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Rasch analysis in developing Jambi culture-based ethnomathematics test for prospective mathematics teachers

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ABSTRACT

Teachers have an important role in the successful implementation of ethnomathematics in the classroom. Teachers need to have a comprehensive understanding of the context of ethnomathematics. This study aims to develop an instrument for measuring prospective teachers' ethnomathematics knowledge. The instrument was developed in the context of Jambi culture. This research is development research using the Plomp Model, which consists of three stages, namely: 1) preliminary research stage, 2) prototyping stage, and 3) assessment stage. The instrument developed consists of seven indicators and 43 items. Five experts in the fields of cultural studies and mathematics education carried out the instrument validation. The instrument was tested on 74 prospective mathematics teachers. The results show the instrument for measuring ethnomathematics knowledge of prospective mathematics teachers that was developed meets the criteria of unidimensionality, validity & reliability and does not indicate item bias. Therefore, this instrument is appropriate for use in measuring the ethnomathematics knowledge of prospective mathematics teachers in the Jambi cultural context.

INTRODUCTION

National culture is an ancestral heritage that functions as a national identity. Globalization allows the influence of various foreign cultures to enter a country. It has the potential to trigger a shift in a nation's cultural values. Serious efforts to preserve the nation's cultural values in the globalization era are needed. There are serious challenges that must be faced to maintain the existence of national identity amidst the cultural onslaught in the globalization era. The education sector has an important role in preserving the culture.

Ethnomathematics is an effort to preserve the nation's cultural values. According to Albanese et al. (2017), Budiarto et al. (2019), D'Ambrosio (1987), Ethnomathematics is broadly defined as the study of the relationship between culture and mathematics. Learning mathematics through cultural relevance and personal experience helps students to know more about Reality, culture, society, environmental issues, and themselves by providing mathematical content and approaches that enable them to master mathematics successfully (Ora &Rosa, 2007; 2017; 2021). Many previous studies studied the benefits of embedding Ethnomathematics into mathematics taught and studied in schools. Rowlands and Carson (2004) argue that by involving students in Ethnomathematics, they can create more. For inclusive math conversations, ensure that students from indigenous and traditional cultures can bring important resources, ideas, and perspectives to the conversations so that they are more interactive. Recent studies in Ethnomathematics show that Ethnomathematics

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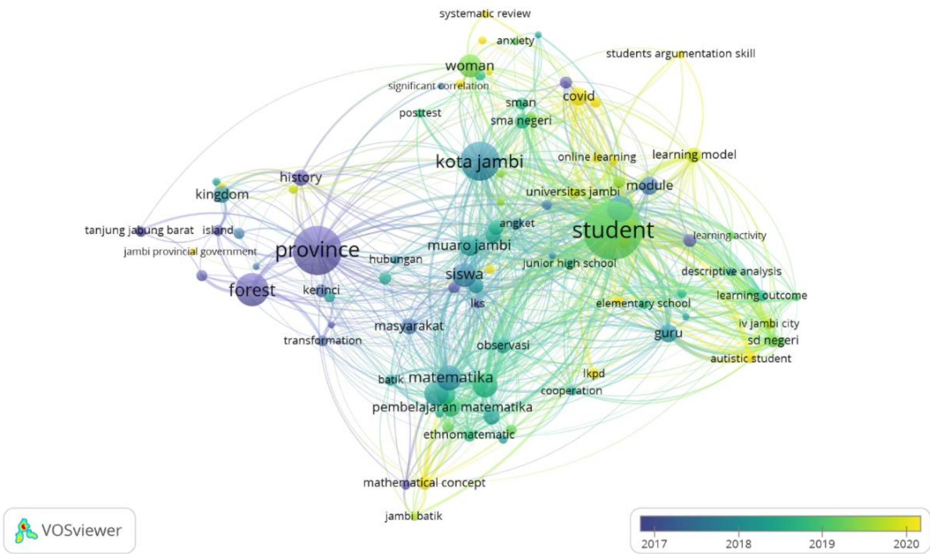

Figure 1. *Bibliometric* analysis *overlay visualization*

supports student agency, achievement, and creativity (Supriyadi, 2019; Prahmana & Istiandaru, 2021; Rosa & Orey, 2018; 2019).

Teachers play an important role in the successful implementation of Ethnomathematics in the classroom (Brandt & Chernoff, 2015). Every math teacher needs to learn about their students' culture and make math content relevant to local interests. It may give rise to changes in approaches to content content or even instructional techniques (Rosa & Orey, 2007; Peni & Baba, 2019). Therefore, teachers need to have a comprehensive understanding of the conceptualization and practice of ethnomathematics. This understanding needs to be instilled from an early age, even when they become prospective teachers, before entering the world of education. Furthermore, it is necessary to have a measurement instrument developed so that it meets the criteria for high validity and reliability to provide an accurate assessment of the level of ethnomathematics abilities of prospective teachers.

