Ilkogretim Online - Elementary Education Online, 2020; 19 (3): pp. 1407-1421
http://ilkogretim-online.org.tr
doi:10.17051/ilkonline.2020.730747

Pre-service elementary teachers: analysis of the disposition of mathematical modeling in ethno mathematics learning

S. Supriadi, *Universitas Pendidikan Indonesia,* Indonesia, *supriadi.upiserang@upi.edu*
ORCID: 0000-0003-0752-1557

Abstract. Cultural disappearance in the social order is one of the concerns in Indonesia nowadays, one of which is Sundanese culture. In addition, the crash of globalization also requires people to be inspired by learning many aspects away from their own culture. This paper aims at increasing the position of ethno mathematics learning in attractive the disposition modeling of mathematics while maintaining the traditional culture. This quantitative study applied the Rasch Wins Step Model to survey 90 elementary pre-service elementary teachers education students as the respondents in which they were grouped based on educational background, namely science or non-science, and Sundanese language ability background, and by Sundanese and non-Sundanese language, based on educational background, 59 respondents were the students of natural science class, and 31 respondents were not the students of natural science class and consisting of 42 Sundanese respondents and 48 non-Sundanese respondents. The data were gathered by means of questionnaires regarding mathematics modeling disposition. The consequences exposed that most students decided to increase mathematics modeling disposition with ethno mathematics learning because student curiosity increases the understanding of Sundanese culture in learning mathematics. The more ordinary science and Sundanese origin support ethno mathematics learning compared to non-science and non-Sundanese mathematics modeling disposition. Mathematical modeling activities will be more meaningful for students if they use culture.

Keywords: Education, ethno mathematics, disposition modeling, Sundanese culture

Received: 28.01.2020	Accepted: 02.03.2020	Published: 15.06.2020

INTRODUCTION

Elementary school teachers in mathematics learning must emphasize the importance of building students basic knowledge in ways that carry their culture and history in order to promote cultural values, then pre-service elementary school teacher must learn how to improve and restore cultural dignity for children in the classroom (Harding-DeKam, 2007; Sharp, 1999; Supriadi, 2019). Learning mathematics will be more fun if students are active in connecting between local culture and mathematical understanding that students will get because the mathematical concepts learned are daily student activities that can be used in solving problems (Gravemeijer and Terwel, 2000). One way to realize the learning is by ethno mathematics. The term ethno mathematics is used to express the relationship between culture and mathematics (d'Ambrosio, 2001; Orey and Rosa, 2006). Thomas and Hart (2010); Garcia, Maass and Wake (2010) are important in developing students understanding in their own cultural environment and to consider how they can help inform teacher education programs that seek to promote mathematical modeling.

The development of mathematical modeling abilities by students needs to be supported by effective aspects, such as the disposition of mathematical modeling. Royster, Kim Harris, and Schoeps, (1999) suggests that a mathematical disposition shows: a. confidence in using mathematics, solving problems, giving reasons and communicating ideas, b. flexibility in investigating mathematical ideas and trying to find alternative methods of solving problems; c. diligently doing mathematical tasks; d. interest, curiosity (curiosity), and your activities in doing mathematical tasks; e. tend to monitor, reflect on their own performance and reasoning; f. assess the application of mathematics to other situations in mathematics and everyday experiences; g. appreciation (appreciation) the role of mathematics in culture and values, mathematics as a tool, and as a language. Consequently, this study focuses on the analysis of mathematical modeling disposition by using culture as the original background of student thinking processes through Rasch- model applications.

LITERATURE REVIEW

Disposition of Mathematical Modeling

The emotional knowledge of mathematics learners throughout education is a vital constituent of their learning, and students' aptitude to center on learning can be aggravated by positive emotions (Sylwester, 1995). Unfortunately, many mathematics lecturers abandon the growth of students' positive mathematics dispositions, in its place exclusively emphasizing increasing students' technical ease and planned capability (Kilpatrick, 2001). Preceding studies have exposed that negative dispositions toward mathematics were extensively recognized in the middle of not only middle school and high school, preservice elementary teachers' students but also among lower elementary students and even kindergarteners (Supriadi et.all, 2019; Rameau and Louime, 2007). Students with negative mathematics dispositions displayed considerably advanced levels of nervousness towards mathematics than their peers and generally established lower self-assurance with mathematics and less motivation to learn mathematics (Ashcraft, 2002).

There are numerous explanations for the possible causes of negative mathematics dispositions, as well as the decontextualization of happy that frequently occurs throughout traditional teaching methods (Geist, 2010), and famine of chance for students to spread out their own theoretical sympathetic (Furner and Berman, 2005). Preceding studies have recognized that traditional teaching methods often lead to students' negative mathematics dispositions because of a propensity to (a) allocate the similar trouble to every student, (b) teach by lecturing as of the textbook, (c) be obstinate on only one method to explain a trouble (d) abandon real-world applications, (e) highlight rote memorization and recurrence, and (f) first and foremost aspire to get better scores on consistent manifold-choice tests (Tobias and Weissbrod, 1980; Tsui and Mazzocco, 2006). Also, past negative experiences with mathematics education, for example, deficits of theoretical accepting requiring remediation and preceding math lecturer that being un empathetic to persons stressed with the subject matter, can add to students toward the inside a math classroom with preformed negative dispositions that are hard to unfasten (Beilock, Gunderson, Ramirez, and Levine, 2010; Geist, 2010).

Preceding studies investigative the origin of negative mathematics dispositions have established association with a diversity of other unwanted mathematics learning outcomes, counting deprived mathematics attainment and harmful mathematical behaviors (Ashcraft, 2002; Tobias & Weissbrod, 1980). Especially, students with negative mathematics dispositions are inclined to keep away from mathematics-connected behavior, for example, attempting demanding mathematics troubles or investigating higher mathematical concepts, which in revolve has a negative crash on these students' decisions concerning lessons and vocation choices that engage mathematics (Ho et al., 2000). To expand and uphold students' positive dispositions towards mathematics, lecturer or teachers be supposed to slot in manifold instructional approaches emphasizing real-life contextualized and connection with culture behavior that build conceptual understanding and application (Supriadi, 2019). Methods that have been found effectual comprise teaching mathematics in non-traditional ways, such as using problem-solving activities culture, simulations, challenges, discoveries, and games traditional (Supriadi, 2019). Contribution students interdisciplinary mathematics education is one documented plan for rising students' mathematics dispositions and comfortable information, with documented settlement counting: (1) inspiring students to connect in suggestion, (2) as long as students by means of a context for real-world inquiry, and (3) facilitating students information family members between their newly acquired information and their obtainable information (Ellis & Fouts, 2001; Hargreaves & Moore, 2000). The mathematical disposition used in the learning activities in this article is the disposition of mathematical modeling using local culture, namely Sundanese culture, Indonesia.

