

MATHEMATICAL RESILIENCE: VALIDITY AND RELIABILITY WITH RASCH MODEL AND SPSS IN SENIOR HIGH SCHOOL

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Abstrak

Pengujian validitas dan reliabilitas penting dilakukan untuk sebuah instrument, keduanya dapat menentukan bagus atau tidaknya instrument yang digunakan. Penelitian yang dilakukan ini bertujuan untuk mengkaji perbandingan proses validitas angket mathematical resilience pada siswa dengan menggunakan SPSS dan Rasch Model. Metode penelitian yang diterapkan ialah metode kuantitatif survei, dengan ditunjang total responden sebanyak 207 peserta didik yang menempati sekolah menengah atas di Jakarta. Penelitian ini memanfaatkan angket mathematical resilience yang mengacu dari penelitian lain. Melalui angket tersebut terdapat 4 indikator. Uji validitas angket mathematical resilience menggunakan Rasch Model dengan aplikasi WinSteps 3.73 menunjukkan bahwa terdapat tiga item (I9, I16, I18) yang tidak valid, dan ada enam item (I7, I11, I12, I13, I17, I19) yang hanya memenuhi 1 syarat, sehingga 26 harus dipertahankan karena item terpenuhi. Sedangkan uji validitas pada SPSS 24.0 yang dilihat dari nilai pearson correlation didapatkan hasil bahwa 6 item tidak valid yaitu (I7, I8, I9, I11, I16, I18), sehingga sisa item lainnya harus dipertahankan karena memenuhi kriteria. Sementara, perhitungan reliabilitas memperoleh sebesar ($\alpha = 0.84$). Dengan menggunakan dua aplikasi yang berbeda yaitu Winsteps dan SPSS, dinyatakan bahwa angket resiliensi matematika telah dinyatakan valid dan reliabel. Hal ini diperoleh dengan cara menghilangkan 8 item pernyataan pada angket tersebut.

Kata kunci: Mathematical Resilience; Winsteps; Reliabilitas; SPSS; Validitas.

Abstract

Validity and reliability testing is very important for an instrument, both of which can determine whether the instrument used is good or not. This study intends to break down the correlation of the the mathematical resilience questionnaire for for studies utilizing SPSS and the Rasch Model. The research method used is a quantitative survey method, with a total of 207 students in one of the senior high schools in Jakarta. This study uses a mathematical resilience questionnaire which was adopted from other studies in which there are 4 indicators in the questionnaire. Testing the validity of the mathematical resilience questionnaire using the Rasch Model with the WinSteps 3.73 application showed that there were three invalid items (I9, I16, I18), and six items (I7, I11, I12, I13, I17, I19) which only met 1 condition. , so 26 must be retained because the item is satisfied. While the validity test on SPSS 24.0 which is seen from the Pearson correlation value, the results show that 6 items are invalid, namely (I7, I8, I9, I11, I16, I18), so the rest of the other items must be maintained because they meet the criteria. Meanwhile, the reliability calculation is ($\alpha = 0.84$). The use of two different applications, namely Winsteps and SPSS, stated that the mathematical resilience questionnaire was declared valid and reliable. This is obtained by eliminating 8 statement items in the questionnaire.

Keywords: Mathematical Resilience; Winsteps; Reliability; SPSS; Validity.



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INTRODUCTION

Each student has a diverse personality as well as their attitude in facing various challenges in learning mathematics. The ability to calculate, solve and develop what is done in action, behavior or emotional response to academic or social problems with the right character can be said to be an attitude of resilience (Grimm & Calabrese, 2011; Yeager & Dweck, 2012). Along with the presence of resilience, there are many positive results in dealing with various obstacles, especially in learning mathematics, if someone gets pressure it can trigger stress and affect adaptation in a negative direction (Zanthy, 2018).

From the world development of science, Mathematical resilience that a significant thought in education. This perspective accordance with the opinion of (Cahyaningsih et al., 2021; Lee & Johnston-Wilder, 2017) which reveals that it is very important to have a discussion about mathematical resilience, because quite a lot of students who face obstacles and defeats in learning numerical. Students' resilience will help in creating self-confidence. This causes a sense of distrust in mathematics which is no longer seen as a barrier. So that the difficulties obtained can be used as a desire for students to struggle and succeed. Surely this success will help those around him who have difficulty with the knowledge possessed by students. Based on this statement able to see the benefits of mathematical resilience. According to (Goodall & Johnston-Wilder, 2015; Himawan et al., 2021) students who have a high level of mathematical resilience will be confident in their mathematical skills which will definitely improve.