Accurate measuring requires valid and reliable instruments (Falani et al., 2019; Susongko, 2016; Susongko, 2021). Accurate measuring can produce data that can describe actual conditions related to certain latent measurement variable problems, especially the ethnomathematics abilities of prospective teachers. Therefore, it is very important to carry out in-depth studies regarding the development of instruments that meet the criteria for validity and reliability (Falani et al., 2022). Increasingly advanced Rasch analysis is widely used to develop and develop interval-level scales to measure abilities (Falani et al., 2022; Medvedev & Krägeloh, 2022; Erfan et al., 2020; Dutt et al., 2019). The Rasch Model approach in instrument development aims to increase measurement accuracy. (Bond & Fox, 2013; Falani et al., 2022; Sumintono, 2015; Lamprianou, 2019; Reise & Revicki, 2014; Andrich & Marais, 2019; Chan et al 2019) .

Preliminary study with use *Analysis Bibliometry* helpful *Vos viewers* pointed out that Not yet exists instrument standard measurement ability Ethnomathematics context Jambi culture for prospective mathematics teachers. This thing, of course, needs to be taken seriously. Remember, the teacher is the spearhead of a successful effort to preserve the existence of Jambi culture through the integration of ethnomathematics in learning quality in the class. Based on the results, the analysis of bibliometry involved 134 articles. As Figure 1 shows, study-related instrument measurement ethnomathematics For prospective teachers has yet to be done.

Jambi culture is one of Indonesian cultures, a cultural heritage from our ancestors that must be preserved. The choice of Jambi culture in this research was based on ease of access. Because the researcher lives in Jambi, apart from that, Jambi culture has many unique things that can be explored as ethnomathematics objects. Therefore, this research aims to develop an instrument for measuring prospective teachers' ethnomathematics knowledge in the Jambi cultural context.

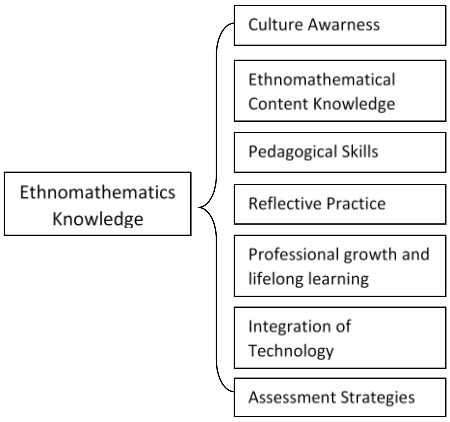

Figure 2. Indicators of ethnomathematics knowledge

Based on the background explained above, it can be concluded that there is a need to develop an instrument for measuring ethnomathematics skills in the Jambi cultural context by implementing the Rasch Model approach.

METHODS

The model used in the development instrument measurement ethnomathematics in research is the Plomp Model. The selection of this model is considered an appropriate model because it relies more focus on observation and literary study to get a possible context made as more foundation relevant, actual, and complex so that in "*grand theory,*" it is a deep fundamental foundation preparation instrument measurement ethnomathematics (Plomp & Nieveen, 2013; Novitra; 2020). The stages of development of the Plomp Model consist of several stages.

Preliminary stage

This stage entails developing a theoretical and conceptual framework for the study, reviewing pertinent literature, and conducting an in-depth analysis of the requirements and environment.

Prototyping stage

In this stage, researchers design the initial framework and develop prototypes based on the findings from the preliminary investigation. Validation of the instrument prototype was carried out by five experts in the fields of mathematics education, ethnomathematics, and Jambi culture.

Testing stage

This stage involves summative evaluation to conclude the effectiveness of the developed product and its implementation in a real-world setting. The sample size used in this research was 74 prospective mathematics teachers who came from characteristics seen from gender, teaching experience, and level of education. The population involved in the research development is students educated in mathematics in Jambi Province. The sampling technique used was purposive sampling. Study development was conducted at the Mathematics Education Laboratory, FKIP, Jambi University.

Data analysis from field trials was carried out using the Rasch Model approach using Ministep software. The analysis includes several tests: statistical descriptive test, unidimensional test, item fit, reliability, differential item function test, and information function test.

FINDINGS

Preliminary stage

At the beginning of the study, this review references compiling test instrument construct knowledge ethnomathematics. Jambi culture will be developed. Based on the results, review References served as following form Indicator - Indicator Instrument Test Knowledge Ethnomathematics Based Jambi Culture for Prospective Mathematics Teachers.