Mathematical modeling is a location of techniques, gear, and equations that can be modified to exacting disciplines. In epidemiology, mathematical models more often than not define interactions among persons or populations and other persons, populations, or environments. By defining the rules that explain these connections and translating person rules into equations, a multifaceted locate of processes can be broken down into workings and quantified. The model can then be old to travel around associations in the modeled population, to examination the crash of distorted system on the system and its gears, and to look at the outcomes of a variety of procedures that strength has a result on a population (Chubb and Jacobsen, 2010).

The modeling procedure starts by means of a real-world problem. Though modeling a real-world problem, one is supposed to do something flanked by reality and mathematics. A model for a problem is supposed to be urbanized by simplifying, constructing and idealizing. Expressing the model within the mathematics world forms the mathematical model. Modeling evils have a real, dependable and multifaceted construction (Lesh and Doer, 2003).

This paper in the context of mathematics culture, mathematical disposition relates to how students view and solve problems culture, whether confident, persevering, interested, and flexible thinking to explore various alternative problem-solving strategies with culture. Disposition is also related to the tendency of students to reflect on their own thinking. The disposition of mathematical modeling is needed by students in developing mathematical modeling abilities. Students can be passionate in learning, confident, flexibility in exploring ideas and alternative solutions to problems, persistence in facing and solving problems, monitoring and reflecting thinking, high curiosity and appreciation of mathematics in mathematical modeling activities with culture.

Ethno mathematics Learning

Ethno mathematics is mathematics that grows in an exacting culture, which is considered as an alternative in the growth of mathematics lessons resources that are more conquered by conservative methods (Suryaman and Sarirasa 2018). Ethno mathematics' future by Ubiratan D'Ambrosio has developed into an important sub-field of mathematics teaching investigate (Cimen, 2014). This study has urbanized a novelty in Sundanese ethno mathematics learning by modifying the Sundanese culture so that it is reliable with the concepts in mathematics knowledge**.** The lecturer believes that the enlargement of teaching resources is in agreement with the main beliefs and ladder of ethno mathematics learning by cultural values. The Sundanese culture was second-hand as an ethno mathematics' constituent in mathematical creativity learning. After the implementation of the learning, the lecturer conducted a reflection on the appropriateness between the learning preparation and the performance of learning based on the results of the classification and analysis of learning obstacles that take place. The results of these reflections were manifested in the form of revisions to teaching materials in order to obtain better teaching materials. The lecturer could optimize the students' innovative intelligence. The process of the ethno mathematics learning phase would believe in becoming smoother. In addition to being a spur, the lecturer must identify and analyze any learning obstacles that take place.

Also, ethno mathematics learning was conducted by comparing the Sundanese culture based on conventional systems. Sundanese culture originated from the native inhabitants of western Java, in Indonesia. They are the second largest group in Indonesia, other than Javanese in central and eastern Java, with an estimated number of 48 million in 2018. Sundanese is generally Muslim and easy to interact socially. Based on researchers from Austronesian in Southeast Asia (Bellwood, 2006; Blust, 2013), Sundanese culture originated from Taiwan and reached Java between 1,500 and 1,000 BC. Among Sundanese residents, there are some traditional communities that are close by, called adat villages which still practice traditional ways of life that are more powerful than modern communities. Figure 1 shows this traditional community still lives in relatively limited villages scattered in various districts in West Java.

FIGURE 1. *Sundanese culture from western Java, in Indonesia*.

METHODS

Participant

The participant is formed by 90 elementary pre-service teacher education students with 10 (11%) men and 80 (89%) women. Age of the participant 22 years old 68 (75 %), 23-24 years old 22 (25%) Respondents in which they were grouped based on educational background, namely science or non-science, and Sundanese language ability background, and by Sundanese and non-Sundanese. Dispositions modeling of mathematics variable was measured after getting ethno mathematics learning with Sundanese culture for two months. The characteristics of respondents consisted of: Based on educational background, 59 respondents were the students of natural science class (A), and 31 respondents were not the students of natural science class (B). Meanwhile, based on Sundanese language ability background students, 42 respondents were Sundanese language ability (C), and 38 respondents were non-Sundanese language ability (D)

Learning Process

Preliminary Activities, the lecturer conducted ethno mathematics learning by introducing Sundanese culture, explaining the rules of the game, providing the assignment and his assessment. The activity provided perception by asking oral questions to students in order to explore the initial abilities related to the mathematical concepts to be learned.

Center Performance

1. The lecturer shaped groups consisting of 4-5 students. In attempting to create group sharing best, each group must consist of male students and female students.
2. The lecturer provided the worksheets for each student telling the trouble in the background of Sundanese culture, which will be discussed in the learning procedure.
3. One of the students understands writing cultural problems in the spreadsheet, while other students pay notice.
4. The lecturer provided the chance for the students to ask questions connected to the cultural problems on the spreadsheet.
5. The lecturer explained the students about the material on the spreadsheet before discussing it with other group members.
6. The students were asked to solve the problem separately. The marks are then discussed jointly in the group.

7. When the students discussed the problems-solving, the lecturer acted as a launchpad and motivator by observing the performance of learning cautiously in sequence to observe the appropriateness between the preparation and the implementation of learning. In total, the lecturer also recognized any learning obstacles and do structure.
8. The lecturer provided support to groups that knowledgeable difficulty when solving trouble on the worksheets.
9. The results of the students in the functioning group then existed in front of the classroom.
10. When one of the students wrote their work on the board, group members and other groups experiential and compared the marks of their work.
11. The lecturer asked the other group to mark the answer on the board if the response was dissimilar with the marks from other groups, then the lecturer led the class discussion.
12. Previous groups provided their responses to the marks from the appearance group, help as long as to reply if essential, and additional answers. The appearance group responded and answered the questions from the students or other groups.
13. Throughout the conversation, the lecturer acted as launch protection and moderator, so that the students might discover and build knowledge concerning the problem beneath the study. The lecturer again observed the implementation of learning carefully to see the appropriateness flanked by the plan and the performance of learning the instrument, the lecturer also recognized any learning obstacles and do structure.
14. The lecturers and students did an indication to examine and re-examine, the learning procedure that had been obtainable.
15. If the learning procedure was accurate, the lecturer then asked the student questions, for example: "What if ...? Are there other ways? Of the three answers, which is better organized? Why?"
16. The final marks of the conversation were the equations of students' insight into the concepts restricted in the problems discussed so that they could be practical to solve the sensible question.