The way to improve mathematical resilience is to be able to adapt in every condition, have a sense of awareness of their abilities, be confident, and confident that they also understand what other people understand and are able to face and solve problems and hindrances in learning math, and have the option to give suitable arrangements. Until finally they will be successful (Sugandi, 2017). To determine the level of mathematical resilience, we need to use an instrument in research. The instrument utilized in this examination is form of a questionnaire. Therefore, in collecting questionnaire data, testing the validity and reliability is important. Validity and reliability are very important in a questionnaire, both of which can determine whether or not the questionnaire instrument being studied is good, then the questionnaire used in the study must be correct when revealing data from the variables studied and the questionnaire must also be trusted because of its consistency in order to produce data as desired (Retnawati, 2017; Yusup, 2018).

Several studies that are relevant to this research, namely (Muntazhimah et al., 2020) inspect the reliability and validity of the instrument of numerical strength capacity in imminent science teachers utilizing the Rasch model, in particular with four markers that are brought down into 32 inquiry things and the aftereffects of the exploration show that the instrument is expressed solid and substantial with extremely legitimate measures; (Ramdani et al., 2020) examination to create and approve a scale to quantify the scholastic versatility of understudies utilizing the Rasch model has high legitimacy and unwavering quality with the goal that estimating the scholarly strength of middle school students can

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be utilized. Other research that discusses mathematical resilience is (Safitri et al., 2020) which raises the theme, namely the development of a valid and reliable questionnaire instrument to gauge the degree of mathematical resilience of students using Research & Development research and the research results show that the questionnaire instrument product has met the criteria valid and meet the reliable criteria so that being utilized to quantify the degree of mathematical resilience of students is reasonable.

Based on the findings of several relevant studies above, research related to the validity and reliability of mathematical resilience is still difficult to find at the high school level, several studies were conducted at various other levels of education such as elementary, junior high and higher education. In addition, no previous research has been found that compares the results of validity and reliability using two different applications. Therefore, the topic of mathematical resilience must be continued with research on testing its validity and reliability. In addition, a quality measuring instrument is needed that can produce an accurate value, namely an evaluation instrument used in a study (Muntazhimah, 2019). Results related to mathematical resilience will be better, objective and accurate with the evaluation instruments used.

Furthermore, the objective of this study is to inspect the comparison of the validity and reliability of the mathematical resilience questionnaire for high school students using SPSS and the Rasch Model. The calculation uses the Winstep 3.73 application which can be used specifically for the Rasch Model and SPSS 24.0.

METHOD

This study uses a survey quantitative research method. The subjects in this study were 207 respondents from one of the senior high schools in Jakarta. The resilience math instrument used in this study adopted the research instrument (Kookan et al., 2016). Where the instrument is translated using language and words adapted to the level of education of the subject of this study. The data collection technique used a questionnaire and to obtain a good questionnaire, validation was carried out on two expert lecturers and one expert educator in the field of mathematics education, by obtaining good and appropriate validation results used in mathematical resilience research. Mathematical resilience in this study is represented by 4 indicators which are reduced to 35 statements, both positive and negative statements, these statements contain responses using a Likert scale of 1-7, specifically emphatically deviate, dissent, marginally dissent, unbiased, fairly concur, concur, firmly concur.

Table 1. Instrument mathematical resilience

Indicator	Item	Many Items
Value	1, 2, 3, 4, 5, 6	6
Struggle	7, 8, 9, 10, 11, 12, 13	7
Growth	14, 15, 16, 17, 18, 19, 20, 21	8
Resilien ce	22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35	14
Total		35

The motivation behind this study was to inspect the cycle of validating mathematical resilience instruments on students using SPSS and the Rasch Model. SPSS is one of the popular statistical data processing programs to

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calculate the validity (product moment correlation) and reliability (Alpha Cronbach) of an instrument using the Bivariate Paerson Correlation and Corrected Item-Total Correlation techniques (Janna, 2020). A good instrument is an instrument that has a high level of validity and reliability, besides that a valid and reliable instrument is a requirement to get maximum research results (Nurmawati & Suryani, 2018). The following are the criteria for the validity and reliability of an instrument using SPSS.