Table 1
The grid of instrument knowledge ethnomathematics

Variable measurement	Indicator	No. Item	Item Format	Scoring Scale
Ethnomathematical Knowledge	1. Cultural Awareness	1,2,3,4,5,6	Multiple choice	Dichotomy
	2. Ethnomathematics Content Knowledge	7,8,9,10,11,12,13	Multiple choice	Dichotomy
	3. Pedagogical Skills	14,15,16,17,18,19, 20,21,22	Multiple choice	Dichotomy
	4. Reflective Practice	23,24,25,26,27	Multiple choice	Dichotomy
	5. Professional growth and lifelong learning	28,29,30,31,32,33	Multiple choice	Dichotomy
	6. Technology Integration	34,35,36,37,38	Multiple choice	Dichotomy
	7. Assessment Strategy	39,40,41,42,43	Multiple choice	Dichotomy

As we can see in Figure 2, based on the review Of the literature carried out, there are 7 (seven) indicators of knowledge of Ethnomathematics, including.

Cultural awareness

Understand and appreciate. Students' cultural backgrounds and experiences then incorporate relevant cultural examples and practices into their teaching (Koschmieder & Neubauer, 2021; Kusuma et al., 2019).

Ethnomathematics content knowlwdge

Understand the concepts, principles, and theories of Ethnomathematics, including the ability to explain and apply them in teaching (Herawati et al., 2020; Herawati et al., 2018; Herawati et al., 2019; Kusuma et al., 2019)

Pedagogical skills

Ability To plan and implement lesson effective Ethnomathematics, facilitating _ involvement of students, encouraging think critically, and creating a creative environment supportive learning (Yang et al., 2022; Umugiraneza et al., 2022; Peni & Baba, 2019; Naji et al., 2020; Kusuma et al., 2019).

Reflective Practice

Involved in reflection ongoing and evaluation of teaching practice (Oot et al., 2023). Ability To inspect in a way critical of bias, assumptions, and stereotypes they Alone related to mathematics and culture.

Professional growth and lifelong learning

Commitment to the development of professional sustainability and will Keep learning and deepen their understanding of Ethnomathematics.

Technology integration

Utilise tools and resources Power technology To increase teaching and learning ethnomathematics (Antonietti et al., 2023; Hidayat et al., 2023; Saubern et al., 2020).

Assessment strategy

Ability to design appropriate assessment strategies for understanding students to draft Ethnomathematics (Kirsch, 2022; Maryani et al., 2021; Maxwell et al., 2021).

Prototyping stage

This preparation instrument tests knowledge of Ethnomathematics Jambi culture for prospective mathematics teachers based on indicators obtained from stage preliminary r*esearch.* Following is the instrument-developed grid.

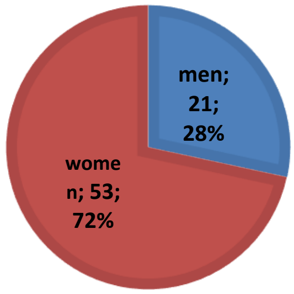

Figure 3. Characteristics respondents based on gender

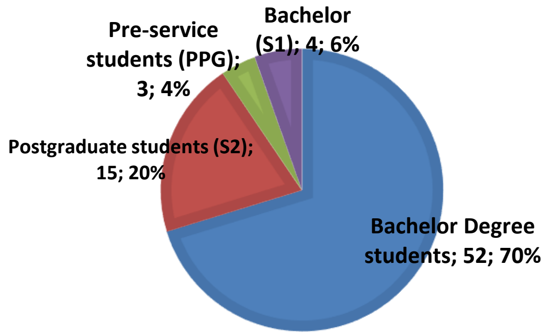

Figure 4. Characteristics respondents based on level of education

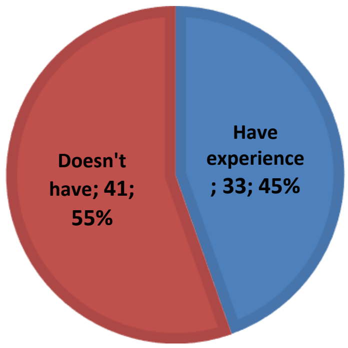

Figure 5. Characteristics respondents based on experience teach

Furthermore, instrument tests that have been arranged proceed to the review stage by 5 (five) experts For validation. Expert consists of three Mathematics Education lecturers and two Lecturers/Culturalists. Validation by experts is done in quantitative and qualitative ways. Qualitative data obtained _ shaped enter /suggestions/criticism repair For instrument perfection. Meanwhile, data is quantitative and obtained from a results evaluation expert or expert For every item using a Likert Scale. Assessment results in expert quantitative or expert explained using the Aiken Method. Following is the results analysis of Aiken's method.

Testing stage

Respondents in research A total of 74 prospective mathematics teachers came from characteristics seen from gender, experience teaching, and level of education. Unt Rasch measurements are given the name "logit" (Linacre & Wright, 1989). Unit This used Fis or state size of the Person and the items. Logit states the location of an item in variable measure units, and logit units also express a lot of action in everyone in the same variables. Because people and items have the same units, and because logit is equal unit intervals, they cannot only be compared to other people, items can compared to other items, but items and people can also compared. (Boone, 2013). According to Storey (2022), Linacre (1994), and Sumintono & Widhiarso (2014), the number This has to fulfill the size sample For Item calibration is stable at ± 0.5 logit with a level of 95% confidence with a size sample between 64–144. Instruments Test Knowledge Ethnomathematics Based Jambi culture for prospective mathematics teachers who have developed. Furthermore, 74 respondents who were prospective mathematics teachers with characteristics as follows.

