	MNS	SQ Z	STD	MNSQ	ZSTD
MEAN	9.8	64.0	50.	00 7.89	.9	97	.24	.62	13
SEM	7.5	.0	14.	71 1.48	1	11	.17	.28	.32
P.SD	12.9	.0	25.	48 2.57	. 1	19	.29	.48	.55
S.SD	15.0	.0	29.	43 2.97		21	.34	.56	.64
MAX.	32.0	64.0	70.	61 10.46	1.2	26	.74	1.25	.67
MIN.	1.0	64.0	8.	20 5.31		81	.04	.15	64
REAL	RMSE 8.41	TRUE SD	24.06	SEPARATION	2.86	Item	REL	IABILITY	.89
	RMSE 8.30 OF Item MEA		24.09	SEPARATION	2.90 1	Item	RELI	IABILITY	.89

Figure 3. Summary Statistics

The reliability values of the respondents obtained showed that the first 75 students and the remaining 64 students were unreliable (Aprillia et al., 2021). Meanwhile, the item reliability of the numeracy questions developed was 0.80 in the first 75 samples, 0.95 in the following 75 samples, and 0.89 in the last 64 samples, indicating that the questions developed were excellent and could measure students' abilities well.

 TABLE 13.1 DATA 1-75
 ZOU969WS.TXT
 Dec 21 2023 19:25

 INPUT: 75 Person 10 Item REPORTED: 75 Person 10 Item 2 CATS MINISTEP 5.6.3.0
 Person: REAL SEP.: .00 REL.: .00 ... Item: REAL SEP.: 1.83 REL.: .77

Item STATISTICS: MEASURE ORDER

ENTRY	TOTAL	TOTAL	JMLE	MODEL	INFIT	1 OUT	FIT	PTMEAS	JR-AL	EXACT	MATCH	
NUMBER	SCORE	COUNT	MEASURE		VSQ ZSTD					OBS%	EXP%	Item
3	1	75	67.51		.46 .75					97.1	97.1	53
6	1	75	67.51	11.26 1	.33 .63	.32	20	.27	.29	97.1	97.1	S6
7	1	75	67.51	11.26 1	.33 .63	.32	20	.27	.29	97.1	97.1	S7
9	1	75	67.51	11.26	.4063	.05	87	.44	.29	97.1	97.1	S9
10	1	75	67.51	11.26	.4063	.05	87	.44	.29	97.1	97.1	S10
1	4	75	48.33	6.04	.96 .05	1.19	.49	.45	.45	91.4	90.5	S1
8	5	75	45.01	5.48 1	.06 .28	1.62	1.09	.42	.48	88.6	87.8	S8
2	13	75	28.73	3.95	.99 .02	1.00	.08	.63	.63	74.3	73.3	S2
4	14	75	27.20	3.89	.79 -1.28	.71	-1.09	.72	.64	71.4	71.7	S4
5	23	74	13.17	3.96 1	.17 1.20	1.59	1.19	.68	.74	67.6	67.8	S5
				+								
MEAN	6.4	74.9	50.00	7.96			01				87.6	
P.SD	7.3	.3	19.72	3.36	.35 .72	.55	.75			11.4	11.4	

 TABLE 13.1 DATA 76-150
 ZOU093WS.TXT
 Dec 13 2023 19:43

 INPUT: 75 Person 10 Item REPORTED: 75 Person 10 Item 2 CATS MINISTEP 5.6.3.0

 Person: REAL SEP:: .94 REL: .47 ... Item: REAL SEP: 2.27 REL: .84

Item STATISTICS: MEASURE ORDER

ENTRY	TOTAL	TOTAL	JMLE	MODEL	IN	IFIT	OUT	FIT	PTMEAS	UR-AL	EXACT	MATCH	
NUMBER	SCORE	COUNT	MEASURE	S.E.	MNSQ	ZSTD	MNSQ	ZSTD	CORR.	EXP.	OBS%	EXP%	Item
3	0	75	99.79	18.12	MAXI	MUM ME	EASURE		.00	.00	100.0	100.0	\$3
7	0	75	99.79	18.12	MAXI	MUM ME	EASURE		.00	.00	100.0	100.0	S7
8	0	75	99.79	18.12	MAXI	MUM ME	EASURE		.00	.00	100.0	100.0	S8
9	0	75	99.79	18.12	MAXI	MUM ME	EASURE		.00	.00	100.0	100.0	S9
10	0	75	99.79	18.12	MAXI	MUM ME	EASURE		.00	.00	100.0	100.0	S10
1	1	75	87.14	10.26	1.13	.43	3.41	1.58	.13	.22	97.0	96.8	S1
6	1	75	87.14	10.26	1.13	.43	3.41	1.58	.13	.22	97.0	96.8	S6
5	12	75	47.50	5.08	.52	-1.97	.31	-1.35	.79	.73	93.9	84.4	S5
4	18	75	32.61	5.01	.77	74	.57	81	.85	.82	87.9	84.1	S4
2	31		-4.39	7.54								93.8	
MEAN	6.3		74.90									91.2	
P.SD	10.2	.0	34.96	5.50	.25	.95	1.38	1.29			3.3	5.8	

 TABLE 13.1 DATA 151-214
 ZOU656WS.TXT
 Dec 15 2023 18:30

 INPUT: 64 Person 10 Item REPORTED: 64 Person 10 Item 2 CATS MINISTEP 5.6.3.0
 10 Item 2 CATS MINISTEP 5.6.3.0