Table 2. Criteria for validity and reliability instrument (Arikunto, 2018; Darma, 2021)

Criteria for Validity Instrument	
Correlation Coefficient	Criteria
0,91 – 1,00	Very High
0,71 – 0,90	High
0,41 – 0,70	Medium
0,21 – 0,40	Low
<i>Negative</i> – 0,20	Very Low
Reliability Criteria	
Significance level (0.50)	Criteria
<i>Cronbach alpha</i> > 0.50	Reliable
<i>Cronbach alpha</i> < 0.50	Not Reliable

Subsequent to working out the validity and reliability utilizing SPSS. Then, at that point, ascertaining the validity and reliability of mathematical resilience instruments utilizing the Rasch model. The Rasch model is thought of as fit for seeing the connection among things and respondents all the while, so one worth isn't just seen from the crude score however the logit esteem that can mirror the likelihood of choosing a thing against an assortment of respondents (Muntazhimah, 2019). In this systematic recitation the Rasch model was utilized for assessment as well as to decide reliability and validity of the instrument

utilizing WinSteps programming and to decide quality of the information for assessing the unwavering quality of Cronbach Alpha (α) (Osman et al., 2016).

Table 3. Reliability analysis on the Rasch model

Statistics	Fit Indices	Interpretation
Cronbach's	< 0.5	Low
alpha (KR-20)	0.5 – 0.6	Moderate
	0.6 – 0.7	Good
	0.7 – 0.8	High
	> 0.8	Very High
Item and Person Reliability	< 0.67	Low
	0.67 – 0.80	Sufficient
	0.81 – 0.90	Good
	0.91 – 0.94	Very Good
	> 0.94	Excellent
Item and Person Separation		A high separation value indicates that the instrument has good quality because it can identify groups of items and respondents.

The unwavering quality of the Rasch model comprises of three suitable file standards, in particular Cronbach Alpha, thing and respondent dependability and the division between items and respondents, this is explained by (Sumintono & Widhiarso, 2014) in Table 4.

Table 4. Item fit and person fit index of suitability

Statistics	Fit Indices
Outfit Mean Square Values (MNSQ)	0.5 – 1.5
Outfit Z-Stardarized Values (ZSTD)	-2.0 – +2.0
Point Measure Correlation (PTMEA-CORR)	0.4 – 0.85

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Table 4 shows three criteria that can be used to show that the item is fit, namely MNSQ, ZSTD, and PTMEA-CORR. Item fit can illuminate that the thing capacities ordinarily for the estimation it ought to be, in the mean time assuming the thing shows a jumble, it is demonstrated that the respondent has a misconception of the thing, to show that our individual fit can likewise utilize the arrangements of the 3 measures above, outfit Mean Square Values (MNSQ) denotes a proportion of irregularity which is how much mutilation in the estimation framework. Expected values are between 0.5 - 1.5; assuming the worth is not exactly that worth, it demonstrates model overfit information; while a bigger worth shows information that doesn't fit the model. Outfit Z-Standardized Values (ZSTD) is a t-test for the theory of the appropriateness of the information with the model, the outcome is the z esteem which is the unit deviation (Sumintono & Widhiarso, 2014).

RESULT AND DISCUSSION

Validity and Reliability with SPSS

Validity

Information about the validity of mathematical resilience instruments that can be displayed through the *Bivariate* output on SPSS. There is a *Bivariate Pearson Correlation* value of each statement item based on the criteria of Table 2 which if *negative* – 0.20 the item is said to be invalid (Arikunto, 2018; Hidayat, 2021). The summary of Bivariate output which shows invalid items from the results of the validity test of the mathematical resilience instrument explained in Table 5.

According to Table 5, it very well may be seen that the invalid items are (I7, I8, I9, I11, I16, I18) because the Paerson Correlation value does not

match the criteria with table 2. According (Arikunto, 2018; Hidayat, 2021) the item is said to be invalid if it is in the criteria of Pearson correlation is *negative* – 0.20.

Table 5. Item Misfit

Items	Total	
	Pearson Correlation	Sig. (2-tailed)
I7	-0.007	0.921
I8	0.006	0.930
I9	-0.178	0.010
I11	-0.016	0.817
I16	0.016	0.814
I18	0.090	0.199

On the other hand, I7, I8, I9 and I11 are indicators of difficulty. The statements on these items are related to two things: first, difficulty in solving math problems. Mathematics is a subject that is considered difficult because of its abstract nature so that many students in high school consider mathematics as a difficult subject, boring and uninteresting subjects (Faradillah & Febriani, 2021). Furthermore, errors in solving math problems are often experienced. As stated by research that students are often careless in doing mathematical calculations (Faradillah et al., 2018).

