Students' Mathematical Literacy Ability: Evaluation of Validity and Reliability

Asa Raila Salam[1], Adzkia Fikriyati[2], Ayu Faradillah[3]*, Asih Miyatun[4], Abd Salam[5]

[1,2,3,4] *Faculty of Teacher Training and Education, Universitas Muhammadiyah Prof. DR. HAMKA
Jalan Tanah Merdeka No. 20, RT.11/RW.2, Rambutan, Ciracas Sub-district, East Jakarta City,
Special Capital Region of Jakarta 13830, Indonesia*
[5]*Madrasah Aliyah Minhajut Tholibin, Jakarta, Indonesia, 11830.*

Corresponding author's e-mail: *** ayufaradillah@uhamka.ac.id**

ABSTRACT	
Keywords: ***Proceeding;*** ***Mathematics topic;*** ***Alphabetic***	*Mathematical literacy is the ability to understand, use and convey mathematical concepts in various contexts known as mathematical literacy. In Indonesia, the level of students' mathematical. Mathematical literacy is the ability to understand, use, and convey mathematical concepts in various contexts known as mathematical literacy. In Indonesia, the level of students' mathematical literacy skills is still low. This research aims to evaluate the validity and reliability of mathematical literacy test instruments using Rasch Model and SPSS. This research used a quantitative method with a survey approach involving 100 high school students from various demographic backgrounds, the instrument must be valid and reliable to ensure accurate measurement. The results of the analysis showed that the instruments tested has the same result which is invalid on item 5 and have good reliability of 0.639.*

1. INTRODUCTION

Mathematical literacy is the ability to understand, apply and communicate mathematical concepts in various contexts [1][2][3][4]. His includes problem solving, using formulas, and understanding numerical and graphical information. Mathematical literacy also enables individuals to understand the role of mathematics in real life, use it to solve problems and be constructive members of society[5][6].

Mathematical literacy is very important in learning mathematics because it helps Students understand concepts, solve problems, communicate, and apply mathematical procedures [7]. In addition, mathematical literacy is also related to important 21st century skills such as critical thinking, problem solving, communication, collaboration, creativity, and innovation [8]. However, in Indonesia, mathematical literacy is still one of the educational problems that need serious attention. This is evidenced by the 2022 PISA (Programme for International Student Assessment) results which showed that Indonesia ranked 67th with a score of 379, lower than the global average score of 498 points [9].

Research on students' mathematical literacy skills requires valid and reliable instruments. A valid instrument will produce accurate and reliable data so that it can be used to draw appropriate research conclusions, while high reliability indicates that the instrument can be relied upon to produce accurate and reliable data. Validity and reliability are important foundations in research. Validity is an important step in research that is intended to evaluate the accuracy of the instrument in measuring objectives, while reliability tests the consistency of the measurement results of research instruments [10][11][12][13]

Research conducted by Yamtinah, Marhaeni and Lasmawan (2021), showed that the mathematical creative ability instrument for junior high school students tested through Excel software has good validity and reliability. The content and construct validity of the instrument is evidenced by the high Content Validity Index and Kaiser-Meyer-Olkin Sampling Adequacy values, as well as adequate factor loading values for each item. The internal reliability of the instrument is also assured by the high Cronbach's Alpha value. Based on the validity and reliability test results, it can be concluded that the developed mathematical creative ability instrument for junior high school students is effective for measuring the mathematical creative ability of junior high school students [14]

Additionally, research by Aini, Pramasdyahsari, and Setyawati (2023) demonstrates that the Winsteps software-based mathematical critical thinking ability instrument has a strong fit with the data, with an average item reliability value of 0.52 and a person reliability value of 0.71. The reliability of the instrument was classified as good, with a Cronbach's alpha value of 0.78. This instrument is effectively used to measure the mathematical critical thinking skills of junior high school students [15].