Closing Activity

1. The lecturer reviewed the mathematical concepts that have been deliberate, then concentrating students to recapitulate the significant teaching fabric.
2. The lecturer everlastingly reminded the students about the significance of preserving Sundanese cultural main beliefs in everyday existence and the significance of learning mathematics connected to mathematical modeling of cultural problems existed in Sundanese society.
3. The lecturer provided in order about the next teaching matter in order and supposed that at the next meeting, the questions would forever be provided to be answered by the students in groups, and each group member would in attendance it in the front of the classroom. Consequently, each student must get ready themselves.

Student Learning Activity Sheet

Agriculture

These days, inorganic farming systems have been implemented by the farmers in agriculture outstanding to the fast development of plants, so that they can produce quick income also, even though it affects the obliteration of nature that cannot be avoided from current agricultural culture.

Cultural Value of the Sundanese Society

Many Sundanese people in agriculture make use of organic fertilizers, such as leaves, animal waste, etc. Organic agriculture is measured as a Sundanese culture that must be preserved in order to avoid injury to nature. One of the ancestral teachings in Sundanese culture is also said "*Gunung teu meunang dilebur, Sagara teu meunang diruksak, buyut teu meunang dirempak*", connotation that the mountain should not be destroyed, the sea must not be damaged, and history should not be beyond.

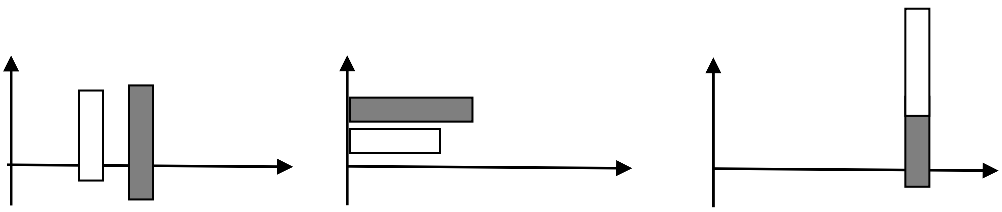
Contextual Problems

The next present two simulations of inorganic and organic farming systems

Table 1. *Comparison of the cost of farming inorganic and organic plants (Area of 1 hectare)*

No	Description	Cost of inorganic/in organic farming systems (thousand rupiahs)	Cost of organic / Sundanese agricultural systems(rupiah)
1	a. Seed	150	35
	b. Fertilizer	600	500
	c. Advanced fertilizer	2,400	700
	d. Land management	1,050	1,050
	e. Nursery	100	100
	f. Rice plantation process by	630	630
	moving backward)	705	835
	g. Weeding	150	50
	h. Control of plant-disturbing organisms	830	830
	i. Harvest Costs	2,550	2,550
	j. Land lease	300	300
	k. Hand sprayer		
	Total	9,465	7,580
2	The output component of the production of dry grain prices	15,000	24,000
3	Profit	5,535	16,420
4	Profit difference	10,000	

Action I
1. Is the estimate of the more than profit dissimilarity correct or wrong? Explain!
2. Does the data above comprise discrete data / by counting, including or incessant / by measuring? Explain!
3. Organize the bar diagram that contains the two farming systems (Use data from the a-k variable)! Make different types of bar diagrams, namely
   (Horizontal Type, Vertical Type, and Combined Type)



Action II
Sundanese culture teaches us to be innovative in dealing with the problems of everyday life. "*Mun teu ngopek moal nyapek, mun teu ngakal moal ngakeul, mun teu ngarah moal ngarih*", which means that Sundanese people must be creative, innovative, diligent in facing life. Mathematics culture also teaches us to think, behave, and solve a problem creatively. Therefore, here is the example form of creativity that can be done in the classroom.

1. Look again at the data on organic farming systems that are compatible with Sundanese culture. How many ways to present it with a bar chart?
2. How many ways can organic agricultural data presented in the form of other diagrams?
3. Choose a diagram that you like? Include the reasons.

Teaching and Learning Activities with Action 1 and 2

Preliminary Activities, the lecturer conducted ethno mathematics learning by introducing Sundanese culture, amplification the rules of the game, as long as the task and the measurement.

They provided insight by asking oral questions to students in order to travel around the initial abilities connected to the mathematical concepts to be learned.

Center activities

1. The lecturer produced groups with 4-5 students. In attempting to make group distribution optimal, each group must consist of male students and female students.
2. The lecturer provided the worksheets for each student with whole cultural problems in the community, Sundanese cultural values as a comparison and contextual issues that would be used as mathematical models.
3. One of the students read cultural problems in agriculture in the worksheets, while other students pay attention.
4. The student read Sundanese cultural values: Action I: " ***Gunung teu meunang di lebur, sagara teu meunang diruksak, buyut teu meunang dirempak"*** (the mountain must not be destroyed, the sea must not be injured, and the past should not be forgotten) to study as an assessment to a cultural problem.
5. Action II: "***Mun teu ngopek moal nyapek, mun teu ngakal moal ngakeul, mun teu ngarah moal ngarih***" (it must be creative, innovative, diligent in facing life).
6. The lecturer provided the chance for the students to react to cultural problems in the community with the Sundanese cultural values studied.
7. The students established the wisdom of Sundanese cultural values by answering community cultural problems through mathematical modeling activities.
8. The lecturer provided the opportunity for the students to ask questions connected to contextual issues on the worksheets.
9. The lecturer concentrating on students to understand the material on the worksheet before discussing it with other group members.
10. The students were asked to solve the problem separately. The marks were discussed together in the group. When they solved problems, the lecturer acted as a launch-pad and motivator by observing the performance of knowledge cautiously to see the appropriateness between the plan and the functioning of learning. In addition, the lecturer also recognized any learning obstacles and did the structure.
11. The lecturer provided support to groups who knowledge problems when the students explain problems on the worksheet.
12. The marks of the students in the working group were obtainable in front of the classroom.
13. When one of the students wrote their work on the board, group members and other groups practical and compared the marks of their work.
14. The lecturer asked the other group to write the answer on the board, if the answer was dissimilar with the results from other groups, then the lecturer led the class conversation.
15. Other groups provided their responses to the marks from the appearance group, helped as long as answer if necessary, and supplementary answers. The presentation group responded and answered the questions from the students or other groups.
16. During the discussion, the lecturer acted as a launch-pad and moderator, so that the students could discover and build knowledge concerning the problem under study. The lecturer once more observed the performance of learning carefully to see the appropriateness between the plan and the implementation of learning. In addition, the lecturer also recognized any learning obstacles and does a framework.
17. The lecturers and students did an indication, namely to evaluate and re-examine, the learning procedure that had been presented.
18. If the learning procedure was correct, the lecturer then asked the student questions, for model: "What if ...? Are there previous ways? Of the three answers, which is well-organized? Why?"
19. Students recognized the wisdom of Sundanese cultural values by interpreting them through mathematics learning outcomes generated through interpretation delivered to each group.
20. The final results of the conversation were the equations of student perceptions of the concepts controlled in the problems discussed so that they could be practical to resolve sensible questions.