Moreover, I16 and I18 are statements about growth indicators. Both of these statements are related to the way students respond to dislike in learning mathematics. Math problems can make students afraid and avoid them even they can give up (Faradillah & Fadhilah, 2021). This causes students who from the start experience difficulties in solving math problems will give up more quickly to be able to understand math material.

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Reliability

Information about the validity of mathematical resilience instruments that can be displayed through the output of Reliability Analysis on SPSS. There is a *Cronbach's Alpha* value from the mathematical resilience instrument in this study. Based on the criteria in Table 3, if the Cronbach's Alpha value is > 0.50 the instrument is said to be reliable.

Table 6. The result of SPSS reliability

Reliability Statistics	
Cronbach's Alpha	N of Items
0.842	35

Based on Table 6, the value of *Cronbach's Alpha* instrument in this study is 0.842, it can be seen that 0.842 is greater than 0.50. Which means that the mathematical resilience instrument in this study has high reliability criteria (Arikunto, 2018; Darma, 2021).

Instrumen Validity with Rasch Model Item Fit

Item fit can illuminate that the thing capacities regularly for the estimation it ought to be, though assuming the thing shows a disparity, this demonstrates that the respondent has a misinterpretation about the thing. Things that can be supposed to be fit are assuming they meet the measures for Outfit Mean Square Values (MNSQ), Outfit Z-Standardized Values (ZSTD), and Point Measure Correlation (PTMEA-CORR), or possibly meet 2 of the 3 rules. Any thing that neglects to meet these three models (MNSQ outfit, ZSTD outfit, and PTMEA-CORR) should be updated or adjusted to guarantee the quality and appropriateness of the thing (Saidi & Siew, 2019). Scientists can see if these things are fit or rebel.

Table 7. Misfit Order of the Items

Item	Outfit MNSQ	Outfit ZSTD	PTMEA-CORR
I18	2.01	7.0	0.09
I9	1.77	4.6	-0.17
I16	1.61	5.2	0.02
I19	1.49	4.8	0.22
I7	1.46	4.7	0.01
I12	1.46	4.7	0.23
I15	1.36	2.6	0.46
I11	1.42	3.6	-0.01
I33	1.38	3.8	0.44
I13	1.38	3.9	0.18
I17	1.30	2.5	0.28
I20	1.19	2.0	0.32
I35	1.18	2.0	0.35
I32	1.13	1.5	0.35
I34	1.12	1.4	0.24
I31	1.12	1.3	0.53
I30	1.09	1.1	0.48
I10	0.95	-0.4	0.40
I14	0.93	-0.6	0.59
I8	1.01	0.1	0.03
I23	0.93	-0.8	0.43
I24	0.78	-2.6	0.48
I5	0.70	-3.4	0.61
I2	0.71	-3.4	0.58
I3	0.70	-3.6	0.59
I27	0.69	-3.5	0.58
I25	0.64	-3.8	0.67
I28	0.69	-3.6	0.60
I6	0.66	-4.1	0.63
I1	0.64	-4.2	0.65
I22	0.65	-4.3	0.54
I4	0.63	-4.5	0.62
I21	0.63	-4.2	0.63
I26	0.59	-4.9	0.71
I29	0.55	-5.5	0.67

Table 7 shows in light of the worth of the MNSQ outfit, ZSTD outfit and PTMEA-CORR for the request for things that don't coordinate. There are a few numbers in strong, this shows that the worth doesn't meet the current standards (table 3). It is realized that there are three things (I9, I16, I18) that are invalid, then, at that point, there are six things (I7, I11, I12, I13, I17, I19) which just meet 1 condition, while the

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rest should be kept up with in light of the fact that the things are satisfied from the MNSQ outfit, outfit ZSTD and PTMEA-CORR (Faradillah & Febriani, 2021a). Based on the results of running using Winstep, several misfit statements were obtained, namely I11, I12, I13, I17 and I19. These five statements are contained in the struggle and growth indicators as obtained in SPSS. This indicates that students have problems in believing in themselves to be able to change their perceptions of mathematical material.

Hence, the total statements in the mathematical resilience questionnaire that fit using the Winsteps application are 26 items. Meanwhile, the indicators whose statements are all fit are value and resilience.

Person Fit

Proper respondent data is likewise given by the Rasch examination. Respondents who are fit or appropriate can be identified with the Rasch Model based on unusual response patterns such as students who may not be serious when an item is given and there may be a possibility that students with lower scores unexpectedly can do it right and students with higher grades. higher can easily make mistakes (Boone, 2016). Then according to (Saidi & Siew, 2019) Measure, the MNSQ outfit and the ZSTD outfit are prerequisites for evaluating an individual's fit.