Research on students' mathematical literacy ability requires valid and reliable instruments. The results show that the mathematical reasoning ability questionnaire has empirical validity of fourteen items, with one invalid item, and has a reliability of 0.85, which indicates that this tool can be used to assess students' mathematical thinking skills [16]

Based on the research that has been discussed, the gap from this research is that the instrument to measure students' mathematical ability has shown good validity and reliability using statistical software. This shows that the instrument can be used to measure students' mathematical abilities quite accurately. These studies provide empirical evidence that the instruments developed to measure Students' mathematical ability are of good quality. They can be used to identify Students with high or low mathematical ability, monitor Students' progress in mathematics, and develop more effective mathematics learning programmed.

Based on the gap that has been analyzed, this research aims to ensure that the mathematical literacy measurement instruments used are accurate, consistent and reliable to measure students' mathematical literacy skills. Based on the research objectives that have been set, this research has a problem formulation, namely. (1) How to develop a valid and reliable mathematics literacy measurement instrument using Winsteps and SPSS software for high school students? (2) What are the results of the validity and reliability tests of the developed mathematics literacy measurement instrument to ensure its quality?

2. RESEARCH METHODS

2.1 Research Design and Participant

This research uses a quantitative descriptive method with a survey approach. Quantitative descriptive methods focus on collecting and analyzing quantitative data in the form of numbers, scores, or other statistical data to describe the characteristics or conditions of a phenomenon at a time. [17] This method usually uses descriptive statistical techniques to analyze data and produce research findings. While the survey approach is a research method used to collect data from a large population sample through questionnaires or other instruments, then analyzed to produce general research findings [18]. The survey approach is often used to research the opinions, attitudes or behavior of a population.

Subject selection technique with purposive sampling. Purposive sampling is a sample selection technique with certain considerations by the researcher, such as the characteristics, experience, or knowledge of the subject that are considered relevant to the research [19][20]. This technique does not use random sampling, so it cannot be generalized to a wider population. However, purposive sampling is very useful for research that requires in-depth information from specific subjects. The data of the selected subjects are as follows.

Table 1. Participants

Num	Demographics	Description	Code	Amount
1	Class	X	X	32
		XI	Y	68
2	Age	15	A	13
		16	B	48
		17	C	32
3	Gender	Female	P	59
		Male	L	41

Based on Table 1, the researcher divided the respondents' data into several categories contained in the description column consisting of class, age, and gender. The respondents consisted of tenth and eleventh grades, the respondents were about fifteen to seventeen years old with a total of 100 respondents. This data was obtained from the participant's answer sheet in the identity section.

2.2 Instrument

The instrument in this research is based on indicators of mathematical literacy skills. The indicators are:

Table 2. Indicators and Scoring Guidelines

Num	Indicator Aspect Mathematical Literacy Skills	Description	Scoring	Score
1	Comprehension Aspect	Students are able understand each piece of information, describe mathematics to various conditions	1. Students do not show an understanding of the mathematical information and concepts presented in the problem. 2. Students are unable to describe mathematical information and concepts. 3. Students are unable to use mathematical symbols and notation. 4. Students are unable to explain the steps of problem solving.	0
			1. Students show a lack of understanding of the mathematical information and concepts presented in the problem. 2. Students are less able to describe mathematical information and concepts clearly and precisely.	1

