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Ethnopedagogy and Mathematics Learning Outcomes: Evidence from Ende Traditional House Miniatures

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ABSTRACT

The current research aims to develop and validate an ethnopedagogical material based on Ende traditional house miniatures to support elementary school students' mathematics achievement in Kupang, Indonesia. A research and development design was used involving experts, teachers, and students. Two experts are rating the content validity of the media; a teacher and ten students are confirming the practicality of the media. A survey instrument was used to examine the content validity and practicality of the media, and a test was used to examine students' mathematics achievement. The data analysis was carried out in JAMOVI software, involving the content validity index and descriptive analysis. Preliminary observations indicate the need to develop and implement appropriate and accessible learning media to support both teaching practices and students' mathematics achievement. The result confirms the initial content validity of the media, shown through the expert agreement that confirms the structure of the media, alignment of the media with syllabi and material, and the miniature of the media. The finding also confirms the preliminary practicality of the media through teachers' agreement on the media's attractiveness, usability, and content clarity. Other than that, the students agree on the preliminary practicality of use of the media, interest and feelings about using the media, and the effect of the media on their comprehension and ability to answer mathematics questions. Furthermore, the mean difference between the pre-test and post-test of students in using the media indicates the initial improvement of the students' scores. Therefore, this media is recommended for use in primary-level mathematics education to improve both teaching practices and student learning outcomes. However, this research did not use experimental design to test the empirical effect of the media. Hence, future research is suggested to examine the media through a more robust research design.

Keywords: elementary school students, local wisdom material, mathematical comprehension, validation study

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INTRODUCTION

Mathematics is an important aspect to be taught in early education, as it enables the development of students' executive functions that become the groundwork for complex operation abilities and reasoning skills (Wolf & McCoy, 2019; Nogues & Dorneles, 2022). Research indicates that learning mathematics sharpens students' problem-solving ability and working memory (Lin & Powell, 2021; Davis-Kean et al., 2021; Short & McLean, 2023). It is therefore stated that mathematical mastery in early education is subsequent to the mathematical achievement at the secondary and high school levels (Little et al., 2022). Furthermore, mathematics learning strengthens students' executive function, which is valuable for students' future career skills (Anthony and Ogg, 2019). In this case, executive function enables students to represent problems efficiently, plan strategies and solutions, and comprehend solution mechanisms (Drigas & Karyotaki, 2019). These skills are much more valuable in workplaces that generally require planning ability, cognitive flexibility, and inhibitory control (Gkora & Christou, 2023). Therefore, early achievement in mathematics is important to support students both in academic achievement and future job success.

However, students' mathematics ability in Kupang was found to be low, as revealed by several data points and research. The data show that the average mathematics score of Kupang students was 34.98 in 2018 and slightly increased to 38.15 in 2019, which is still below the Indonesian national minimum of 43.33 (Missa et al., 2023; Pangaribuan & Ndii, 2023; Benu et al., 2024). Furthermore, research indicates that elementary school students in Kupang failed to reach expected proficiency at their age, with their ability remaining at Level 2 (41.33%) or Level 1 (13.29%) in numeracy (Benu et al., 2024). Tong and Tobe's (2022) research also revealed that only 33.33% of elementary school students at Kupang met the minimum proficiency in numeracy standard, with the remaining 66.66% not achieving the minimum standard. This low quality reflects the overall mathematical education quality in Kupang, with teaching and learning aids remaining as the significant challenges revealed in the literature. Teachers in Kupang heavily rely on traditional teaching aids that focus on surface learning rather than deep learning, which leads to inappropriate intervention and demotivates students (Zulfikar, 2019; Tamur et al., 2022; Pangaribuan et al., 2023). A survey by Djong et al., (2021) revealed that 75% of teachers in Kupang did not use teaching aids in teaching mathematics, as they perceived that developing teaching materials was time-consuming and complicated. As teaching aids are an important aspect for effective and deep learning, it can be stated that the unavailability of learning aids handicaps students' abilities in mathematics (Simamora et al., 2026). Therefore, it is important to provide valid and reliable media to be appropriately used in mathematics learning.