Characteristics respondent by gender

As we can see in Figure 3, based on gender, respondents above 21 people (28%) are men, and 53 people (72%) are women.

Characteristics respondent based on education level

As we can see in Figure 4, Based on level of education, respondents to the study consist of 52 people (70%) are undergraduate education study program students Jambi University mathematics,

Table 2
Dimensionality

	Item information units	
	Eigenvalues	Observed
Total raw variance in observations	79.8429	100.0%
Raw variance explained by measures	36.8429	46.1%
Raw variance explained by persons	15.5464	19.5%
Raw Variance explained by items	21.2966	26.7%
Raw unexplained variance (total)	43.0000	53.9%
Unexplained variance in 1st contrast	4.5326	5.7%

15 people (20%) are students of the Master of Education study program Jambi University mathematics, 4 people (6%) are alumni of the Bachelor of Education study program Jambi University mathematics, and 3 people (4%) are student of the Teacher Professional Education (PPG) study program at Jambi University.

Characteristics respondent based on education teach

As we can see in Figure 5, There are 41 participants (55%) who responded to the category "does not have experience teaching at school yet", while 33 others (45%) already have experience teaching at school.

Field trial results (empirical)

Following is the analysis of the results carried out on test results data _ field related knowledge ethnomathematics prospective mathematics teacher in the context of Jambi culture. The analysis is done by using Winstep Software to implement the Rasch Model.

Unidimensional test results

Test dimensions aim For appear is instrument test knowledge ethnomathematics based Jambi culture for developed prospective Mathematics teachers _ capable measure what do you want to be measured, in matter This is construction knowledge ethnomathematics. Rasch model analysis uses the analysis component main (*Principal Component Analysis*) of the remainder, that is, measure the extent of the diversity from instrument measure construction main. Following is the output Winstep from the unidimensional test results.

The output on Tabel 2 shows that variance data values are raw by 46%, including in the Category of goods. It shows that the condition minimum unidimensionality of 20% has been fulfilled. (Sumintono & Widhiarso, 2014). This indicates that the instrument developed can produce information about the ethnomathematics knowledge of prospective mathematics teachers, amounting to 46.1% (with an eigenvalue of 36.85) of the measurements that have been carried out.

Meanwhile, mark variants that are not explained by the instrument are below 10 %, namely 5.7%, 4.8%, 3.8%, 3.1%, and 2.8%.

Items fit

This test aims to see the suitability of the items to the model, or what is known as item fit. Item fit explains if the item question functions normally measurement or not. If found question No suitable, This showed that students' misconceptions about the items that. Information is very useful in development tests because it can made as print For repair quality tests.

According to Boone et al. (2004) and Bond and Fox (2015), three criteria can be used For test-level suitability items (item fit), namely (1) Outfit mean square (MNSQ) value received: Interval 0.5 to 1.5, (2) Outfit Z-standard (ZSTD) values accepted: -2 to 2 and, (3) Point Measure Correlation (Pt Mean Corr) values accepted: Interval 0.4 to 0.85.