Num	Indicator Aspect Mathematical Literacy Skills	Description	Scoring	Score
			3. Students are less able to use mathematical symbols and notations correctly. 4. Students are less able to explain the steps of problem solving logically and systematically.	
			1. Students show sufficient understanding of the mathematical information and concepts presented in the question. 2. Students are able to describe mathematical information and concepts with sufficient clarity and precision, using informal language. 3. Students are able to use mathematical symbols and notation correctly enough. 4. Students are able to explain the steps of problem solving logically and systematically.	2
			1. Students show a good understanding of the mathematical information and concepts presented in the problem. 2. Students are able to describe mathematical information and concepts clearly and precisely, using formal language. 3. Students are able to use mathematical symbols and notations correctly. 4. Students are able to explain the steps of problem solving logically, systematically, and structurally.	3
2	Aspect analysis	Students are able to convert key information into mathematical form	1. Students are unable to analyse the information in the question accurately. 2. Students are unable to distribute/organi e information into smaller components. 3. Students are unable to identify patterns and relationships between information components. 4. Students are unable to identify or formulate questions in the problem.	0
			1. Few Students analyze the information in the question accurately. 2. Students distribute/organise information into smaller components less well. 3. Students identify patterns and relationships between information components less clearly. 4. Students identify or formulate questions in the problem that are less relevant and important to solve it.	1
			1. Students mostly analyse the information in the question accurately. 2. Students distribute/organise information into smaller components fairly well. 3. Students identify patterns and relationships between information components quite clearly. 4. Students identify or formulate questions in the problem that are relevant and important enough to solve it.	2

Num	Indicator Aspect Mathematical Literacy Skills	Description	Scoring	Score
			1. Students accurately analyse all the information in the question. 2. Students effectively distribute/organise information into smaller, relevant components. 3. Students clearly identify patterns and relationships between information components. 4. Students correctly identify or formulate questions in the problem that are relevant and important for solving it.	3
3	Aspect of representation	Students are able to analyze every piece of information, organizing it into smaller pieces	1. Students are unable to transform significant information into various mathematical forms.	0
			1. Students are rarely able to transform significant information into various mathematical forms precisely and accurately. 2. Students have difficulty using various mathematical forms, and the transformations performed may not be clear or effective.	1
			1. Student are generally able to transform significant information into various mathematical forms precisely and accurately. 2. Students are able to use two kinds of mathematical forms, but there may still be some mistakes in the transformation.	2
			1. Students are always able to transform significant information into various mathematical forms precisely and accurately. 2. Students are able to use three types of mathematical forms, such as equations, tables, graphs, and diagrams, to represent information clearly and effectively.	3
4	Communication Aspects	Students are able to argue and be able to solve problems	1. Students are only able to explain solutions vaguely or illogically. The argument is incomprehensible. 2. Students are not able to solve problems appropriately. The strategies used are inappropriate or ineffective. The resulting solution is incomplete or inaccurate	0
			1. Students are able to explain solutions quite clearly, but are not logical or structured. Arguments are difficult to understand or poorly supported by evidence. 2. Students are able to solve problems quite precisely, but less efficiently. The strategies used are not appropriate or effective. The resulting solution is incomplete or accurate.	1

Num	Indicator Aspect Mathematical Literacy Skills	Description	Scoring	Score
			1. Students are able to explain solutions quite clearly and logically. Arguments can be understood with several efforts. 2. Students are able to explain solutions quite clearly and logically. Arguments can be understood with several efforts.	2
			1. Students are able to explain solutions quite clearly and logically. Arguments can be understood with several efforts. 2. Students are able to solve problems appropriately and efficiently. The strategy used is appropriate and effective. The resulting solution is complete and accurate.	3

Data source: [21]

The Table above is a guideline for assessment and scoring as a tool to measure the level of student achievement in all aspects of the mathematical literacy ability instrument of high school students. Furthermore, this instrument goes through content validation. Content validation testing is the process of ensuring that Measurement tools such as questionnaires, tests, or grading scales actually measure what they are meant to measure [14][15][16]. In other words, content validation tests ensure that the items in the instrument are relevant to the concept or variable to be measured. The validation process is carried out by two experts, namely mathematics education lecturers and mathematics teachers with the following validation results.