Responding to this problem, the researchers propose the use of ethnopedagogy materials to support mathematics teaching in Kupang's elementary school education. Ethnopedagogy is defined as the learning process that utilizes cultural aspects of customs, languages, and everyday life of local communities (Sándor, 2019). The possibility of this type of material to empower students' critical thinking lies in its ability to enhance engagement and provide relevancy in learning mathematics (Subekhi et al., 2022). Mathematics is presented as an abstract concept where it creates cognitive distance so that the students do not clearly see the link between formal procedures and real-world phenomena (Fouze & Amit, 2023). Ethnopedagogy can help to make it clearer and relevant by providing mathematical concepts in local practices, artifacts, and community routines that the students are familiar with (Nepal & Shrestha, 2023). Subekhi et al.'s (2022) research shows that students with ethnopedagogical material gain greater understanding of conceptual material compared to the comparison group. Studies on ethnopedagogy mathematics also show that incorporating local cultural elements into thematic or problem-based practice improves conceptual comprehension (Hendriyanto et al., 2023).

The ethnopedagogy material that can be used is Ende traditional house miniatures. This material might be significant in mathematics learning, mainly in geometry material, as it visualizes the abstract material of mathematics. For example, the roof of the house is miniature, similar to the concept of a cone or triangular prism; the walls are similar to rectangles or squares; and the foundation is similar to a rectangular prism. When students see and touch the miniatures,

it enables them to do practice-based learning rather than imagining the concept. It directly provides a mathematics learning activity of measuring the length, width, and height of the house and comparing sizes or estimating the perimeter, area, and volume, which are parts of geometry material.

Existing research has investigated ethnomathematy in a variety of cultural contexts, including Bima, Madura, and Yogyakarta, by combining local features such as weaving patterns, traditional games, and architecture into geometry learning (Anwar et al., 2024; Andang & Hadi, 2025; Nadia et al., 2025). However, there is no evidence of similar research focusing on the unique cultural heritage of NTT, such as its traditional houses or other local artifacts, to support elementary school mathematics education. Furthermore, most studies emphasize secondary education or general applications of ethnomathematics (Richardo et al., 2023; Sunzuma & Umbara, 2025). While some research targets elementary school students, it often focuses on digital or multimedia tools rather than traditional, tangible learning materials (Prasetyo & Hidayati, 2026; Pramesti & Novitasari, 2026). There is a lack of research on how traditional house-based media can be specifically designed to enhance elementary students' understanding of geometry in NTT. Even Madu (2024) link the use of traditional houses to mathematical concepts; this research was only elaborative and did not detail the actual creation and systematic testing of physical miniatures as the primary teaching aid in a classroom setting. Therefore, the current research aims to examine the use of ethnopedagogy material of the Ende traditional house to support the students' mathematics learning.

METHODS

Ende Traditional House Media

The current research examines the use of Ende traditional house media to be used in elementary school mathematics teaching. The details of the media are shown in Figure 1. The media were used in geometry learning with the specific learning objective to recognize the squares, rectangles, triangles, and trapezoids and to determine the perimeter and area of plane shapes such as squares, rectangles, triangles, and trapezoids. In the learning process, the students are given descriptions of the learning media as well as hands-on activities such as assembling and disassembling the media. Throughout the learning process, teachers explain the general concept of geometry as well as trigger students to observe and find geometry patterns in the media. At the end of the learning process, students should fill out a worksheet containing questions that critically examine the geometry concept in the media.

Figure 1. Ende Traditional House Media

Media development

The media were developed based on the 4D model (Define, Design, Develop, and Disseminate) as displayed in Figure 2. In the define stage, the researchers conducted several analyses, namely, (1) initial analysis is used to analyze curriculum alignment with basic competencies and existing syllabi at SDK Sta. Maria Assumpta; (2) student analysis is used to examine students' characteristics such as ability level, background, prior knowledge, and cognitive development; (3) task analysis is used to identify the key learning tasks students must master, particularly evaluation tasks aligned with lesson objectives; (4) concept analysis is used to identify, organize, and structure relevant geometry concepts (especially plane shapes); and (5) specification of

learning objectives is conducted by translating curriculum competencies into measurable behavioral indicators. In the design stage, the researchers developed assessment instruments (tests to measure students' achievement), selected the Ende traditional house miniature as a culturally relevant learning medium, determined the appropriate format aligned with the curriculum and student needs, and created an initial prototype (draft 1). In the develop stage, the prototype underwent expert validation by both material and media experts to ensure content accuracy and design quality, followed by revisions producing draft II; this was then tested through a limited field trial with students to evaluate its effectiveness, particularly in improving learning outcomes, leading to further refinement of the product. Finally, in the dissemination stage, the finalized media were distributed on a limited scale to 10 students at SDK Sta. Maria Assumpta in Kupang is aiming to introduce and promote the use of culturally based geometry learning media in classroom practice.