Table 3

Item fit summary

Entry No	Total Score	Total Count	Measure	Model S.E	INFIT MNSQ	INFIT ZSTD	OUTFITS MNSQ	OUTFITS ZSTD	PTMEASURED CORR	PTMEASURED EXP	Items
34	5	74	4.74	.47	1.22	.7	9.29	4.7	.30	.19	34
40	5	74	4.74	.47	1.14	.5	6.36	3.7	.15	.19	40
6	18	74	3.10	.29	1.21	1.5	1.71	1.6	.14	.35	6
10	26	74	2.48	.27	1.40	3.5	2.02	2.9	.06	.41	10
15	27	74	2.41	.27	1.10	1.0	.98	.0	.37	.42	15
11	28	74	2.33	.27	1.37	3.3	1.93	2.9	.12	.42	11
2	30	74	2.19	.27	1.06	.7	1.19	.8	.37	.44	2
21	31	74	2.12	.27	.80	-2.1	.72	1.3	.58	.44	21
3	37	74	1.70	.27	.84	-1.5	.86	-.7	.57	.47	3
1	46	74	1.05	.28	1.34	2.4	1.38	1.8	.27	.50	1
23	47	74	.97	.28	.92	-.5	.89	-.5	.55	.50	23
5	49	74	.81	.29	.91	-.6	.79	1.0	.58	.50	5
25	50	74	.73	.29	.79	-1.4	.70	1.5	.65	.50	25
37	50	74	.73	.29	.89	-.8	.78	1.0	.59	.50	37
13	51	74	.64	.29	.76	-1.7	.62	1.9	.68	.50	13
14	51	74	.64	.29	1.19	1.3	1.19	.9	.38	.50	14
27	51	74	.64	.29	.74	-1.9	.57	2.2	.69	.50	27
33	51	74	.64	.29	.71	-2.1	.59	2.0	.70	.50	33
24	52	74	.56	.30	.97	-.1	1.00	.1	.51	.50	24
35	58	74	-.02	.33	1.04	.3	.78	-.6	.50	.49	35
29	59	74	-.13	.33	.85	-.7	.64	1.1	.60	.48	29
8	61	74	-.36	.35	1.03	.2	.96	.0	.45	.47	8
28	62	74	-.48	.36	1.15	.7	1.35	.9	.34	.47	28
32	63	74	-.62	.37	.89	-.4	.46	1.4	.58	.46	32
22	64	74	-.76	.39	.72	-1.2	.82	-.2	.59	.45	22
31	65	74	-.92	.40	1.17	.7	1.59	1.1	.29	.44	31
36	65	74	-.92	.40	.97	.0	.47	1.1	.52	.44	36
7	67	74	-1.28	.44	.83	-.5	.85	.0	.50	.41	7
26	67	74	-1.28	.44	.63	-1.3	.24	1.6	.65	.41	26
39	67	74	-1.28	.44	.69	-1.0	.29	1.4	.61	.41	39
41	67	74	-1.28	.44	.91	-.2	.73	-.3	.47	.41	41
43	67	74	-1.28	.44	.75	-.8	.37	1.1	.58	.41	43
4	68	74	-1.49	.47	1.10	.4	1.57	.9	.28	.40	4
9	68	74	-1.49	.47	1.04	.2	.64	-.3	.40	.40	9
16	68	74	-1.49	.47	1.32	1.0	2.21	1.5	.16	.40	16
19	68	74	-1.49	.47	.93	-.1	.63	-.4	.44	.40	19
38	68	74	-1.49	.47	.70	-.9	.24	1.4	.60	.40	38
20	69	74	-1.73	.51	.75	-.6	.75	-.1	.49	.38	20
12	70	74	-2.02	.56	.83	-.3	.40	-.5	.45	.35	12
17	70	74	-2.02	.56	.88	-.1	.35	-.6	.45	.35	17
18	72	74	-2.87	.77	1.24	.6	1.16	.6	.15	.28	18
42	72	74	-2.87	.77	1.09	.4	.29	-.3	.31	.28	42
30	73	74	-3.67	.05	1.12	.4	.34	-.2	.20	.21	30
MEAN	53.6	74.0	0.00	0.41	0.98	0.00	1.20	0.0			
P. SD	18.1	0.0	1.89	0.16	0.20	1.20	1.57	1.5			

If the item question on the third criterion is Not fulfilled, yes, inevitably, the item question is not good enough, so it needs to be repaired. Who knows, replaced. Value uniformity item The size sample greatly influences this. As noted, mark Zstd will always be above 3 for a large sample size (N>500); therefore, the criteria are not recommended for large sample sizes. Level test results suitability item using Winstep software as shown in Table 3.

Table 4

Summary 74 People Measured

	Total Score	Count	Measure	Model S.E.	Infit		Outfit	
					MNSQ	ZSTD	MNSQ	ZSTD
Mean	31.1	43.0	1.61	0.48	0.94	-0.1	1.19	0.3
P. SD	6.8	0.0	1.27	0.07	0.28	1.1	1.58	1.4
S. SD	6.9	0.0	1.28	0.07	0.28	1.2	1.59	1.5
Max.	39.0	43.0	3.53	0.65	1.66	3.1	9.90	6.1
Min.	6.0	43.0	-2.71	0.38	0.53	-2.2	0.18	-1.3

Real RMSE 0.50 True SD 1.16 Separation 2.34 Person Reliability 0.85
Model RMSE 0.48 True SD 1.17 Separation 2.44 Person Reliability 0.86
S.E. of Person Mean = .15
Person raw score-to-measure correlation = 0.99
Cronbach Alpha (KR-20) person raw score "test" reliability = 0.89 SEM = 2.25

Table 5

Summary 43 Measured Item

	Total Score	Count	Measure	Model S.E.	Infit		Outfit	
					MNSQ	ZSTD	MNSQ	ZSTD
Mean	53.6	74.0	0.00	0.41	0.98	0.0	1.20	0.0
P. SD	18.1	0.0	1.89	0.16	0.20	1.2	1.57	1.5
S. SD	18.3	0.0	1.91	0.16	0.21	1.3	1.59	1.5
Max.	73.0	74.0	4.74	1.05	1.40	3.5	9.29	4.7
Min.	5.0	74.0	-3.67	0.27	0.63	-2.1	0.24	-2.2