Table 8. Summary of Winsteps The Misfit sequence of the person

	Total Subject	Outfit MNSQ		Outfit ZSTD		PTMEA-CORR	
		≤ 0.5	≥ 1.5	≤ -2.0	≥ 2.0	≤ 0.4	≥ 0.85
F	13	7	6	7	6	6	7
M	9	3	6	3	6	6	3

Table 8 shows student responses that don't match the rules recommended in the Rasch Model investigation. This shows that the reaction given is not the same as the reach given by the Rasch model (Faradillah and Febriani, 2021). There were 22 (11.11%) understudies out of 207 understudies, with code F as female and M as male, demonstrating that their reactions didn't match the given rules. Hence in this review there were 185 (89.37%) understudies who showed reactions as per the suggested rules, so one might say that the reactions were of good quality. For individual fit, 22 (11.11%) understudies out of 207 didn't meet the measures for MNSQ Outfit, ZSTD Outfit, and PTMEA-CORR.

Instrument Reliability with Rasch Model

Information that can be displayed through the Summary Statistics output is one of the values for the measurement reliability. Based on the output Summary Statistics in Winsteps 3.73 is obtained.

Table 9. Review of output summary statistics

Statistics	Value
(KR-20)	0.84
The Reliability of Person	0.82
The Reliability of Item	0.99
Person Separation	2.11
Item Separation	11.11

Table 9 shows the worth of Cronbach's alpha (KR-20), respondent unwavering quality, think dependability,

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respondent partition and thing detachment in view of an investigation with the Rasch model utilizing Winsteps programming. In light of table 65, the coefficient of Cronbach's has a worth of 0.84, so it tends to be classified as "exceptionally high" (table 2). When the respondent's reliability value and item reliability are less than 0.67, it can be categorized as "low" (Table 2). In this manner the respondent's dependability score of 0.82 can be arranged as "great" and thing unwavering quality with a worth of 0.99 is remembered for the "superb" class. Then the detachment worth of the respondents is 2.11 and the item 11.11 where if the separation value is high it will indicate that the instrument is of good value (Sumintono & Widhiarso, 2014). Overall, as the Rasch Model examination, the instrument has an exceptionally high Cronbach's alpha (KR-20), great individual dependability and fantastic thing unwavering quality. A higher reliability value indicates a strong relationship between statement items and vice versa, high reliability indicates the consistency of the instruments used in the study even at different times (Mohamad et al., 2015; Sundayana, 2018).

Based on the results of the data analysis, validity testing using the Winsteps and SPSS applications showed a slight difference in results. The results of calculating the validity of the resilience math questionnaire at Winsteps stated that there were 9 misfit items and 22 misfit persons. Meanwhile, in SPSS, there were only 6 items that were invalid and could not analyze the number of invalid people. This indicates that the results of validity calculations using Winsteps can be more specific and detailed to find out which items and persons are invalid.

According to the research (Faradillah & Adlina, 2021), it was found that the results of validity calculations using Winsteps were different from the results of calculations using Confirmatory Factor Analysis (CFA). Furthermore, there is no significant difference in the results of reliability calculations using Winsteps or SPSS.

The description of the results of the research and discussion above shows that there are advantages and disadvantages in this study. The advantage of this research is the use of two different applications to calculate the results of validity and reliability analysis. By using different applications, it can compare applications that can be more detailed to perform validity and reliability calculations. Meanwhile, the drawbacks of this study were that the subjects of this study were only students at the senior level of education so that when other researchers wanted to use resilience math instruments, these instruments had to go through a process of validity and reliability again.

CONCLUSION AND SUGGESTION

Based on the validity calculation of the resilience math questionnaire using Winsteps and SPSS, it was found that in the Rasch model using Winsteps there were three invalid items and there were six items that only fulfilled 1 condition, while 26 statements were declared fit because of the three calculation requirements. Then the validity test on SPSS seen from the Pearson correlation value shows 6 items are invalid while the other items must be maintained because they meet the criteria. Invalid statement items using Winsteps and SPSS are both found in the struggle and growth indicators. While the results of reliability calculations using these two applications obtain a very high category (0.84).

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In this study, it only compares the results of calculating the validity and reliability of mathematical resilience using the Winsteps and SPSS applications. Therefore, in future research it is possible to compare the results of calculations using other applications. Apart from using other applications, further research can also analyze the results of validity and reliability calculations on other questionnaires that affect mathematics learning

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