 Person: REAL SEP.: .00 REL.: .00 ... Item: REAL SEP.: 1.14 REL.: .57

Item STATISTICS: MEASURE ORDER

ENTRY	TOTAL	TOTAL	JMLE	MODEL	IN	FIT OUT	FIT	PTMEAS	UR-AL	EXACT	MATCH	
NUMBER	SCORE	COUNT	MEASURE	S.E.	MNSQ	ZSTD MNSQ	ZSTD	CORR.	EXP.	OBS%	EXP%	Item
				+	+	+		+	+	+	+	
1	0	64	83.46	18.32	MAXI	MUM MEASURE		.00	.00	100.0	100.0	S1
3	0	64	83.46	18.32	MAXI	MUM MEASURE		.00	.00	100.0	100.0	S3
6	0	64	83.46	18.32	MAXI	MUM MEASURE		.00	.00	100.0	100.0	S6
8	0	64	83.46	18.32	MAXI	MUM MEASURE		.00	.00	100.0	100.0	S8
9	0	64	83.46	18.32	MAXI	MUM MEASURE		.00	.00	100.0	100.0	S9
10	0	64	83.46	18.32	MAXI	MUM MEASURE		.00	.00	100.0	100.0	S10
4	1	64	70.61	10.46	.81	.04 .15	64	.30	.21	97.2	97.2	S 4
7	1	64	70.61	10.46	.81	.04 .15	64	.30	.21	97.2	97.2	S7
5	5	64	50.58	5.31	1.26	.74 1.25	.67	.30	.39	83.3	88.2	S5
2	32	64	8.20	5.34	1.00	.14 .92	.09	.84	.84	88.9	88.9	S2
				+	+	+		+	+	+	+	
MEAN	3.9	64.0	70.08	14.15	.97	.24 .62	13			91.7	92.8	
P.SD	9.5	.0	22.99	5.36	.19	.29 .48	.55			5.9	4.3	

Figure 4. Logit measure

Analysis of the Difficulty Level of Questions

The logit value for each question has been sorted from highest to lowest and is presented in Figure 3. Item S10 has the highest logit value throughout the analysis of 214 samples, namely + 67.51, +99.79, +83.46. This value shows that question S10 is the most challenging question, followed by questions S3, S8, and S9. Figure 4.8 shows the distribution of scores on S10 questions. No students could answer the questions correctly, or 100% of students got a score of 0. Questions S2, S4, and S5 had the lowest relative logit values , with the lowest in question S2, namely -4.39. This value shows that these three questions are the most straightforward questions students can answer. Of the 214 students, 147 of them were able to solve the three questions correctly.

 TABLE 13.1 DATA 1-75
 ZOU969WS.TXT
 Dec 21 2023 19:25

 INPUT: 75 Person 10 Item REPORTED: 75 Person 10 Item 2 CATS MINISTEP 5.6.3.0

 Person: REAL SEP: .00 REL: .00 ... Item: REAL SEP: 1.83 REL: .77

Item STATISTICS: MEASURE ORDER

ENTRY	TOTAL	TOTAL	JMLE	MODEL	I	IFIT	OUT	FIT	PTMEAS	UR-AL	EXACT	MATCH	
NUMBER	SCORE	COUNT	MEASURE	S.E.	MNSQ	ZSTD	MNSQ	ZSTD	CORR.	EXP.	OBS%	EXP%	Item
				+		+	+		+	+	+	+	
3	1	75	67.51	11.26				.24				97.1	_
6	1	75	67.51	11.26	1.33	.63	.32	20	.27	.29	97.1	97.1	S6
7	1	75	67.51	11.26	1.33	.63	.32	20	.27	.29	97.1	97.1	S7
9	1	75	67.51	11.26		63	.05	87	.44	.29			_
10	1	75	67.51	11.26	.40	63	.05	87	.44			97.1	
1	4	75	48.33	6.04	.96	.05	1.19	.49	.45	.45	91.4	90.5	S1
8	5	75	45.01	5.48	1.06			1.09		.48	88.6	87.8	S8
2	13	75	28.73	3.95	.99	.02	1.00	.08	.63	.63	74.3	73.3	S2
4	14	75	27.20	3.89	.79	-1.28	.71	-1.09	.72	.64	71.4	71.7	S4
5	23	74	13.17	3.96	1.17	1.20	1.59	1.19	.68	.74	67.6	67.8	S5
				+		+	+		+	+	+	+	
MEAN	6.4	74.9	50.00	7.96	.99	.10	.76	01			87.9	87.6	
P.SD	7.3	.3	19.72	3.36	.35	.72	.55	.75			11.4	11.4	

 TABLE 13.1 DATA 76-150
 ZOU093WS.TXT
 Dec 13 2023 19:43

 INPUT: 75 Person 10 Item
 REPORTED: 75 Person 10 Item 2 CATS MINISTEP 5.6.3.0

 Person: REAL SEP.: .94
 REL: .47 ... Item: REAL SEP.: 2.27
 REL: .84

Item STATISTICS: MEASURE ORDER

ENTRY	TOTAL	TOTAL	JMLE	MODEL	II	IFIT	OUT	FIT	PTMEAS	UR-AL	EXACT	MATCH	
NUMBER	SCORE	COUNT	MEASURE	S.E.	MNSQ	ZSTD	MNSQ	ZSTD	CORR.	EXP.	OBS%	EXP%	Item
					+		+		+				
	0	75	99.79			emum mi			.00			100.0	
7	0	75	99.79	18.12	MAX	emum mi	EASURE		.00	.00	100.0	100.0	S7
8	0	75	99.79	18.12	MAX	emum mi	EASURE		.00	.00	100.0	100.0	S8
9	0	75	99.79	18.12	MAXI	emum mi	EASURE		.00	.00	100.0	100.0	S9
10	0	75	99.79	18.12	MAX1	emum mi	EASURE		.00	.00	100.0	100.0	S10
1	1	75	87.14	10.26	1.13	.43	3.41	1.58	.13	.22	97.0	96.8	S1
6	1	75	87.14	10.26	1.13	.43	3.41	1.58	.13	.22	97.0	96.8	S6
5	12	75	47.50	5.08	.52	-1.97	.31	-1.35	.79	.73	93.9	84.4	S5
4	18	75	32.61	5.01	.77	74	.57	81	.85	.82	87.9	84.1	S4
2	31	75	-4.39	7.54	1.12	. 39	2.81	1.38	.84	.86	93.9	93.8	S2
					+		+		+		+	+	
MEAN	6.3	75.0	74.90	12.87				.48				91.2	
P.SD	10.2	.0	34.96	5.50	.25	.95	1.38	1.29			3.3	5.8	