Table 2. *The instrument of disposition modeling mathematics*

No	Activity, Feeling, or Opinion	Pos/ Neg	VF	F	R	N
	Passion and serious attention in learning mathematics					
1	Happy learning mathematical modeling nuanced Sundanese culture	+				
2	Avoiding doing mathematical modeling tasks	-				
3	Interested in learning mathematical modeling material from various sources	+				
4	Eagerly followed the discussion about mathematical modeling	+				
5	Lazy learns mathematical modeling material	-				
6.	Deliberately setting aside time to study mathematical modeling material	+				
	Confident					
7	Fear of asking about mathematical modeling that has not been understood during lectures	-				
8	Dare to solve mathematical modeling problems in front of the class	+				
9	Initiative answering lecturers' questions about mathematical modeling	+				
10	Hesitating on getting good grades in mathematical modeling tests	-				
11	Worried when asked about sudden mathematical modeling	-				
12.	Sure you can solve difficult mathematical modeling problems	+				
13.	Fear of giving feedback about mathematical modeling	-				
	Flexible in exploring ideas and alternatives about mathematical modeling					
14.	Try a number of different ways to solve mathematical modeling problems	+				
15.	Can accept different friends' answers along with reasons about mathematical modeling	-				
16.	Reject different answers about mathematical modeling	-				
17.	not working on a variety of mathematical modeling problems	-				
18.	Defend one's own opinion about mathematical modeling even though the data is not supported	-				
	Persistent in solving mathematical modeling problems					
19.	Waiting for help when having difficulty solving mathematical modeling problems	-				
20.	Endure solving mathematical modeling problems until you get the right solution	+				
21.	Give up when it fails to compile a mathematical model of a situation	-				
22.	Give up when it fails to compile a mathematical model of a situation	+				
	Monitor and reflect on the thought					
23.	Matching your own mastery in mathematical modeling material with targets that have been prepared	+				
24.	do not care about the achievement of learning outcomes in mathematical modeling material	-				
25.	Identify the shortcomings themselves in understanding mathematical modeling	+				
26.	Argues that monitoring student understanding in mathematical modeling is a lecturer's task only	-				
	Curiosity					
27.	Study mathematical modeling material in more depth from a variety of sources	+				
28.	Ask teachers and friends when you have difficulty understanding mathematical modeling	+				
29.	Divert attention when facing difficulties learning mathematical modeling material	-				
30	Refuse to attend a seminar on mathematical modeling for elementary school teachers	-				
	Appreciation for mathematical modeling					
31	Increase Sundanese cultural values through relevant mathematical modeling activities	+				
32	Argues that mathematical modeling is not related to Sundanese cultural values	-				
33	Socializing mathematical modeling activities nuanced Sundanese culture in everyday problems	+				
34	Arguing mathematical modeling is beneficial for elementary teacher candidates	+				
35	Look at theoretical mathematical modeling that is difficult to apply in everyday problems	-				

Measure

The participant after leaning gave the instrument a Likert ranking scale (Brown, 2011) was used with 4 choices with 30 statements. Scores of each value statement 1, 2, 4 and 5. Score 3 was omitted so that the respondents were able to immediately see whether they had a positive or negative response. The statement positive value consists of very frequently (VF) = 5, frequently (F) = 4, rarely (R) = 2, never (N) = 1. The statement negative value consists of very frequently (VF) = 1, frequently (F) = 2, rarely(R) = 4, never (N) = 5.

Data Analysis

The data of disposition modeling of mathematics test was analyzed with Rasch Model modeling. (Sumintono and Widhiarso, 2014; Briggs, 2019; Ho, 2019). This study employed quantitative analytic observational with survey methods. For the analysis of the data, Rasch Analysis and Rach Measurement software Ministep.

RESULTS

Table 3 provides overall information about the quality of respondents as a whole, the quality of the instruments used and the interactions between people and items. Person measure = +0.40 logit indicates the average value of the respondent in the mathematical modeling disposition instrument.

The average value of logit 0.0 is more than 0.40, indicating the tendency of respondents who answered more in agreement with statements in various items. Cronbach's alpha value (Gliem and Gliem, 2003) <0.5: Poor 0.5-0.6: Bad 0.6-0.7: Sufficient 0.7-0.8: Good> 0.8: Very good. Value Person Reliability and item Reliability <0.67 Weak, 0.67-0.80 Fair 0.81-0.90 Good 0.91-0.94 Very Good> 0.94 Special. From the person reliability value of 0.87 and item reliability of 0.92, it can be concluded that the consistency of answers from respondents is high, and the quality of the items in the instrument is very good.

Table 3. *Quality data of respondents with the Rasch model*

SUMMARY OF 75 MEASURED Person								
	TOTAL SCORE	COUNT	MEASURE	MODEL ERROR	INFIT MNSQ	ZSTD	OUTFIT MNSQ	ZSTD
MEAN	82,2	25,0	0,40	0,23	1,02	-0,20	1,03	-0,20
S.D.	13,2	0,0	0,71	0,03	0,55	1,80	0,58	1,80
MAX	112,0	25,0	2,47	0,35	4,07	5,20	4,34	5,60
MIN.	46,0	25,0	-1,66	0,21	0,18	-3,90	0,20	-3,70
REAL RMSE 0.26 TRUE SD 0 .66 SEPARATION 2,53 Person RELIABILITY 0,87								
MODEL RMSE 0.23 TRUE SD 0 .67 SEPARATION 2,85 Person RELIABILITY 0,89								
S.E. OF Person MEAN = 0.08								
IGNORED: 15 Person								
Person RAW SCORE-TO-MEASURE CORRELATION = 0.99								
CRONBACH ALPHA (KR-20) Person RAW SCORE "TEST" RELIABILITY = 0.88								
SUMMARY OF 25 MEASURED Item								
	TOTAL SCORE	COUNT	MEASURE	MODEL ERROR	INFIT MNSQ	ZSTD	OUTFIT MNSQ	ZSTD
MEAN	246,7	75,0	0,00	0,13	0,99	-0,10	1,03	0,1
S.D.	27,4	0,0	0,49	0,01	0,21	1,40	0,25	1,5
MAX	316,0	75,0	0,88	0,17	1,44	2,9	1,57	3,4
MIN.	194,0	75,0	-1,43	0,13	0,68	-2,4	0,72	-1,9
REAL RMSE 0,14 TRUE SD 0 ,47 SEPARATION 3,39 Item RELIABILITY 0 ,92								
MODEL RMSE 0,13 TRUE SD 0 ,47 SEPARATION 3,53 Item RELIABILITY 0,93								
S.E. OF Item MEAN = 0,10								