Real RMSE 0.45 True SD 1.83 Separation 4.04 Person Reliability 0.94
Model RMSE 0.44 True SD 1.84 Separation 4.22 Person Reliability 0.95
S.E. of Person Mean = 0.29
Person raw score-to-measure correlation = 0.99
Item RAW SCORE-TO-MEASURE CORRELATION = -.97
Global statistics: please see Table 44.
UMEAN=.0000 USCALE=1.0000

In the Table 3, the results can be seen that Step won will appear in a way sequentially item questions that don't fit the part above. Based on the analysis of conformity test results, items in the table above show empathy for the same item. No, fulfill none. The criteria used are items 34, 40, 10, and 11. Furthermore, If at least one criterion is still met, an item can be considered for inclusion in further analysis. These four items were declared invalid because they did not meet the three-item fit criteria. This showed that the fourth item question was " No good. So that will deleted from the test instrument. So, from a total of 43 items – 4 items = 39 remaining items. This thing Still can tolerated because there is a representative item in every indicator, although there is an empathy deleted item _ from the instrument. Furthermore, test instrument knowledge ethnomathematics based Jambi culture for prospective mathematics teachers will use 39 fixed items.

Reliability test instrument

The reliability test aims for consistency instruments, but respondents did not answer (Petra & Aziz, 2020). There are two reliabilities in Rasch modeling, namely, Reliability Personality and Reliability item (Planinic et al., 2019).

Based on the Table 4 and Table 5, it can be seen that the Reliability Personality and Reliability items consecutively are 0.85 and 0.94 (in Category excellent and good once). According to Sumintono and Widhiarso (2014), values <0.5 (Poor); 0.67-0.8 (fair); 0.8-0.9 (Good); 0.91-0.94 (Very good);> 0.94 (excellent). Apart from that, based on the Table 4 and Table 5, we can see a separation value of items and people. That value is possible identification done to group items and measurement items carried out, using formula 1.

$$\boldsymbol{H} = \frac{[(\mathbf{4xseparation})+\mathbf{1}]}{\mathbf{3}} \quad (1)$$

With substitute mark separation of people (2.34) in the formula above, obtained consecutive marks are 3.45 and 5.72, which can be rounded to 3. This showed that respondents could be classified into 3 categories: ability high, medium, and low.

Table 6
The DIF class/group specification is DIF=$S3W1.

Person Classes	Summary DIF Chi-Squared	D.F	Prob.	Between-Class/Group		Item Number
				UNWTD MNSQ	T=ZSTD	
4	1.3624	3	0.7138	3.5727	2.2149	1
4	0.0414	3	0.9978	0.0252	-2.3250	2
4	3.5086	3	0.3184	2.1458	1.3370	3
4	1.0187	3	0.7965	0.6210	-0.2674	4
4	5.4798	3	0.1390	2.3333	1.4713	5
4	2.8095	3	0.4207	1.0816	0.3695	6
4	1.6150	3	0.6552	0.8919	0.1347	7
4	0.5396	3	0.9103	0.3938	-0.7090	8
4	1.0187	3	0.7965	0.6210	-0.2674	9
4	5.9564	3	0.1130	2.7985	1.7757	10
4	0.5838	3	0.9003	0.9516	0.2120	11
4	0.1366	3	0.9872	0.2120	-1.2113	12
4	0.8682	3	0.8330	0.5599	-0.3737	13
4	0.1953	3	0.9785	0.2971	-0.9504	14
4	2.8468	3	0.4146	1.0756	0.3625	15
4	0.3844	3	0.9437	0.5298	-0.4290	16
4	1.6843	3	0.6396	0.9918	0.2621	17
4	1.8531	3	0.6026	19.5586	6.4974	18
4	1.0187	3	0.7965	0.6210	-0.2674	19
4	0.3958	3	0.9413	0.6268	-0.2576	20
4	0.3144	3	0.9575	0.1195	-1.5925	21
4	0.0343	3	0.9983	0.2592	-1.0593	22
4	0.3726	3	0.9461	0.2702	-1.0267	23
4	0.7405	3	0.8637	0.5607	-0.3723	24
4	0.0846	3	0.9937	0.2677	-1.0340	25
4	0.1518	3	0.9851	0.3911	-0.7151	26
4	0.4999	3	0.9191	0.4346	-0.6190	27
4	1.0309	3	0.7935	0.5757	-0.3456	28
4	0.4916	3	0.9209	1.1370	0.4329	29
4	0.1806	3	0.9808	0.1793	-1.3300	30
4	0.1559	3	0.9845	0.3222	-0.8833	31
4	2.0495	3	0.5612	1.3058	0.6139	32
4	0.1953	3	0.9785	0.2971	-0.9504	33
4	4.7384	3	0.1910	2.0522	1.2671	34
4	3.5875	3	0.3084	2.4035	1.5197	35
4	0.9685	3	0.8087	0.7818	-0.0173	36
4	0.7081	3	0.8713	0.4831	-0.5191	37
4	1.8036	3	0.6133	1.3905	0.6989	38
4	1.1391	3	0.7673	0.7338	-0.0880	39
4	0.0064	3	0.9999	0.0628	-1.9415	40
4	1.6150	3	0.6552	0.8919	0.1347	41
4	0.7476	3	0.8620	1.9322	1.1742	42
4	0.1518	3	0.9851	0.3911	-0.7151	43