 TABLE 13.1 DATA 151-214
 ZOU656WS.TXT
 Dec 15 2023 18:30

 INPUT: 64 Person 10 Item
 REPORTED: 64 Person 10 Item 2 CATS MINISTEP 5.6.3.0

 Person: REAL SEP.: .00 REL.: .00 ... Item: REAL SEP.: 1.14 REL.: .57

Item STATISTICS: MEASURE ORDER

ENTRY	TOTAL	TOTAL	JMLE	MODEL	INFIT	OUT	FIT	PTMEAS	UR-AL	EXACT	MATCH	
NUMBER	SCORE	COUNT	MEASURE	S.E. MNS	SQ ZSTD	MNSQ	ZSTD	CORR.	EXP.	OBS%	EXP%	Item
				+		+	+		+	+	+	
1	0	64	83.46	18.32 M	AXIMUM M	EASURE	I	.00	.00	100.0	100.0	S1
3	0	64	83.46	18.32 M	XIMUM M	EASURE	I	.00	.00	100.0	100.0	S3
6	0	64	83.46	18.32 M	XIMUM M	EASURE		.00	.00	100.0	100.0	S6
8	0	64	83.46	18.32 M	XIMUM M	EASURE	- 1	.00	.00	100.0	100.0	S8
9	0	64	83.46	18.32 M	XIMUM M	EASURE		.00	.00	100.0	100.0	S9
10	0	64	83.46	18.32 M	XIMUM M	EASURE	- 1	.00	.00	100.0	100.0	S10
4	1	64	70.61	10.46 .8	.04	.15	64	.30	.21	97.2	97.2	S 4
7	1	64	70.61	10.46 .8	.04	.15	64	.30	.21	97.2	97.2	S7
5	5	64	50.58	5.31 1.2	.74	1.25	.67	.30	.39	83.3	88.2	S5
2	32	64	8.20	5.34 1.6	.14	.92	.09	.84	.84	88.9	88.9	S2
				·····		+						
MEAN	3.9	64.0	70.08	14.15 .9	.24	.62	13			91.7	92.8	
P.SD	9.5	.0	22,99	5.36 .1	19.29	.48	.55		i	5.9	4.3	

Figure 5. Logit measures

The third analysis is related to the level of difficulty of the questions. The results show that three questions are included in the easy category, three questions are included in the medium category, and four questions are included in the difficult category.

Table 1. Distribution of Ques	stion Difficulty Levels
Question Difficulty level	Question items
Easy	S2, S4, and S5
Currently	S1, S6, and S7
Difficult	S3, S8, S9, and S10

Questions in the problematic category measure high-level mathematical literacy skills, namely levels 4, 5, and 6. Overall, students can answer questions well on low-level questions, which shows that most students have medium to lower mathematical literacy abilities.

Subject Ability Analysis

Figure 5 displays information related to the logit for each student. The measured column is the logit measure for each respondent. Students with code P009 have a logit value of +65.86, which means that these students often answer questions correctly compared to other students. Meanwhile, students with code P150 have the lowest logit value, namely -12.90, which means that these students answer questions incorrectly more often. The overall student logit value is more than 0.00, meaning that students tend to answer more questions correctly on the test.

```
        TABLE 17.1 DATA 1-75
        ZOU969MS.TXT
        Dec 21 2023 19:25

        INPUT: 75 Person 10 Item REPORTED: 75 Person 10 Item 2 CATS MINISTEP 5.6.3.0

        Person: REAL SEP.: .00 REL.: .00 ... Item: REAL SEP.: 1.83 REL.: .77
```