Table 4 measure is the logit value of the item, for item S8: Dare to solve mathematical modeling problems in front of the class with +0.88 logit shows this is the item most difficult for respondents to agree on in the disposition instrument of mathematical modeling; while the S24 item: do not care about the achievement of learning outcomes in mathematical modeling material with a value of -1.94 logit is the most easily approved item.

Table 4. *Quality data of instruments with Rasch model*

ENTRY NUMBER	TOTAL SCORE	TOTAL COUNT	MEASURE	MODEL S.E	INFIT MNSQ	INFIT ZSTD	OUTFIT MNSQ	OUTFIT ZSTD	PT-MEASURE CORE	PT-MEASURE EXP	EXACT OBS%	MATCH EXP%	Item
8	194	75	0,88	0,13	1,15	1,00	1,19	1,20	0,56	0,52	26,7	41,8	S8
9	200	75	0,78	0,13	0,94	-0,30	0,92	-0,40	0,54	0,53	40,0	41,4	S9
12	203	75	0,73	0,13	0,93	-0,40	0,90	-0,60	0,51	0,53	48,0	40,8	S12
14	211	75	0,60	0,13	1,20	1,40	1,45	2,70	0,35	0,53	40,0	37,9	S14
6	224	75	0,39	0,13	1,02	1,50	1,21	1,40	0,42	0,53	22,7	38,6	S6
11	224	75	0,39	0,13	1,21	0,20	0,97	-0,10	0,57	0,53	37,3	38,6	S11
10	228	75	0,32	0,13	1,02	2,90	1,57	3,40	0,27	0,53	26,7	38,5	S10
7	239	75	0,15	0,13	1,44	2,70	1,40	2,50	0,47	0,52	25,3	36,1	S7
19	240	75	0,13	0,13	1,41	-0,80	0,84	-1,10	0,53	0,52	37,3	36,0	S19
25	242	75	0,10	0,13	0,88	-0,20	1,06	0,50	0,43	0,52	36,0	37,3	S25
23	244	75	0,06	0,13	0,97	-0,40	0,94	-0,40	0,52	0,52	42,7	38,2	S23
22	247	75	0,01	0,13	0,94	-1,60	0,78	-1,50	0,62	0,52	36,0	38,1	S22
18	251	75	-0,05	0,13	0,79	1,70	1,46	2,70	0,28	0,51	42,7	40,0	S18
1	252	75	-0,07	0,13	1,25	0,60	1,14	0,90	0,49	0,51	42,7	40,0	S1
3	253	75	-0,08	0,13	1,08	-0,40	0,94	-0,40	0,58	0,51	41,3	38,7	S3
13	253	75	-0,08	0,13	0,94	-0,50	0,88	-0,70	0,59	0,51	33,3	38,7	S13
20	257	75	-0,15	0,13	0,93	-1,40	0,78	-1,50	0,66	0,51	45,3	39,8	S20
4	260	75	-0,20	0,13	0,80	-2,40	0,72	-1,90	0,65	0,51	52,0	40,5	S4
17	266	75	-0,31	0,13	0,68	-1,90	0,75	-1,60	0,67	0,50	54,7	43,7	S17
5	267	75	-0,33	0,13	0,73	-1,50	0,81	-1,20	0,69	0,50	52,0	43,7	S5
2	269	75	-0,36	0,13	0,78	-2,00	0,73	-1,80	0,70	0,49	56,0	44,3	S2
15	272	75	-0,42	0,13	0,72	-1,60	0,79	-1,30	0,55	0,49	64,0	46,2	S15
21	274	75	-0,45	0,13	1,18	1,20	1,16	1,00	0,38	0,49	49,3	48,2	S21
16	281	75	-0,59	0,13	1,18	1,10	1,29	1,60	0,34	0,48	48,0	49,5	S16
24	316	75	-1,43	0,13	0,93	-0,30	0,98	0,00	0,40	0,41	62,7	57,5	S24
MEAN	246.7	75,0	0,00	0,13	0,99	-0,10	1,03	0,10			42,5	41,4	
S.D.	27,4	0,00	0,49	0,01	0,21	1,4	0,25	1,5			10,8	4,8	

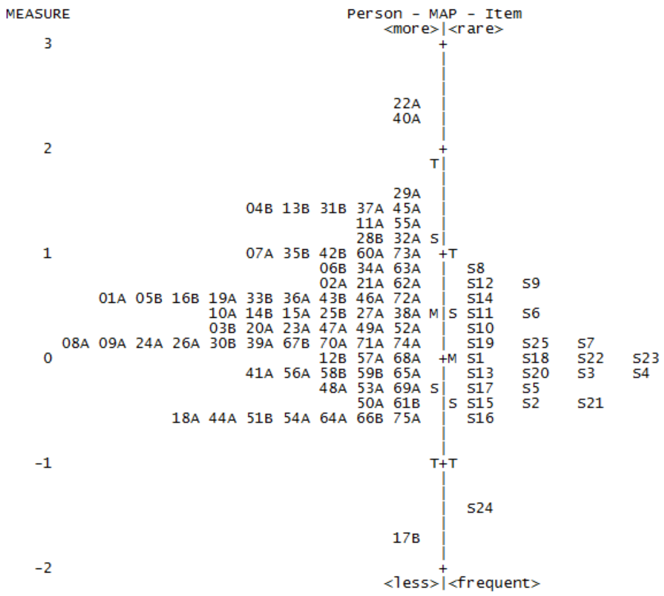


FIGURE 2: *Wright's maps of abilities and statements with the Rasch Model*

Figure 2 shows the students who have the high ability are seen as three people, namely 22A, 40A and 29A, all of which are higher than all given difficulty levels. This means that all three will get the maximum value that can be obtained. The logit value of these students is more than +2 logit and +1 logit. 22A students are also outside the limits of two standard deviations (T) which show different high intelligence. The student with the lowest ability was 17B, with a logit value of -1 logit which also showed very low ability. Based on these data students with science ability tend to be higher than non-science group students.