Fadel wanted to play at a playground with Rp120,000 and wanted to try some games. In the park there are 3 different games, namely Ferris wheel, carousel, and roller coaster. Ferris wheel admission costs IDR 50,000, carousel admission costs 25000, and roller coaster admission costs IDR 30,000. How many different ways does Fadel choose two games and spend all his money?	Fadel wanted to play at a playground with Rp120,000 and wanted to try some games. In the park there are 3 different games, namely Ferris wheel, carousel, and roller coaster. Ferris wheel entrance tickets cost IDR 50,000, carousel tickets cost 50% of the Ferris wheel ticket price, and roller coaster tickets cost 3/5 of the Ferris wheel ticket price, so determine how many ways Fadel spends all his money?
(a)	**(b)**

Figure 1. Questions after and before validation

The figure above shows the questions from a number of questions used for instrument validation tests in various high schools. The question (a) shows the question that has not been validated, while the question (b) shows the question that has been validated by two validator experts, with the results of the improvement, namely from routine problems to non-routine by replacing integers with various numbers, and improvements in word composition.

3. RESULTS AND DISCUSSION

This research aims to measure the validity and reliability of the instrument through analysis using SPSS and Winsteps software.

3.1 Validity and Reliability with Software SPSS

3.1.1 Validity

After eight statements with 100 respondents, the results of the validity test of the mathematical literacy ability instrument using SPSS displayed through Bivariate output can be said to be valid if the following.

Table 3. Bivariate output result in SPSS

Item	Total	
	Person Correlation	Sig. (2-tailed)
1	0.452	0
2	0.560	0
3	0.690	0
4	0.587	0
5	0.397	0.001
6	0.585	0
7	0.439	0
8	0.556	0

Table 3 shows that seven out of eight questions on the mathematical literacy ability test instrument of high school students have a product moment correlation coefficient value of 0.1729. This value is statistically significant with a significant level of 5%, based on the distribution of values in the Table [22]. Therefore, it can be stated that seven of the eight questions of the mathematical literacy test instrument of high school students are valid.

3.1.2 Reliability

After running eight statements with 100 respondents, the results of the validity test of the mathematical literacy ability instrument using SPSS were displayed through statistical output with the criteria that if Cronbach Alpha 0.6 – 0.7 it achieved good reliability. The results are as follows.

Table 4. Reliability output result in SPSS

Reliability Statistics	
Cronbach Alpha	N of Items
0.639	8

Table 4 demonstrates that the Cronbach Alpha instrument's value in this research is 0.639. Since this value is higher than 0.5, the mathematical resilience tool used in this investigation meets high dependability standards [23][24].

3.2 Validity and Reliability with Winsteps

3.2.1 Item Fit

If the object does not suit the respondent's expectations regarding its size, it may not be performing as intended. On the other hand, if the item fits the respondent's expectations, it may be functioning properly [24]. Three criteria—Outfit Mean Square Values (MNSQ), Outfit Z-Standardized Values (ZSTD), and Point Measure Correlation—were used to identify data inconsistencies (PTMEA-CORR) [23]. Because there are still data from the first and second rounds of this research that do not fulfill the criteria, those that do need to be eliminated or adjusted to fit the model employed [25]. The results are as follows.

Table 5. Output Result of Fit Items in Winsteps

Item	Outfit MNSQ	Outfit ZSTD	PTMEA-CORR
1	1.25	1.51	0.45
2	0.92	-0.46	0.56
3	0.78	-1.41	0.66

Item	Outfit MNSQ	Outfit ZSTD	PTMEA-CORR
4	1.21	1.21	0.55
6	0.77	-1.51	0.53
7	0.90	-0.57	0.46
8	0.91	-0.51	0.53

Table 5 demonstrates that the requirements of Outfit MNSQ, Outfit ZSTD, and PTMEA-CORR are met by seven of the eight items. As a result, it can be said that seven out of the eight questions on the high school students' mathematical literacy ability test are legitimate.

3.2.2 Person Fit

The person-fit method can be used to control the behavior of examinees because it measures how participants understand the material being tested, not only their ability to give the right answers, and it is also useful to guarantee the validity of the measurement during the process because it results in objective decisions [26]. The results are as follows.