Person STATISTICS: MEASURE ORDER

											1 5	0	10	-1.64	19,40	MINIMUM MEASURE	1	.00	.00 100.0 100	.01 P
NTRY	TOTAL	TOTAL	JMLE				PTMEASUR-	AL EXACT	MATCH		6	0	10	-1.64		MINIMUM MEASURE	- i	.00	.00100.0 100	
UMBER	SCORE	COUNT	MEASURE	S.E. MNSQ	ZSTD MNSQ	ZSTD	ORR. EX	P. OBS%	EXP%	Person	8	0	10	-1.64	19.40	MINIMUM MEASURE	- i	.00	.00 100.0 100.	.0 U
						+-		+	+-		11	0	10	-1.64	19.40	MINIMUM MEASURE	- i	.00	.00 100.0 100	.0 P
9	7	10	65,86	8.13 .83	57 .53	.06	.58 .	50 80.0	74.0	P009	15	0	10	-1.64		MINIMUM MEASURE	- I	.00	.00 100.0 100	
68	4	10	44,65	9.07 3.07	2.66 5.01	2.87	07	70 50.0	82.8	P068	16	0	10	-1.64		MINIMUM MEASURE	- I	.00	.00 100.0 100	
2	3	10	36,00	9.59 1.14	.43 .66	.01		59 80.0			18	0	10	-1.64		MINIMUM MEASURE		.00	.00 100.0 100	
4	3	10	36.00	9.59 1.20	.52 .70	.06		59 80.0		P002	20	0	10	-1.64		MINIMUM MEASURE		.00	.00 100.0 100	
-	_										21	0	10	-1.64		MINIMUM MEASURE	- 1	.00	.00 100.0 100	
10	3	10	36.00		-1.52 .19	80		59 100.0		P010	23	0	10	-1.64		MINIMUM MEASURE	- 1	.00	.00 100.0 100	
31	3	10	36.00		-1.52 .19	80		59 100.0		P031	24	0 0	10	-1.64 -1.64		MINIMUM MEASURE MINIMUM MEASURE		.00. .00	.00 100.0 100. .00 100.0 100.	
39	3	10	36.00		1.01 2.72	1.45		59 80.0		P039	26	8	10 10	-1.64		MINIMUM MEASURE		.00	.00 100.0 100.	
72	3	10	36.00	9.59 .32	-1.52 .19	80	.90 .	59 100.0	85.7	P072	27	9	10	-1.64		MINIMUM MEASURE	- 1	.00	.00 100.0 100.	
7	2	10	26.24	10.28 .65	57 .28	26	.74 .	51 90.0	85.6	P007	28	ă	10	-1.64		MINIMUM MEASURE		.00	.00 100.0 100.	
12	2	10	26.24	10.28 .57	78 .25	31	.76 .	51 90.0	85.6	P012	33	Ä	10	-1.64		MINIMUM MEASURE	- 1	.00	.00100.0 100.	
14	2	10	26,24	10.28 .57		31		51 90.0		P014	34	ด้	10	-1.64		MINIMUM MEASURE	- 1	.00	.00 100.0 100	
17	2	10	26.24	10.28 1.31	.71 .64	.18		51 70.0		L017	37	ă	10	-1.64		MINIMUM MEASURE	- 1	.00	.00 100.0 100	
22	2	10	26.24	10.28 .65	57 .28	26		51 90.0		P022	38	ñ	10	-1.64		MINIMUM MEASURE	- 1	.00	.00100.0 100	
		-									40	0	10	-1.64		MINIMUM MEASURE	- i	.00	.00 100.0 100	
36	2	10	26.24	10.28 .57		31		51 90.0		P036	42	0	10	-1.64	19.40	MINIMUM MEASURE	- i	.00	.00 100.0 100.	.ej 1
41	2	10	26.24	10.28 1.31	.71 .64	.18		51 70.0		P041	43	0	10	-1.64	19.40	MINIMUM MEASURE	- i	.00	.00 100.0 100.	.0 F
52	2	10	26.24	10.28 1.96		.62		51 70.0		P052	44	9	10	-1.64	19.40	MINIMUM MEASURE	- i	.00	.00 100.0 100	
47	1	9	23.29	12.01 .73	26 .26	30	.58	45 88.9	88.8	P847	45	0	10	-1.64		MINIMUM MEASURE	- I	.00	.00 100.0 100	
1	1	10	13.92	12.30 1.95	1.33 3.28	1.50	.03 .	47 80.0	90.3	L001	49	0	10	-1.64		MINIMUM MEASURE		.00	.00 100.0 100	
13	1	10	13.92	12.30 .47	75 .15	52	.62 .4	47 100.0	90.3	P013	50	0	10	-1.64		MINIMUM MEASURE		.00	.00 100.0 100	
19	1	10	13,92	12.30 .47		52		47 100.0		P019	53	0	10	-1.64		MINIMUM MEASURE		.00	.00 100.0 100	
25	1	10	13,92		75 .15	52		47 100.0			55	0	10	-1.64		MINIMUM MEASURE	- 1	.00	.00 100.0 100	
30	- î	10	13.92		75 .15	52		47 100.0		P030	56	0 0	10	-1.64		MINIMUM MEASURE MINIMUM MEASURE		.00	.00 100.0 100	
32	1	10	13.92	12.30 .47		52		47 100.0		P032	57	9	10	-1.64 -1.64		MINIMUM MEASURE	- 1	.00 .00	.00 100.0 100. .00 100.0 100.	
	1										61	8	10	-1.64		MINIMUM MEASURE		.00	.00 100.0 100.	
35	-	10	13.92	12.30 .47		52		47 100.0		P035	62	ă	10	-1.64		MINIMUM MEASURE	- 1	.00	.00 100.0 100	
46	1	10	13.92	12.30 .47		52		47 100.0		P846	64	ă	10	-1.64		MINIMUM MEASURE	- 1	.00	.00 100.0 100	
48	1	10	13.92	12.30 .47	75 .15	52	.62 .	47 100.0	90.3	P048	65	ă	10	-1.64		MINIMUM MEASURE	- 1	.00	.00 100.0 100	
51	1	10	13.92	12.30 .47	75 .15	52	.62 .	47 100.0	90.3	P051	66	ด้	10	-1.64		MINIMUM MEASURE	- 1	.00	.001100.0 100	
54	1	10	13.92	12.30 .47	75 .15	52	.62 .	47 100.0	90.3	P054	67	0	10	-1.64		MINIMUM MEASURE	- i	.00	.00 100.0 100	
58	1	10	13,92	12.30 .47	75 .15	52	.62 .4	47 100.0	90.3	P058	73	0	10	-1.64	19.40	MINIMUM MEASURE	- i	.00	.00 100.0 100	
60	1	10	13,92	12.30 1.48	.85 .58	.12		47 80.0		P868	74	0	10	-1.64	19.40	MINIMUM MEASURE	- i	.00	.00 100.0 100	.0 1
63	1	10	13.92	12.30 1.41	.76 .52	.05		47 80.0		P063										
			13.92								MEAN	.9	10.0	9.93		.9706 .75	.00		88.0 87	
69	1	10		12.30 1.48		.12		47 80.0			P.SD	1.2	.1	14.77	4.21	.64 1.01 1.08	.78		12.1 3	.3
70	1	10	13.92	12.30 1.91	1.30 2.40	1.19	.08 .	47 80.0	90.3	P070										