To the right of S8, "dare to solve mathematical modeling problems in front of the class" is a statement that has a high degree of difficulty variability. All of the above statements are good because they vary and do not gather all the statements in one line, this shows the statement items from the instrument of disposition modeling mathematics can provide useful information about the modeling abilities of the students being tested.

If we compare the distance between M-S-T it can be seen that the distribution for students' abilities in mathematical modeling is wider than the distribution at the level of difficulty of statements/items. This shows that the items on the disposition statement of mathematical modeling are not far adrift; however, from the ability aspect of the students, it can be seen that the ability range is very wide. This indicates that the abilities of 90 students differ greatly, and the statement of the disposition of mathematical modeling can provide the necessary information.

```
MEASURE  Item - MAP - Person
           <rare>|<more>
    3            +
                 |
                 |
                 |
                 |  22AD
                 |  40AD
                 |
    2            +
                 |T
                 |
                 |  29AC
                 |  04BD  13BC  31BC  37AD  45AD
                 |  11AD  55AD
                 |S 28BD  32AC
    1           T+  07AD  35BD  42BC  60AC  73AD
             X   |  06BD  34AD  63AC
            XX   |  02AD  21AD  62AC
             X   |  01AD  05BC  16BC  19AD  33BC  36AD  43BD  46AD  72AC
            XX  S|M 10AC  14BC  15AD  25BC  27AD  38AD
             X   |  03BC  20AD  23AD  47AC  49AD  52AD
           XXX   |  08AC  09AC  24AC  26AC  30BC  39AC  67BC  70AD  71AC  74AD
    0     XXXX  M+  12BD  57AC  68AD
          XXXX   |  41AD  56AC  58BD  59BC  65AC
            XX   |S 48AD  53AC  69AD
           XXX  S|  50AC  61BC
             X   |  18AC  44AC  51BD  54AD  64AC  66BC  75AC
                 |
                 |
   -1           T+T
                 |
                 |
             X   |
                 |
                 |  17BD
                 |
   -2            +
         <frequen|<less>
```

FIGURE 3. *Wright's map of the distribution of abilities and statements based on educational and Sundanese language ability settings with the Rasch Model*

Figure 3 shows If based on educational and Sundanese language ability background, students who have a high ability can be seen that there is one person, namely 22AD, 40AD and 29AC, all three are higher than all levels of difficulty given. This means that all three will get the maximum value that can be obtained. The logit value of these students is more than +2 logit and +1 logit. So that students with science and Sundanese background are superior in Sundanese ethno mathematics learning. But if we observe in 17BD, students with non-science and Sundanese backgrounds have a lower ability. Sundanese ethno mathematics learning in mathematical modeling ability has more educational background. But in the language ability background, there is no difference, so that both Sundanese and non-Sundanese cultures can be appropriate in learning mathematics.

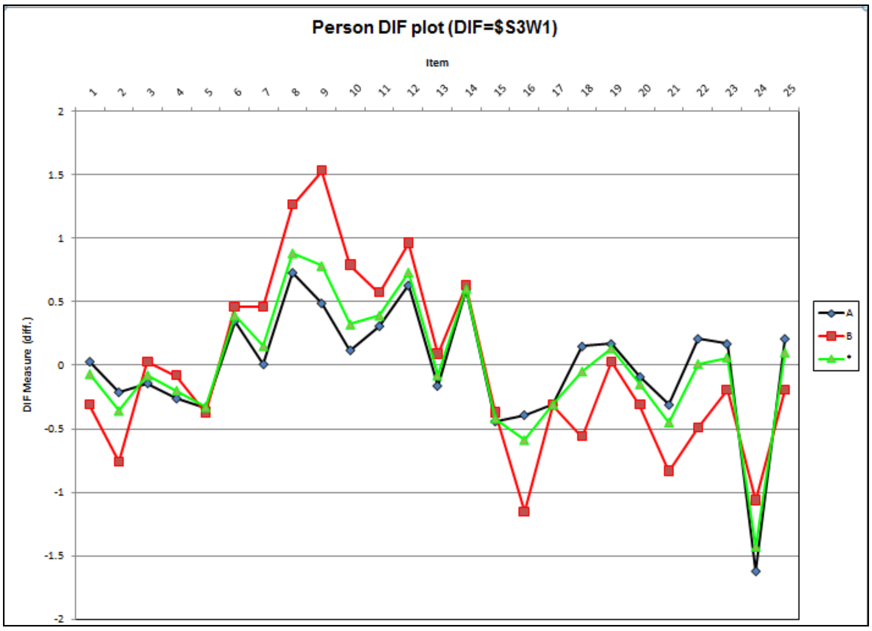


FIGURE 4. *Disposition of mathematical modeling based on an educational background in Sundanese ethno mathematics learning with the Rasch Model*

Based on figure 4, there are several questions that distinguish between the modeling abilities of students from science and non-science. Statement No. 1 and Problem No. 9, the distance between non-scientific graphs appears to be further than that of science. There are findings in questions no. 5, 14, 15, and 17 which do not show differences in educational background.

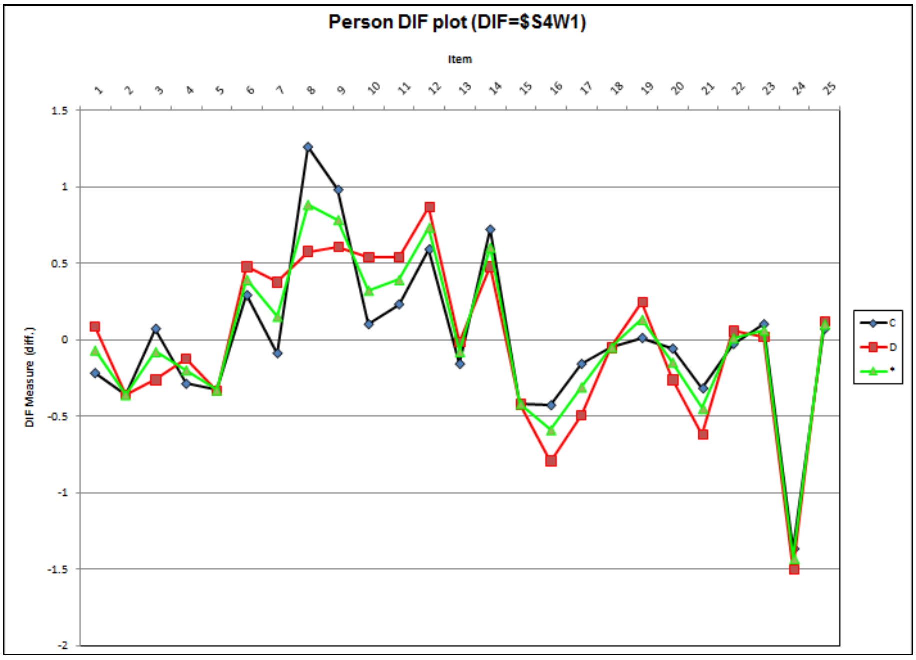


FIGURE 5. *Disposition of mathematical modeling based on Sundanese language ability background in Sundanese ethnomathematics learning with the Rasch Model*