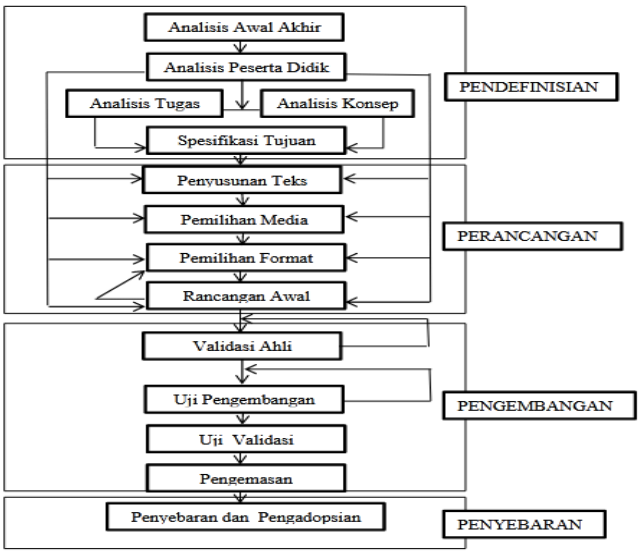

Figure 2. Media development design

Specific revision was given by experts during the development stages. As shown in Table 1, experts comment on parts of the Ende House miniature. He suggested adding thatch to the roof part of the miniatures. Researcher, then add the thatch to the roof of the miniature and ensure it characterizes the NTT culture.

Table 1 Media revision

Aspect revised	Before revision	After revision
Parts of the Ende Traditional House Miniature	Add thatch (alang-alang grass) to the roof to strengthen the local aspect of the media.	Thatch was added to the roof, and it has been ensured that the alang-alang is characteristic of NTT.

Participants

This study was designed as a pilot study to explore the initial potential of the developed learning media in a real classroom context. The participants consisted of 10 fourth-grade students from a single elementary school in Kupang, Indonesia. The participants were selected using a purposive sampling technique, with the following considerations: (1) students were enrolled in the class where the intervention was implemented, (2) they had relatively similar academic backgrounds, and (3) they had not previously been exposed to the developed media.

The use of purposive sampling in this pilot study was intended to ensure that the selected participants were relevant to the objectives of the study, particularly in examining the feasibility and initial effectiveness of the intervention in a controlled classroom setting. Accordingly, the

findings of this study should be interpreted within the specific context of the participants involved and are intended to provide preliminary insights into the implementation of the intervention, which may inform future studies with broader and more diverse samples.

Instrument

There are two types of instruments in this research, namely, survey and test. The test for students' mathematics achievement was in the form of essay questions. The test measures students' ability to identify plane shapes found in the media, students' ability to explain the meaning of the plane shape depicted through the media, students' ability to match pictures with the correct shape name, students' ability to describe properties of the plane based on the media, and students' ability to identify shapes based on their characteristics. Detailed information on the sample items is depicted in Table 2.

Table 2. Test item and indicators

No.	Indicator	Sample Item	Cognitive Level
1	Identifying plane shapes found in the Ende traditional house miniature	From the pictures above, what information can you get from the Ende traditional house miniature?	C2
2	Explaining the meaning of plane shapes	Explain the meaning of a square, rectangle, trapezoid, and triangle.	C2
3	Matching pictures with the correct shape names	Match the following shapes with their correct names: rectangle, triangle, trapezoid, and square.	C2
4	Describing the properties of plane shapes	Explain the properties of a square, rectangle, triangle, and trapezoid.	C2
5	Identifying shapes based on their characteristics	Which plane shape has four sides, two pairs of equal parallel sides, and four right angles?	C3

A survey questionnaire was used to obtain expert judgments regarding media, syllabus, teaching module, and material. To examine the media, experts consider the content feasibility, media design, safety, ease of use, and attractiveness. To examine the syllabus alignment with the media, experts consider the syllabus's relevancy to learning outcomes, suitability of materials, learning activities, language, and time allocation. To examine the teaching module, experts consider the module format, language clarity, content suitability, learning steps, and time allocation. To examine the material, experts consider the material's suitability with competencies, concept accuracy, learning support, attractiveness, and material updates. Detailed indicators with the sample items are displayed in Table 3.