		8 REL.:	ORTED: 75 Person 10 Item 2 0 .00 Item: REAL SEP.: 1.72								
			EASURE ORDER			9	10	2.66 19.38	MINIMUM MEASURE	j .00	.00 100.0 100.0 P011
	0TAL TOTAL CORE COUNT 4 10 3 10 3 10 3 10 3 10 3 10 3 10	MEASURE	MODEL INFIT OUTFIT S.E. MNSQ ZSTD MNSQ ZSTD 8.78 2.76 2.56 4.54 2.95 9.40 1.15 .44 .81 .05 9.40 1.15 .44 .81 .05 9.40 1.38 .80 1.90 .15 9.40 30 -1.57 .22 -1.12	CORR. EXP. 085% EXP% Perso 	18 20 21 23 24	0 0 0 0 0 0	10 10 10 10 10 10	2.66 19.38 2.66 19.38 2.66 19.38 2.66 19.38 2.66 19.38 2.66 19.38 2.66 19.38 2.66 19.38 2.66 19.38	MINIMUM MEASURE MINIMUM MEASURE MINIMUM MEASURE MINIMUM MEASURE MINIMUM MEASURE MINIMUM MEASURE	99. 99. 99. 99. 99. 99. 99.	.00 100.0 100.0 P015 .00 100.0 100.0 P016 .00 100.0 100.0 P018 .00 100.0 100.0 P020 .00 100.0 100.0 L021 .00 100.0 100.0 P023 .00 100.0 100.0 P024
31 39 72 7 12 14	3 10 3 10 3 10 2 10 2 10 2 10 2 10	39.91 39.91 39.91 30.42 30.42 30.42	9.40 .30 -1.57 .22 -1.12 9.40 1.38 .80 1.90 1.12 9.40 .30 -1.57 .22 -1.12 10.22 .6068 .3029 10.22 .6068 .3029 10.22 .6068 .3029	.90 .67 100.0 83.6 P031 .50 .67 77.8 83.6 P039 .90 .67 100.0 83.6 P072 .75 .61 88.9 84.1 P072 .75 .61 88.9 84.1 P012	26 27 28 29 33 34	0 0 0 0 0	10 10 10 10		MINIMUM MEASURE	99. 99. 99. 99. 99.	.00 100.0 100.0 P026 .00 100.0 100.0 P027 .00 100.0 100.0 P027 .00 100.0 100.0 P028 .00 100.0 100.0 L029 .00 100.0 100.0 L033 .00 100.0 100.0 P034
17 22 36 41 52 47	2 10 2 10 2 10 2 10 2 10 2 10 1 9	30.42 30.42 30.42 30.42 30.42 27.50	$\begin{array}{c ccccccccccccccccccccccccccccccccccc$.55 .61 66.7 84.1 L017 .75 .61 88.9 84.1 P022 .75 .61 88.9 84.1 P022 .55 .61 66.7 84.1 P041 .31 .61 66.7 84.1 P052	37 38 40 42 43	0 0 0 0	10 10 10 10	2.66 19.38 2.66 19.38 2.66 19.38 2.66 19.38 2.66 19.38	MINIMUM MEASURE MINIMUM MEASURE MINIMUM MEASURE MINIMUM MEASURE MINIMUM MEASURE	00. 00. 00. 00. 00.	.00 100.0 100.0 P037 .00 100.0 100.0 P038 .00 100.0 100.0 L040 .00 100.0 100.0 L042 .00 100.0 100.0 P043
1 13 19 25 30	1 10 1 10 1 10 1 10 1 10 1 10	18.19 18.19 18.19 18.19 18.19	$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	02 .47 77.8 89.3 L001 .64 .47 100.0 89.3 P013 .64 .47 100.0 89.3 P019 .64 .47 100.0 89.3 P019 .64 .47 100.0 89.3 P025 .64 .47 100.0 89.3 P030	44 45 49 50 53	0 0 0 0	10 10 10 10	2.66 19.38 2.66 19.38 2.66 19.38 2.66 19.38	MINIMUM MEASURE	99. 99. 99. 99.	.00 100.0 100.0 L044 .00 100.0 100.0 P045 .00 100.0 100.0 P049 .00 100.0 100.0 P059 .00 100.0 100.0 P053
32 35 46 48 51 54	1 10 1 10 1 10 1 10 1 10 1 10 1 10	18.19 18.19 18.19 18.19 18.19 18.19 18.19	$\begin{array}{cccccccccccccccccccccccccccccccccccc$.64 .47 100.0 89.3 P035 .64 .47 100.0 89.3 P046 .64 .47 100.0 89.3 P046 .64 .47 100.0 89.3 P048 .64 .47 100.0 89.3 P051	55 56 57 59 61	0 0 0 0 0	10 10 10 10	2.66 19.38	MINIMUM MEASURE	99. 99. 99. 99. 99.	.00 100.0 100.0 P055 .00 100.0 100.0 L056 .00 100.0 100.0 L057 .00 100.0 100.0 P059 .00 100.0 100.0 P059 .00 100.0 100.0 P061 .00 100.0 100.0 P062
58 60 63 69 70	1 10 1 10 1 10 1 10 1 10 1 10	18.19 18.19 18.19 18.19 18.19	12.31 .4676 .1748 12.31 1.46 .81 .62 .16 12.31 1.46 .81 .62 .16 12.31 1.46 .81 .62 .16 12.31 1.46 .81 .62 .16 12.31 1.46 .81 .62 .16	.64 .47 100.0 89.3 P058 .37 .47 77.8 89.3 P060 .37 .47 77.8 89.3 P060 .37 .47 77.8 89.3 P069 .37 .47 77.8 89.3 P069 .05 .47 77.8 89.3 P070	62 64 65 66 67 73	0 0 0 0	10 10 10 10	2.66 19.38 2.66 19.38 2.66 19.38 2.66 19.38	MINIMUM MEASURE MINIMUM MEASURE MINIMUM MEASURE MINIMUM MEASURE MINIMUM MEASURE MINIMUM MEASURE	99. 90. 90. 90. 90.	.001100.0100.0100.0100.00 .001100.0100.0100.0100.00 .001100.0100.0100.0100.00 .001100.0100.0100.0100.00 .001100.0100.0100.0100.0100.00
71 75 3 5 6 8	1 10 1 10 0 10 0 10 0 10 0 10 0 10	18.19 18.19 2.66 2.66 2.66 2.66	12.31 1.93 1.30 2.92 1.38 12.31 1.46 .81 62 .16 19.38 MINIMUM MEASURE 19.38 MINIMUM MEASURE 19.38 MINIMUM MEASURE 19.38 MINIMUM MEASURE	.05 .47 77.8 89.3 P071 .37 .47 77.8 89.3 L075 .00 .00 100.0 100.0 P003 .00 .00 100.0 100.0 P005 .00 .00 100.0 100.0 P005 .00 .00 100.0 100.0 L000	74 MEAN P.SD	0 .8 1.0	10 10.0 1 .1 1	2.66 19.38 3.76 15.53 3.50 4.20	MINIMUM MEASURE +	.00 .04 .86	