Based on figure 5, it can be seen statements no 2,5,13,15,16,20 and 21 show no difference between the two Sundanese language ability backgrounds. However, statements no. 1,8,9,10,11,12,16 and 17 show differences in Sundanese language ability backgrounds, can be easily done with Sundanese language ability backgrounds or can be difficult for students with Sundanese language ability backgrounds.

DISCUSSION and CONCLUSIONS

Analysis of mathematical modeling disposition by using culture from instrument quality. The average value of logit more than 0.0 indicates the tendency of respondents who answered more in agreement with statements in various items. From the person reliability value of 0.87 and item reliability of 0.92, it can be concluded that the consistency of answers from respondents is high, and the quality of the items in the instrument is very good. The quality of an instrument lies in the quality of the items in question. This is in accordance with the findings (Ariffin, Omar, Isa and Sharif, 2010).

Item S8: Dare to solve mathematical modeling problems in front of the class with +0.88 logit shows this is the most difficult item for respondents to agree on in the disposition instruments of mathematical modeling; while the S24 item: do not care about the achievement of learning outcomes in mathematical modeling material with a value of -1.94 logit is the easiest item to approve. Modeling in front of the class requires a high level of trust from a student, and this is a challenge for all students. Science students are superior to their confidence because mathematics learning is more widely studied by students from elementary school to the senior high school level, however, when viewed from Sundanese language ability backgrounds students both from Sundanese and non-Sundanese all have the same sense of confidence to display a cultural product in front class. The sense of confidence in learning mathematics increases by using culture so that it influences learning achievement and is in accordance with the findings (Burr and Le Fevre, 2020).

Statement No. 1 regarding "happy learning mathematical modeling nuanced Sundanese culture", science students are easier to do than non-science. In question No. 9 "Initiative answering lecturers' questions about mathematical modeling", it appears that the distance of non-scientific graphs is further than that of science, so it can be concluded that science students answer more questions from lecturers in learning. Learning requires pleasure so students will be enthusiastic about answering all questions from the lecturer. The influence of educational background has more influence on the enjoyment of learning. Happiness will affect one's success in learning (Ray, Onifade, and Davis, 2019).

Based on data that students with science ability tend to be higher than non-science group students. All of the above statements are good because they vary and do not gather all statements in one line, this shows the statement items from the instrument of disposition modeling mathematics can provide useful information for the modeling abilities of the students being tested. The analysis indicates that the abilities of 90 students differ greatly, and the disposition statement instruments for mathematical modeling can provide the necessary information. The ability of science in learning influences learning discipline, mathematics learning success is determined by discipline in learning. The ability of science is higher than non-science because it is influenced by the discipline of learning. (Parker and Welch, 2013).

If based on educational and Sundanese language ability background, students who have science and Sundanese background are superior in Sundanese ethno mathematics learning. But if we observe in 17BD, students with non-science and Sundanese backgrounds have a lower ability. Sundanese ethno mathematics learning in mathematical modeling ability has more educational background. Students who study mathematics are more easily understood by students with more scientific learning experience than non-science. Learning experiences can affect a person's ability to learn mathematics. This is in accordance with the opinion (Jansen, Louwerse, Straatemeier, Van der Ven, Klinkenberg, and Van der Maas, 2013). But in the Sundanese language ability background, there is no difference, so that both Sundanese and non-

Sundanese can be appropriate in learning mathematics because mathematics is general in nature can be learned without looking at one's Sundanese language ability background.

There are several questions that distinguish between the modeling abilities of students from science and non-science. Statement No. 1 regarding "happy learning mathematical modeling nuanced Sundanese culture", science students are easier to do than non-science. Mathematics using Sundanese culture makes science students happier to learn so that learning success is higher. This is consistent with the findings of Ray, Onifade, and Davis (2019). That pleasure is very influential on one's academic success. In question No. 9 "Initiative answering lecturers' questions about mathematical modeling", it appears that the distance of non-scientific graphs is further than that of science, so it can be concluded that science students answer more questions from lecturers in learning. There are findings on a problem no. 5 Lazy learns mathematical modeling material, the problem no. 14 Try a number of different ways to solve mathematical modeling problems, the problem no. 15 Can accept different friends' answers along with reasons about mathematical modeling, and the problem no. 17 not working on a variety of mathematical modeling problems does not show differences in educational background. Students from both science and non-science are not lazy to learn mathematics using Sundanese culture, because they are happy with learning mathematics with culture. They always try new ways, because with this learning, students become creative in making mathematical modeling. This is consistent with the findings (Supriadi, et.al, 2019) that learning mathematics with culture can make mathematical modeling activities more creative cultural background can affect students in happy learning mathematical modeling nuanced Sundanese culture, Dare to solve mathematical modeling problems in front of the class, Initiative answering lecturers' questions about mathematical modeling, Hesitating on getting good grades in mathematical modeling tests, Worried when asked about sudden mathematical modeling and Sure you can solve difficult mathematical modeling problems of cultural aspects. Ethno mathematics learning provides experiences for students related to daily life, making it easier for students to interact with mathematics teaching materials. This finding is in accordance with the opinion of Kale, Nur and Durmuş (2018), mathematical experiences at different cultures can be useful for children's mathematical learning to determine strategies that can be used for mathematics education.

In conclusion, the disposition of mathematical modeling has a good instrument because it can suit the needs and diverse backgrounds of students. Students with a background in science are easier to learn, high in ability and happier in learning mathematics. Meanwhile, when viewed from the Sundanese language ability background, all students from both Sundanese and non-Sundanese can learn mathematics well.

REFERENCES

Ariffin, S. R., Omar, B., Isa, A., & Sharif, S. (2010). Validity and reliability multiple intelligent item using rasch measurement model. *Procedia-Social and Behavioral Sciences, 9*, 729-733.

Ashcraft, M. H. (2002). Math anxiety: Personal, educational, and cognitive consequences. *Current directions in psychological science, 11*(5), 181-185.