Differential item function test on instruments test ethnomatheatics

Test carried out For know potency item bias occurs instrument Developed tests _ to Category respondents confident. Categories used in testing in research This is type gender. Is there item bias? Look at the type of sex respondents. The criteria test used is mark probability < 5%, indicating bias for the instrument item (Khalaf et al., 2022; Hussein et al., 2022). Following is the DIF test output using step win.

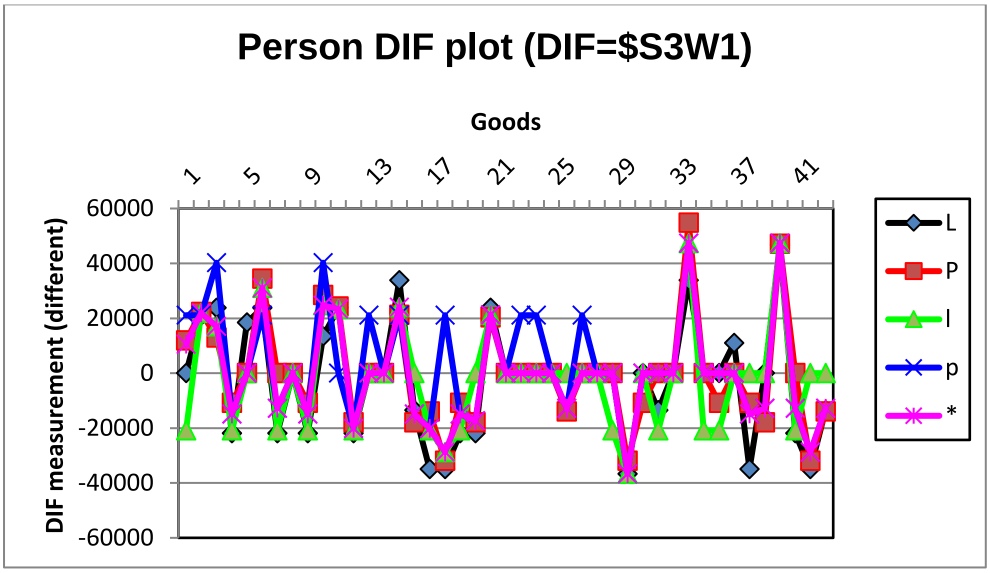

Figure 6. DIF graph for ethnomathematics test instrument items

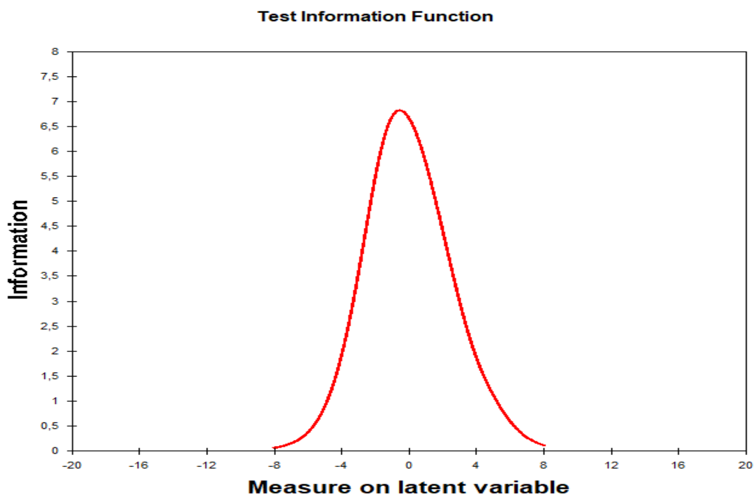

Figure 7. Information function test

Based on the Table 6, it can be seen in the Prob column that the probability value for all items is above 0.05. This means that there is no potential for item bias in all item instruments in terms of the respondent's gender.

As shown in Figure 6, Apart from using the probability values in the DIF table. DIF identification can also be checked via the Winstep external DIF graph above. From this graph, the curve graphs of male respondents (black) and female respondents (red) show curves that are close to each other (similar). It was identified that there was no potential bias in any of the test items developed.

Based on the results of the DIF test, it can be concluded that the instrument developed has no potential bias but is reviewed based on gender. So, this test can be used well to test the ethnomathematics knowledge of prospective mathematics teachers, both male and female.