Table 6. Output Result of Fit Person in Winsteps

Num	Responder	Outfit MNSQ ($0,5 < x < 1,5$)	Outfit ZSTD ($-2,0 < x < 2.0$)	PT.MEASURE-CORR ($0,4 < x < 0,85$)
1.	094CPY	1.81	1.2	-0.03
2.	047BLX	1.74	1.3	0.16
3.	097ALY	1.70	1.7	-0.35
4.	041BPX	1.62	1.7	0.01
5.	073DLY	1.58	1.6	-0.40
6.	070APX	1.55	1.4	-0.16
7.	075BLY	1.53	1.5	-0.33
8.	081ALY	1.52	1.4	-0.31
9.	098APX	1.52	1.4	-0.31
10.	002BLX	1.51	1.2	0.20

Table 6 shows that there are ten people who do not meet the criteria of Outfit MNSQ, Outfit ZSTD, PTMEA-CORR. Therefore, it can be stated that the eight questions of the mathematical literacy ability test instrument for high school students are valid.

3.2.3 Reliability

To find out the results of an instrument and whether the respondent is reliable or not, it can be done with a reliability test. Reliability is a tool to measure that a test can be consistent even though it has been tested repeatedly continuously with unchanged conditions and subjects [16], [25], [26]. So, Reliability can also be referred to as the consistency of the instrument. To determine reliability, you can use Winsteps software and then select summary statistics. The criteria used as a reference are Cronbach's Alpha (KR-20) with a > criteria range of 0.50, Item and Person Reliability with good criteria, 0.81-0.90; very good, 0.91 0.94; excellent, > 0.94) [23], The following is presented with a picture of the results of the reliability test using Winsteps.

Table 7. Output Result of Summary in Winsteps

Statistics	Value
Person Separation	0.70
Person Reliability	0.65
Item Separation	2.60
Item Reliability	0.92
Cronbach Alpha (KR-20)	0.64

Information about the questions and eligible respondents is shown in Table 7. Information on the connection between the respondent and the question is also included. The Person reliability component of the report displays the reliability of the respondents, with a result of 0.65 based on the researcher's data. The reliability item is examined next, yielding a result of 0.92, and the final component of the Cronbach Alpha is 0.64. Thus, it can be said that the products utilized are trustworthy.

4. CONCLUSIONS

The Rasch Model in Winsteps was used to adjust eight items, or nearly all of the test numbers tested, met the adjusted criteria, according to the validity of the mathematical creative thinking ability test instrument calculated using SPSS and the Rasch Model. Ten percent (10 people) do not meet the criterion for those who have had their criteria changed, whereas ninety percent (90 people) do. For the criteria of people who are adjusted, there are 90% (90 people) who meet the criteria and 10% (10 people) who do not meet the criteria. All items tested are valid based on the value of the person correlation, which is tested with SPSS. Therefore, the results show that the mathematical literacy ability evaluation tool is valid when used with both Winsteps and SPSS. This shows that both methods can be used effectively to evaluate the validity of the constructs of the instruments used.

In addition, the reliability of the mathematical literacy test instrument was calculated using the Rasch model and SPSS. The results were the same, with a reliability value of 0.64, which is in the good reliability level category. This shows that the instrument is consistent in measuring Students' ability in their mathematical understanding. However, the validity test results between the Rasch Model and SPSS were different; there were 10 unmatched individuals when using the Rasch Model, suggesting that the Rasch Model can provide more specific and detailed results in identifying unmatched individuals. These results can be an important consideration when choosing which analysis method to use.

REFERENCES

[1]   R. Masfufah and E. A. Afriansyah, "Analisis Kemampuan Literasi Matematis Siswa melalui Soal PISA," Mosharafa J. Pendidik. Mat., vol. 10, Num. 2, pp. 291–300, 2021, doi: 10.31980/mosharafa.v10i2.825.

[2]   E. S. Kiawati, B. Junedi, and M. B. Tabrani, "Penerapan Model Pembelajaran Berbasis Masalah untuk Meningkatkan Kemampuan Literasi Matematis Siswa," J. Cendekia J. Pendidik. Mat., vol. 7, Num. 3, pp. 2465–2474, 2023, doi: 10.31004/cendekia.v7i3.2213.