Beilock, S. L., Gunderson, E. A., Ramirez, G., & Levine, S. C. (2010). Female teachers' math anxiety affects girls' math achievement. *Proceedings of the National Academy of Sciences, 107*(5), 1860-1863.

Bellwood, P. (2006). Asian farming diasporas? Agriculture, languages, and genes in China and Southeast Asia. *archaeology of asia*, 96-118.

Blust, R. (2013). 35 Southeast Asian islands and Oceania: Austronesian linguistic history. *The Encyclopedia of Global Human Migration*.

Briggs, D. C. (2019). Interpreting and visualizing the unit of measurement in the Rasch Model. *Measurement, 146*, 961-971.

Brown, J. D. (2011). Likert items and scales of measurement. *Statistics, 15*(1), 10-14.

Burr, S. M. D. L., & LeFevre, J.-A. (2020). Confidence is key: Unlocking the relations between ADHD symptoms and math performance. *Learning and Individual Differences, 77*, 101808.

Chubb, M. C., & Jacobsen, K. H. (2010). Mathematical modeling and the epidemiological research process. *European journal of epidemiology, 25*(1), 13-19.

Cimen, O. A. (2014). Discussing ethnomathematics: Is mathematics culturally dependent? *Procedia-Social and Behavioral Sciences, 152*, 523-528.
d'Ambrosio, U. (2001). What is ethnomathematics, and how can it help children in schools? *Teaching children mathematics, 7*(6), 308-308.
Ellis, A. K., & Fouts, J. T. (2001). Interdisciplinary curriculum: The research base. *Music Educators Journal, 87*(5), 22-22.
Furner, J., & Berman, B. (2005). Confidence in their ability to do mathematics: The need to eradicate math anxiety so our future students can successfully compete in a high-tech globally competitive world. *Dimensions in Mathematics, 18*(1), 28-31.
García, F. J., Maass, K., & Wake, G. (2010). Theory meets practice: Working pragmatically within different cultures and traditions. In *Modeling Students' Mathematical Modeling Competencies* (pp. 445-457): Springer.
Geist, E. (2010). The anti-anxiety curriculum: Combating math anxiety in the classroom. *Journal of Instructional Psychology, 37*(1).
Gliem, J. A., & Gliem, R. R. (2003). *Calculating, interpreting, and reporting Cronbach's alpha reliability coefficient for Likert-type scales*.
Gravemeijer, K., & Terwel, J. (2000). Hans Freudenthal: a mathematician on didactics and curriculum theory. *Journal of curriculum studies, 32*(6), 777-796.
Harding-DeKam, J. L. (2007). Foundations in ethnomathematics for prospective elementary teachers. *Journal of Mathematics and Culture, 1*(2).
Hargreaves, A., & Moore, S. (2000). Curriculum Integration and Classroom Relevance: A Study of Teachers' Practice. *Journal of curriculum and supervision, 15*(2), 89-112.
Ho, H.-Z., Senturk, D., Lam, A. G., Zimmer, J. M., Hong, S., Okamoto, Y., . . . Wang, C.-P. (2000). The affective and cognitive dimensions of math anxiety: A cross-national study. *Journal for research in mathematics education*, 362-379.
Ho, P. (2019). A new approach to measuring Overall Liking with the Many-Facet Rasch Model. *Food quality and preference, 74*, 100-111.
Jansen, B. R., Louwerse, J., Straatemeier, M., Van der Ven, S. H., Klinkenberg, S., & Van der Maas, H. L. (2013). The influence of experiencing success in math on math anxiety, perceived math competence, and math performance. *Learning and Individual Differences, 24*, 190-197.
Kale, M., Nur, İ., & Durmuş, A. (2018). A theoretical framework to examining mathematical experiences in early childhood: sociomathematical niche.
Kilpatrick, J., & Swafford, J. (2001). ADDING IT.
Lesh, R. A., & Doerr, H. M. (2003). *Beyond constructivism: Models and modeling perspectives on mathematics problem solving, learning, and teaching*: Routledge.
Orey, D. C., & Rosa, M. (2006). Ethnomathematics: Cultural assertions and challenges towards pedagogical action. *The journal of Mathematics and Culture, 1*(1), 57-78.
Parker, M., & Welch, E. W. (2013). Professional networks, science ability, and gender determinants of three types of leadership in academic science and engineering. *The Leadership Quarterly, 24*(2), 332-348.
Rameau, P., & Louime, C. (2007). Mathematics phobia: Are the mathematical sciences a pothole in the road of life? *Current Science, 93*(11), 1481-1482.
Ray, M., Onifade, E., & Davis, C. (2019). Using 'happy'or 'sad'face in a decision-making grid to motivate students to improve academic success. *International Review of Economics Education, 30*, 100131.
Royster, D. C., Kim Harris, M., & Schoeps, N. (1999). Dispositions of college mathematics students. *International Journal of Mathematical Education in Science and Technology, 30*(3), 317-333.
Supriadi, S., Chudari,I.N, Tiurlina,T., Wuryastuti, S., Sundari, N., Ridwan, I.R,Robiansyah, F.,Alfarisa, F. Creative Intelligence Analysis in Ethnomathematics Learning.
Sharp, J. M. (1999). A Teacher-Researcher Perspective on Designing Multicultural Mathematics Experiences for Preservice Teachers. *Equity & Excellence, 32*(1), 31-42.
Sumintono, B., & Widhiarso, W. (2014). *Aplikasi model Rasch untuk penelitian ilmu-ilmu sosial (edisi revisi)*: Trim Komunikata Publishing House.
Supriadi, S. (2019). Didactic Design of Sundanese Ethnomathematics Learning for Primary School Students. *International Journal of Learning, Teaching and Educational Research, 18*(11).
Suryawan, I. (2018). *Integrating ethnomathematics into open-ended problem based teaching materials.* Paper presented at the Journal of Physics: Conference Series.
Sylwester, R. (1995). *A celebration of neurons: An educator's guide to the human brain*: ERIC.
Thomas, K., & Hart, J. (2010). Pre-service teachers' perceptions of model eliciting activities. In *Modeling students' mathematical modeling competencies* (pp. 531-538): Springer.
Tobias, S., & Weissbrod, C. (1980). Anxiety and mathematics: An update. *Harvard Educational Review, 50*(1), 63-70.
Tsui, J. M., & Mazzocco, M. M. (2006). Effects of math anxiety and perfectionism on timed versus untimed math testing in mathematically gifted sixth graders. *Roeper Review, 29*(2), 132-139.