Test function information

The focus of measurement information resulting from the Jambi culture-based ethnomathematics ability test on prospective mathematics teachers can be expressed in the form of a measurement information function. This information describes the relationship between the test and the individual being measured. Variations greatly influence this measurement information in the results of the measurements carried out. The following is *the Test Information Function output* from Winstep.

As we can see in Figure 7, the *x*-axis shows information on Jambi culture-based ethnomathematics abilities in prospective mathematics teachers that have been carried out.

Meanwhile, the Y-axis shows the magnitude of the information function of the measurements that have been carried out. In the Figure 7, it can be seen that this test provides optimal information when given to respondents who have a moderate level of ability. This shows that the test carried out has characteristics that are the test's purpose. It is an initial screening process to determine, in general, the average ability of Jambi Culture-based ethnomathematics knowledge in prospective mathematics teachers.

DISCUSSION

The test instrument developed to measure ethnomathematics knowledge based on Jambi culture must be of high quality. According to Mardapi (2016), Lim and Chapman (2022), and Malonisio (2023), there are two main criteria for the quality of test instruments, namely validity and reliability. The type of validity that is suitable for Jambi Culture-based ethnomathematics knowledge tests is construct validation. Construct validation is a measurement indicator of the variable you want to measure. Construct validation in this research went through several stages, namely validation by experts, which was carried out before the instrument was used for data collection; next was construct validation, which was carried out using the PCA method using Winstep. Based on the test results that have been carried out, the validity and reliability criteria for the instrument developed are already in the high Category.

Based on the results of the literature review carried out, the construct of Ethnomathematics Knowledge includes seven indicators, namely *Cultural Awareness, Ethnomathematics Content Knowledge, Pedagogical Skills, Reflective Practice, Professional Growth and Lifelong Learning, Technology Integration, and Assessment Strategies.* (Zuhri et al., 2023; Zhang et al., 2021; Moses & Cobb, 2001; Bishop, 1991; Susanti et al., 2022; D'Ambrosio, 1990; Powell, Frankenstein, & Andres, 1997). The ethnomathematics knowledge test instrument developed was based on Jambi culture. This knowledge test can be an early detection of teacher knowledge of Ethnomathematics. The next quality criterion is reliability, namely the consistency of the measurement results carried out. This is closely related to measurement error. According to Brennan (2000), a good instrument has a reliability coefficient of more than 0.70 if the instrument wishes to transmit individual test participants. However, for standard instruments, the reliability coefficient should be above 0.90. Based on the results of the reliability coefficient of the developed ethnomathematics test instrument, the coefficient value is 0.94; this shows that the instrument developed is very good. Apart from that, the results of the dimension test, DIF, level of suitability of instrument items, and test function have also shown that the information instrument developed has met the criteria for a test instrument that is suitable for use in measuring the ethnomathematics knowledge of prospective mathematics teachers.

According to Rosa et al. (2016) and Umbara et al. (2021), Ethnomathematics can contribute to overcoming several global challenges facing the education system today. Ethnomathematics is more acceptable to indigenous people and is more accessible and affordable, especially for those in remote locations. Therefore, it is in keeping with traditional practices that are more engaging than existing formal mathematics programs.

Based on the results of measurements that have been carried out, the majority of prospective teachers know a medium level. This needs to be a concern for all interested parties, such as educational institutions and prospective mathematics teachers.

Concrete action is needed to increase teachers' knowledge of Ethnomathematics. Furthermore, Rosa et al. (2016), Supriyadi et al. (2022), and Supriyadi et al. (2019) stated that there needs to be a balance between Ethnomathematics and mathematics in schools. Prospective teachers need to be equipped with comprehensive knowledge regarding the seven existing indicators. The educational curriculum for prospective mathematics teachers needs to examine this further.

CONCLUSIONS

The development of a Jambi Culture-based ethnomathematics ability test instrument has been developed using the Plomp model development, which consists of three stages, namely the Pre-research Stage, Prototyping Stage, and Assessment Stage. The Rasch model is implemented in emerging psychometric components, and the quality of the test instruments is being developed. The test instrument developed meets high quality with high validity and reliability. Apart from that, the instrument also has a very high level of item composure and test information function, and no item bias was found in the instrument developed. The Jambi Culture-based ethnomathematics instrument consists of seven indicators and thirty-nine items that are ready and suitable for use, accompanied by a scoring rubric. The researcher recommends to readers, researchers, and related parties who are measuring ethnomathematics abilities based on Jambi culture to be able to use this instrument because an evaluation has been carried out on the psychometric aspects. In addition, the researcher suggests that future researchers develop an Item Response Theory approach with a one-parameter logistic model to be used as a further psychometric evaluation tool. In this research, the instrument was developed only in the Jambi cultural context; recommendations for future researchers can also be developed in other Indonesian cultural contexts.

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