[3]   N. M. Allo, M. Yusuf, D. R. Arifanti, W. Naflatunnisa, and M. Syaifullah, "Identifikasi Kemampuan Literasi Matematika Ditinjau Dari Perspektif Kecerdasan Logis Matematis," Al-Khwarizmi J. Pendidik. Mat. dan Ilmu Pengetah. Alam, vol. 9, Num. 2, pp. 61–72, 2021, doi: 10.24256/jpmipa.v9i2.2978

[4]   N. K. Riani, A. Husna, and Y. Gusmania, "Pengaruh Kemampuan Verbal Dan Kemampuan Numerik Terhadap Kemampuan Literasi Matematis," AKSIOMA J. Progr. Stud. Pendidik. Mat., vol. 11, Num. 3, p. 2359, 2022, doi: 10.24127/ajpm.v11i3.5082.

[5]   D. Yulistio and R. Kurniawan, "Bentuk Dan Dampak Kemampuan Memberi Penguatan Dalam Praktik Mengajar Mahasiswa," J. Ilm. KORPUS, vol. 5, Num. 2, pp. 192–205, 2021, doi: 10.33369/jik.v5i2.18001.

[6]   A. Lendari, M. Arif Rahman Hakim, Deni Febrini, Dondi Kurniawan, "Pemberian Penguatan Verbal dan Pengaruhnya Pada Motivasi Belajar Matematika Kelas V Sekolah Dasar," J. Stud. Islam , Sos. dan Pendidik., vol. 1, p. 66, 2022.

[7]   R. Hidayat, Y. Roza, and A. Murni, "Peran Penerapan Model Problem Based Learning (PBL) terhadap Kemampuan Literasi Matematis dan Kemandirian Belajar," JURING (Journal Res. Math. Learn., vol. 1, Num. 3, p. 213, 2019, doi: 10.24014/juring.v1i3.5359.

[8]   R. Setyaningsih and L. Munawaroh, "Analisis Kemampuan Literasi Matematis Siswa Dalam Menyelesaikan Soal Berorientasi Pisa Konten Uncertainty and Data," AKSIOMA J. Progr. Stud. Pendidik. Mat., vol. 11, Num. 3, p. 1656, 2022, doi: 10.24127/ajpm.v11i3.4948.

[9]   Kemendikbudristek, "Literasi Membaca, Peringkat Indonesia di PISA 2022," Lap. Pisa Kemendikbudristek, pp. 1–25, 2023.

[10]   R. Alpian and B. S. Anggoro, "Analisis Penalaran Matematis Peserta Didik Berdasarkan Teori Van Hiele," Indones. J. Sci. Math. Educ., vol. 3, Num. 1, pp. 96–105, 2020, doi: 10.24042/ijsme.v3i1.4761.

[11]   Y. E. Widodo, "Keterampilan Teknik Dasar Peserta Ekstrakurikuler Sepakbola Di Smp Negeri 1 Undaan Kudus," SELL J., vol. 12, Num. 1, pp. 196–201, 2023.

[12]   A. Christy Matius and W. Gunawan, "Validitas dan Reliabilitas Perceived Future Employability Scale untuk Dewasa Muda," Psikologika J. Pemikir. dan Penelit. Psikol., vol. 27, Num. 1, pp. 23–46, 2022, doi: 10.20885/psikologika.vol27.iss1.art3.

[13]   M. N. Prabawati, T. Herman, and Turmudi, "Pengembangan Lembar Kerja Siswa Berbasis Masalah dengan Strategi Heuristic untuk Meningkatkan Kemampuan Literasi Matematis," Mosharafa J. Pendidik. Mat., vol. 8, Num. 1, pp. 37–48, 2019, doi: 10.31980/mosharafa.v8i1.533.