NPUT: 75 P		tem REP	ZOU859WS.TX ORTED: 75 Person 10 Item 2 C .47 Item: REAL SEP.: 2.27								
ENTRY TO	TAL TOTAL	JMLE	EASURE ORDER MODEL INFIT OUTFIT	PTMEASUR-AL EXACT MATCH	26	9	10 -1 10 -1		MINIMUM MEASURE	.00 .00	.00 100.0 100.0 L101
1 6 12 13	ORE COUNT 3 10 3 10 3 10 3 10 3 10	64.52 64.52 64.52 64.52 64.52	S.E. MNSQ ZSTD MNSQ ZSTD 17.14 .1367 .0971 17.14 .1367 .0971 17.14 .1367 .0971 17.14 .1367 .0971 17.14 .1367 .0971	.93 .88 100.0 92.3 L076 .93 .88 100.0 92.3 P081 .93 .88 100.0 92.3 P087	n i	0 0 0 0	10 -1 10 -1 10 -1 10 -1	2.90 21.20 2.90 21.20 2.90 21.20	MINIMUM MEASURE MINIMUM MEASURE MINIMUM MEASURE MINIMUM MEASURE	99. 99. 99. 99. 99.	.00 100.0 100.0 110 .00 100.0 100.0 L103 .00 100.0 100.0 L109 .00 100.0 100.0 L110 .00 100.0 100.0 L112 .00 100.0 100.0 P113
19 22 27 31 32	3 10 3 10 3 10 3 10 3 10 3 10	64.52 64.52 64.52 64.52 64.52	17.14 .1367 .0971 17.14 .1367 .0971 17.14 .1367 .0971 17.14 .1367 .0971 17.14 .1367 .0971 17.14 .1367 .0971	.93 .88 100.0 92.3 P094 .93 .88 100.0 92.3 P097 .93 .88 100.0 92.3 P097 .93 .88 100.0 92.3 P102 .93 .88 100.0 92.3 P106	39 40 41 42 43	0 0 0 0	10 -1 10 -1 10 -1 10 -1	2.90 21.20 2.90 21.20	MINIMUM MEASURE MINIMUM MEASURE MINIMUM MEASURE MINIMUM MEASURE	00. 00. 00. 00.	.00 100.0 100.0 P114 .00 100.0 100.0 L115 .00 100.0 100.0 L115 .00 100.0 100.0 P117 .00 100.0 100.0 P117 .00 100.0 100.0 L118
68 3 9 15 18	3 10 2 10 2 10 2 10 2 10 2 10 2 10 2 10	64.52 40.01 40.01 40.01 40.01 40.01	$\begin{array}{c ccccccccccccccccccccccccccccccccccc$.87 .83 100.0 86.5 P078 .76 .83 60.0 86.5 P080 18 .83 20.0 86.5 P084 .87 .83 100.0 86.5 P090	44 45 46 47 48	0 0 0 0	10 -1 10 -1 10 -1 10 -1	2.90 21.20 2.90 21.20 2.90 21.20 2.90 21.20 2.90 21.20 2.90 21.20	MINIMUM MEASURE MINIMUM MEASURE MINIMUM MEASURE MINIMUM MEASURE	99. 99. 99. 99. 99.	.00 100.0 100.0 L119 .00 100.0 100.0 P120 .00 100.0 100.0 L121 .00 100.0 100.0 P122 .00 100.0 100.0 L123
29 51 60 62 66	2 10 2 10 2 10 2 10 2 10 2 10 2 10	40.01 40.01 40.01 40.01 40.01	14.65 .4594 .2042 14.65 .4594 .2042 14.65 .4594 .2042 14.65 .4594 .2042 14.65 1.97 1.44 .85 .36	.87 .83 100.0 86.5 L104 .87 .83 100.0 86.5 P126 .87 .83 100.0 86.5 P135 .87 .83 100.0 86.5 P137 .76 .83 60.0 86.5 P141	49 50 52 53 54	0 0 0 0	10 -1 10 -1 10 -1 10 -1	2.90 21.20 2.90 21.20 2.90 21.20	MINIMUM MEASURE MINIMUM MEASURE MINIMUM MEASURE MINIMUM MEASURE	99. 99. 99. 99. 99.	.00 100.0 100.0 L124 .00 100.0 100.0 P125 .00 100.0 100.0 P127 .00 100.0 100.0 P127 .00 100.0 100.0 L129
2 4 7 10 11 16	1 10 1 10 1 10 1 10 1 10 1 10 1 10	13.14 13.14 13.14 13.14 13.14 13.14 13.14	19.37 .1454 .0778 19.37 .1454 .0778 19.37 .1454 .0778 19.37 .1454 .0778 19.37 .1454 .0778 19.37 .1454 .0778 19.37 .1454 .0778	.76 .70 100.0 93.9 P079 .76 .70 100.0 93.9 P082 .76 .70 100.0 93.9 P082 .76 .70 100.0 93.9 P085 .76 .70 100.0 93.9 P085	55 56 57 58 59	0 0 0 0	10 -1 10 -1 10 -1 10 -1 10 -1	2.90 21.20 2.90 21.20 2.90 21.20 2.90 21.20 2.90 21.20	MINIMUM MEASURE MINIMUM MEASURE MINIMUM MEASURE	99. 99. 99. 99. 99.	.00 100.0 100.0 L130 .00 100.0 100.0 P131 .00 100.0 100.0 P132 .00 100.0 100.0 P133 .00 100.0 100.0 L134
20 25 28 36 69	1 10 1 10 1 10 1 10 1 10 1 10	13.14 13.14 13.14 13.14 13.14 13.14	19.37 .1454 .0778 19.37 .1454 .0778 19.37 .1454 .0778 19.37 5.60 2.13 2.56 1.25 19.37 .1454 .0778	.76 .70 100.0 93.9 P095 .76 .70 100.0 93.9 P100 .76 .70 100.0 93.9 P100 .40 .70 60.0 93.9 P113 .40 .70 60.0 93.9 P113 .76 .70 100.0 93.9 L144	61 63 64 65 67 70	0 0 0 0 0	10 -1 10 -1		MINIMUM MEASURE MINIMUM MEASURE MINIMUM MEASURE MINIMUM MEASURE	99. 99. 99. 99. 99.	.00 100.0 100.0 L136 .00 100.0 100.0 P138 .00 100.0 100.0 P139 .00 100.0 100.0 P140 .00 100.0 100.0 P142 .00 100.0 100.0 P145
71 74 8 14 17 21	1 10 1 10 0 10 0 10 0 10 0 10 0 10	13.14 13.14 -12.90 -12.90 -12.90 -12.90	19.37 .1454 .0778 19.37 .1454 .0778 21.20 MINIMUM MEASURE 21.20 MINIMUM MEASURE 21.20 MINIMUM MEASURE 21.20 MINIMUM MEASURE 21.20 MINIMUM MEASURE	.76 .70 100.0 93.9 L146 .76 .70 100.0 93.9 P149 .00 .00 100.0 100.0 P83 .00 .00 100.0 100.0 P83 .00 .00 100.0 100.0 P893 .00 .00 100.0 100.0 P895 .00 .00 100.0 100.0 P895	72 73 75 MEAN	9 9 9	10 -1 10 -1 10 -1	2.90 21.20 2.90 21.20 2.90 21.20	MINIMUM MEASURE	99. 99. 99.	.00 100.0 100.0 L147 .00 100.0 100.0 P148 .00 100.0 100.0 P150