Table 3. Expert survey instrument.

Instrument	Indicators	Sample Items	Measurement Scale
Media Validation	Content feasibility, media design, safety, ease of use, attractiveness	"The Ende traditional house miniature is appropriate for mathematics learning and attracts students' attention."	1 = Invalid / Not Good, 2 = Less Valid / Less Good, 3 = Valid / Good, 4 = Very Valid / Very Good
Syllabus Validation	Relevance to learning outcomes, suitability of materials, learning activities, language, time allocation	"The syllabus is aligned with Learning Outcomes (CP), ACP, and students' needs."	1 = Invalid, 2 = Less Valid, 3 = Valid, 4 = Very Valid

Instrument	Indicators	Sample Items	Measurement Scale
Teaching Module Validation	Module format, language clarity, content suitability, learning steps, time allocation	"The teaching module uses clear language and appropriate learning steps."	1 = Not Good, 2 = Less Good, 3 = Good, 4 = Very Good
Material Validation	Suitability with competencies, concept accuracy, learning support, attractiveness, material update	"The material presented is accurate, interesting, and supports students' understanding."	1 = Invalid, 2 = Less Valid, 3 = Valid, 4 = Very Valid

Furthermore, the detail of survey items to measure media practicality by teachers and students is shown in Table 4. The indicators for teachers to measure the practicality of the media are ease of use, clarity of instructions, effectiveness in teaching, student engagement, and suitability for classroom learning. The indicators for students to measure the practicality aspect of the media are ease of use, attractiveness, understanding of material, learning motivation, and learning experience.

Table 4. Practicality test instrument

Respondent	Indicators	Sample Items	Measurement Scale
Teacher	Ease of use, clarity of instructions, effectiveness in teaching, student engagement, suitability for classroom learning	"The Ende traditional house miniature media is easy to use and helps teachers explain plane shape concepts effectively."	1 = Strongly Disagree, 2 = Disagree, 3 = Agree, 4 = Strongly Agree
Students	Ease of use, attractiveness, understanding of material, learning motivation, learning experience	"The Ende traditional house miniature media is interesting and helps me understand plane shapes more easily."	1 = Strongly Disagree, 2 = Disagree, 3 = Agree, 4 = Strongly Agree

Data analysis

The data analysis was carried out in JAMOVI software. The validity of the media is examined through the mean score of the experts and the content validity index (CVI). CVI is used to assess how well the components of the learning media represent the intended learning objectives, based on expert evaluation. It helps ensure that each element of the media is relevant, clear, and effective for supporting student learning before implementation. In this case, a CVI ≥ 0.78 is needed to argue the acceptance of the content validity of the media, while a CVI < 0.78 value is an indication for revision or rejection of the content validity of the media (Takom et al., 2025).

Furthermore, descriptive analysis revealing the mean was used to calculate experts' agreement on the content of the media and teachers' and students' agreement on the practicality of the media. The standard of agreement on the mean value can be seen in Table 5.

Table 5. Standard of interpretation

Mean value	Interpretation	
	Content validity	Practicality interpretation
$3.26 < \bar{x} \leq 4.00$	Very Valid	Very Practical
$2.51 < \bar{x} \leq 3.26$	Valid	Practical
$1.76 < \bar{x} \leq 2.51$	Less Valid	Less Practical
$1.00 < \bar{x} \leq 1.76$	Not Valid	Not Practical

In this research, the standard of agreement for the developed media is categorized into four levels to provide an objective assessment of both content validity and practicality. Mean values between 3.26 and 4.00 indicate that the media is very valid and very practical, reflecting strong agreement among experts or users that the media meets content and usability standards. Values between 2.51 and 3.26 indicate that the media is valid and practical, generally acceptable with minor improvements needed. Mean values between 1.76 and 2.51 suggest the media is less valid and less practical, requiring significant enhancement, while values between 1.00 and 1.76 indicate the media is not valid and not practical, meaning it does not meet the required standards and needs major revisions. This standard ensures consistent, clear, and objective interpretation of the learning media's quality and usability.