[14]   Yamtinah, Anak Agung Istri Ngurah Marhaeni, and I Wayan Lasmawan, "Pengembangan Instrumen Keterampilan Menulis Karangan Dan Kemampuan Berpikir Kreatif Pada Materi Karangan Narasi Siswa Kelas Iv Sekolah Dasar," PENDASI J. Pendidik. Dasar Indones., vol. 5, Num. 1, pp. 94–104, 2021, doi: 10.23887/jurnal_pendas.v5i1.262.

[15]   S. N. Aini, A. S. Pramasdyahsari, and R. D. Setyawati, "Pengembangan Instrumen Tes Berpikir Kritis Matematis Berbasis PjBL STEM Menggunakan Pendekatan Etnomatematika," J. Cendekia J. Pendidik. Mat., vol. 07, Num. 2, pp. 2118–2126, 2023.

[16] Sutami, "Pengembangan Instrumen Asesmen Higher Order," vol. 3, Num. 1, pp. 102–113, 2020.

[17] A. Shobikhah, T. E. Siswono, and T. D. Prastiti, "Analisis Kemampuan Berpikir Kreatif Siswa Berbakat Dalam Menyelesaikan Soal Olimpiade," J. Pendidik. Mat. Indones., vol. 6, Num. September, pp. 83–90, 2021.

[18] M. Sari, H. Rachman, N. Juli Astuti, M. Win Afgani, and R. Abdullah Siroj, "Explanatory Survey dalam Metode Penelitian Deskriptif Kuantitatif," J. Pendidik. Sains dan Komput., vol. 3, Num. 01, pp. 10–16, 2022, doi: 10.47709/jpsk.v3i01.1953.

[19] R. Novitasari and S. Supriyanto, "Faktor-Faktor Yang Mempengaruhi Keputusan Penggunaan Ovo Pada Mahasiswa Fakultas Ekonomi Universitas Negeri Yogyakarta," J. Ekon. dan Pendidik., vol. 17, Num. 1, pp. 28–36, 2020, doi: 10.21831/jep.v17i1.33542.

[20] H. H. Syarief and E. Arif, "Pengalaman Komunikasi Korban Trauma KDRT (Studi Fenomenologi Java Institute Hypnotherapy Bandung)," J. Pendidik. Tambusai, vol. 6, pp. 11186–11192, 2022.

[21] K. A. L. G. Simamora and A. L. F. Tilaar, "Analisis Kemampuan Literasi Matematika Ditinjau Dari Penggunaan Soal-Soal Matematika Tipe HOTS," MARISEKOLA J. Mat. Ris. Edukasi dan Kolaborasi, vol. 2, Num. 1, pp. 23–30, 2021, doi: 10.53682/marisekola.v2i1.1139.

[22] N. M. Janna and Herianto, "Artikel Statistik yang Benar," J. Darul Dakwah Wal-Irsyad, Num. 18210047, pp. 1–12, 2021.

[23] A. Faradillah and C. Septiana, "Mathematical Resilience: Validity and Reliability With Rasch Model and Spss in Senior High School," AKSIOMA J. Progr. Stud. Pendidik. Mat., vol. 11, Num. 4, p. 3545, 2022, doi: 10.24127/ajpm.v11i4.5204.

[24] A. Faradillah and L. Febriani, "Mathematical Trauma Students' Junior High School Based on Grade and Gender," Infin. J., vol. 10, Num. 1, pp. 53–68, 2021, doi: 10.22460/infinity.v10i1.p53-68.

[25] A. Faradillah and S. Adlina, "Validity of critical thinking skills instrument on prospective Mathematics teachers," J. Penelit. dan Eval. Pendidik., vol. 25, Num. 2, pp. 126–137, 2021, doi: 10.21831/pep.v25i2.40662.

[26] H. Herwin and S. C. Dahalan, "Person Fit Statistics to Identify Irrational Response Patterns for Multiple-choice Tests in Learning Evaluation," Pegem Egit. ve Ogr. Derg., vol. 12, Num. 4, pp. 39–46, 2022, doi: 10.47750/pegegog.12.04.05