23 24	0 10 0 10	-12.90 -12.90	21.20 MINIMUM MEASURE 21.20 MINIMUM MEASURE	.00 .00 100.0 100.0 P098 .00 .00 100.0 100.0 P099	P.SD	1.1	.0 2	8.47 2.34	.7030 .52 - 1.57 1.15 1.72 1	.32	17.4 3.1
PUT: 64 Per	ATA 151-214 rson 10 It SEP.: .00 son STATIST	em REPOR	TED: 64 Person 10 Item 2 CA1 10 Item: REAL SEP.: 1.14 F	Dec 15 2023 19:50 TS MINISTEP 5.6.3.0 REL.: .57							
NTRY TOTA UMBER SCOR 16	AL TOTAL RE COUNT 2 10	JMLE MEASURE 55.92	MODEL INFIT OUTFIT P1 S.E. MNSQ ZSTD MNSQ ZSTD CC 13.54 .3897 .2629	DRR. EXP. OB5% EXP% Person .88 .80 100.0 81.2 P166							
2 4 5	2 10 2 10 1 10 1 10 1 10 1 10 1 10	55.92 28.11 28.11 28.11	13.54 2.00 1.36 1.57 .82 21.33 .1164 .0779 21.33 7.24 2.46 4.20 1.77 21.33 .1164 .0779	.67 .80 50.0 81.2 P169 .67 .80 50.0 81.2 P205 .90 .82 100.0 93.9 F152 .28 .82 50.0 93.9 F154 .90 .82 100.0 93.9 F155 .90 .82 100.0 93.9 F155	j 6	9			MINIMUM MEASURE	į .ee	
10 11 20 21 25	1 10 1 10 1 10 1 10 1 10 1 10	28.11 28.11 28.11 28.11 28.11 28.11	21.33 .11 64 .07 79 21.33 .11 64 .07 79 21.33 .11 64 .07 79 21.33 .12 .64 .07 79 21.33 .12 .64 .07 79 21.33 .24 2.46 4.20 1.77 21.33 7.24 2.46 4.20 1.77	.90 .82 100.0 93.9 P160 .90 .82 100.0 93.9 P161 .90 .82 100.0 93.9 P161 .90 .82 100.0 93.9 P171 .28 .82 50.0 93.9 P171 .28 .82 50.0 93.9 P175	7 8 12 13 14	0 0 0 0	10 - 10 - 10 -	.31 21.44 .31 21.44 .31 21.44 .31 21.44 .31 21.44 .31 21.44	MINIMUM MEASURE MINIMUM MEASURE MINIMUM MEASURE MINIMUM MEASURE	99. 99. 99. 99. 99.	.00 100.0 100.0 P158 .00 100.0 100.0 L162 .00 100.0 100.0 P163
31 32 33	1 10 1 10 1 10 1 10 1 10 1 10 1 10	28.11 28.11 28.11 28.11 28.11 28.11	21.33 .1164 .0779 21.33 .1164 .0779 21.33 .1164 .0779 21.33 .1164 .0779 21.33 .1164 .0779 21.33 .1164 .0779	.28 .82 50.0 33.9 F176 .90 .82 100.0 93.9 L181 .90 .82 100.0 93.9 F182 .90 .82 100.0 33.9 F182 .90 .82 100.0 93.9 F183 .90 .82 100.0 93.9 F184 .90 .82 100.0 93.9 F186	15 17 18 22 23	0 0 0 0	10 - 10 - 10 -	.31 21.44 .31 21.44 .31 21.44 .31 21.44 .31 21.44 .31 21.44	MINIMUM MEASURE MINIMUM MEASURE MINIMUM MEASURE	99. 99. 99. 99.	.00 100.0 100.0 P167 .00 100.0 100.0 P168 .00 100.0 100.0 P172
38 39 40 41	1 10 1 10 1 10 1 10 1 10 1 10 1 10	28.11 28.11 28.11 28.11	21.33 .1164 .0779 21.33 .1164 .0779 21.33 .1164 .0779 21.33 .1164 .0779 21.33 .1164 .0779	.90 .82 120.0 33.9 F187 .90 .82 120.0 93.9 F189 .90 .82 120.0 93.9 F199 .90 .82 120.0 93.9 F191 .90 .82 120.0 93.9 F191 .90 .82 120.0 93.9 F193	24 27 28 29 30	0 0 0 0	10 - 10 - 10 - 10 -	.31 21.44 .31 21.44 .31 21.44 .31 21.44 .31 21.44 .31 21.44	MINIMUM MEASURE MINIMUM MEASURE MINIMUM MEASURE MINIMUM MEASURE	90. 90. 90. 90.	.00 100.0 100.0 P177 .00 100.0 100.0 P178 .00 100.0 100.0 L179 .00 100.0 100.0 L130
	1 10 1 10 1 10 1 10	28.11 28.11 28.11 28.11 28.11 28.11	21.33 .1164 .0779 21.33 .1164 .0779 21.33 .1164 .0779 21.33 .1164 .0779 21.33 .1164 .0779 21.33 .1164 .0779	.90 .82 100.0 93.9 F194 .90 .82 100.0 93.9 F194 .90 .82 100.0 93.9 F195 .90 .82 100.0 93.9 F195 .90 .82 100.0 93.9 F200 .90 .82 100.0 93.9 F200	35 42 46 47 48	0 0 0 0	10 - 10 - 10 -	.31 21.44 .31 21.44 .31 21.44 .31 21.44 .31 21.44 .31 21.44	MINIMUM MEASURE MINIMUM MEASURE MINIMUM MEASURE	99. 99. 99. 99.	.00 100.0 100.0 P192 .00 100.0 100.0 P196 .00 100.0 100.0 P197
45 49 50 51	1 10										
45 49 50 51 53	1 10 1 10 1 10 1 10 1 10 1 10 1 10 1 10 1 10	28.11 28.11 28.11 28.11 28.11 28.11 28.11	21.33 .1164 .0779 21.33 .1164 .0779	.90 .82 100.0 93.9 L203 .90 .82 100.0 93.9 L207 .90 .82 100.0 93.9 L207 .90 .82 100.0 93.9 P209 .90 .82 100.0 93.9 P210 .90 .82 100.0 93.9 P211 .90 .82 100.0 93.9 P211 .90 .82 100.0 93.9 P213 .90 .82 100.0 93.9 L214	52 54 56 58 62	0 0 0 0	10 - 10 - 10 -	.31 21.44 .31 21.44	MINIMUM MEASURE MINIMUM MEASURE MINIMUM MEASURE MINIMUM MEASURE	99. 99. 99. 99.	.00 100.0 100.0 L202 .00 100.0 100.0 L204 .00 100.0 100.0 P206 .00 100.0 100.0 P208

Figure 6. Person Measure

In Figure 5, the separation value = 2.05 is obtained, so the value $H=H=[(4\times2.05) + 1]:3=3.06$, which if rounded to 3. In Figure 4.2, the separation value = 4.24 is obtained. value $H=H=[(4\times4.24) + 1]:3=5.98$ if rounded to 6. This means that there are six groups of questions. In Figure 5, the separation value = 2.90 is obtained, so the value $H=H=[(4\times2.90) + 1]:3=4.2$. So, based on the upper and lower limits of the logit value, students can be divided into six groups with the same logit interval.

Table 2. of	Frequency and Percentag	e of Student Ab	ility Groups
Ability Group	Logit Interval	Frequency	Percentage
Level 1	$-1,64 \le P < 13,92$	110	51,4%
Level 2	$13,92 \le P < 23,29$	65	30,3%
Level 3	$23,29 \le P < 26,24$	21	9,8%
Level 4	$26,24 \le P < 36,00$	16	7,4%
Level 5	$36,00 \le P < 44,65$	1	0,5%
Level 6	$44,65 \le P < 65,86$	1	0,5%

 TABLE 22.1 DATA 1-75
 ZOU969WS.TXT
 Dec 21 2023 19:25

 INPUT: 75 Person 10 Item REPORTED: 75 Person 10 Item 2 CATS MINISTEP 5.6.3.0

	SCALOGRAM O	F RESPONSES:
Person		
	1	
	5428136790	
	+1111100011	P009
	+0101001100	P068
	+1100100000	P002
	+1010100000	P004
	+1110000000	P010
	+1110000000	P031
39	+1010010000	P039
72	+1110000000	P072
	+1010000000	P007
	+1100000000	P012
14	+1100000000	P014
	+0110000000	L017
	+1010000000	P022
	+1100000000	P036
	+0110000000	P041
52	+0101000000	P052
47	+ 100000000	P047
1	+0000100000	L001
13	+1000000000	P013
19	+1000000000	P019
25	+1000000000	P025
30	+1000000000	P030
32	+1000000000	P032
35	+1000000000	P035
46	+1000000000	P046
48	+1000000000	P048
51	+1000000000	P051
54	+1000000000	P054
58	+1000000000	P058
60	+001000000	P060
63	+0100000000	P063
69	+001000000	P069
70	+0001000000	P070
71	+0001000000	P071
75	+001000000	L075
3	+0000000000	P003
5	+0000000000	P005
6	+0000000000	L006
8	+0000000000	L008
	+0000000000	P011
15	+0000000000	P015

16	+0000000000	P016
18	+0000000000	P018
20	+0000000000	P020
21	+0000000000	L021
23	+0000000000	P023
24	+0000000000	P024
26	+0000000000	P026
27	+0000000000	P027
28	+0000000000	P028
29	+0000000000	L029
33	+0000000000	LØ33
34	+0000000000	P034
37	+0000000000	P037
38	+0000000000	P038
40	+6666666666	L040
42	+0000000000	L042
43	+0000000000	P043
44	+0000000000	L044
45	+0000000000	P045
49		P049
50		P050
53	+0000000000	P053
55	+0000000000	P055
56	+0000000000	L056
57		L057
59	+0000000000	P059
61	+0000000000	P061
62	+0000000000	P062
64	+0000000000	P064
65	+0000000000	P065
66	+0000000000	L066
67	+0000000000	P067
73	+0000000000	P073
74	+0000000000	L074
	1	
	5428136790	

◆TABLE 22.2 DATA 1-75 ZOU969W5.TXT Dec 21 2023 19:25 INPUT: 75 Person 10 Item REPORTED: 75 Person 10 Item 2 CATS MINISTEP 5.6.3.0

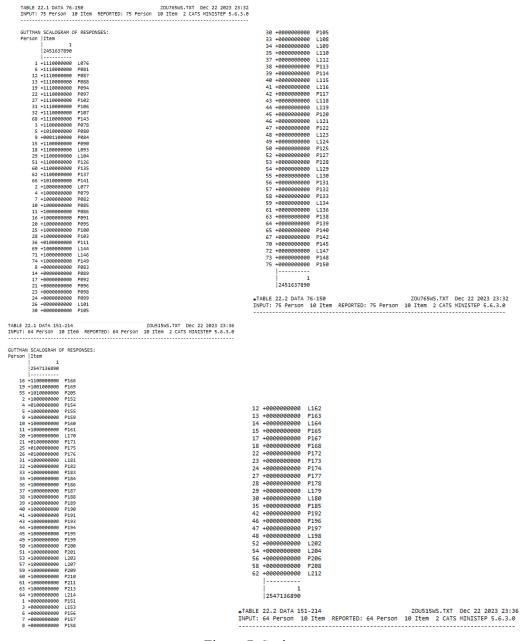


Figure 7. Scalogram

Scalograms sort students' abilities from the highest level to level 6. From left to right, they show the student's score from the lowest level questions to the highest level. The answer pattern shows that student P009 has the highest literacy skills and the highest score.

CONCLUSIONS

The ten questions developed can be used as an instrument to measure students' mathematical literacy abilities because (1) they are valid as seen from the fulfillment of the MNSQ, ZSTD, and Pt Mean Corr categories, (2) they show item reliability of 0.82 which means they are included in the excellent category and can measure ability students'

mathematical literacy; (3) effective because based on analysis of student abilities 51.4 percent of students are at level 1; 30.3% of students are at level 2; 9.8% of students are at level 3; 7.4% of students are at level 4; and 0.5% of students are at levels 5 and 6 respectively which are the highest.

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