RESULT AND DISCUSSION

Result

Preliminary observation

A preliminary observation was conducted to examine the availability and the mathematical learning process to support the students' mathematical development in the study location. In this case, the researcher directly came to school and observed the learning process based on eight observation indicators as displayed in Table 6. On the observation, the researcher ticks the availability or non-availability of the indicator. The result can be seen in Table 6.

Table 6. Preliminary observation

No	Observed Aspect	Yes	No	Notes
1	Media placed in the classroom for learning		✓	Media placed in the cupboard, not in the classroom
2	Media is suitable for use in learning		✓	The classroom does not have appropriate learning media
3	The teacher uses media to explain math material		✓	The teacher uses the guidebook only as a reference
4	The teacher knows how to use the learning media		✓	The teacher does not use the learning media
5	The teacher explains how to use learning media to students		✓	The teacher does not explain how to use the media
6	Students can use the learning media independently		✓	Students only use the guidebook as a reference
7	Students experience difficulty during math learning	✓		Students write slowly and cannot answer questions quickly
8	Students experience difficulty solving math problems	✓		Students work quickly but make many mistakes

Based on the preliminary observation, it was found that the learning media in the classroom was largely unavailable or improperly placed, with most materials stored in cupboards rather than being accessible to students. While some media were deemed suitable for use, teachers did not actively use them to explain mathematical concepts, nor did they demonstrate how to utilize the media to students. As a result, students relied primarily on guidebooks and faced difficulties in following lessons and completing mathematics tasks, often working quickly but making frequent errors. These findings indicate a clear need to develop and implement appropriate, accessible learning media to support both teaching practices and students' mathematical achievement.

Media Validation

The current research tests the effectiveness of Ende Traditional House Miniatures as a learning medium to cultivate students' mathematical learning outcomes. Firstly, the media were validated through several procedures in order to make sure of the appropriateness and alignment of the media with the students, the curriculum, and the students' learning outcomes. There were two procedures carried out, namely content validity through experts' ratings and usability evaluation

through teachers' and students' ratings. In expert validity, the experts were asked to rate the media in the aspects of structure of the media, syllabi, content, and miniature of Ende traditional houses. The result of expert ratings can be seen in Table 7 and Figure 3.

Table 7. Content validity

No	Aspect measured	V_I	V_{II}	Mean	Criteria
1	Structure of the media	4	4	4	Very Valid
2	Syllabi	3.93	4	3.97	Very Valid
3	Material	4	4	4	Very Valid
4	Miniature	3.80	3.80	3.80	Very Valid

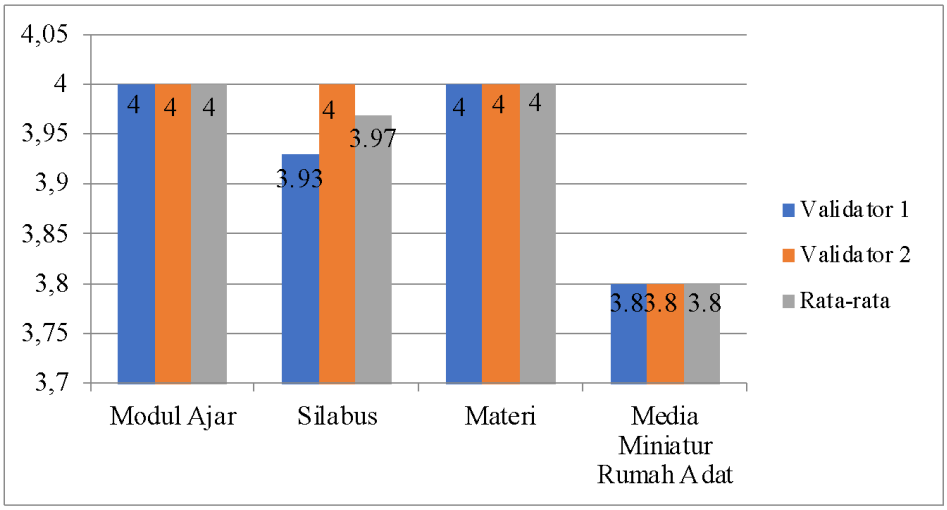

Figure 3. Content validity

Table 7 and Figure 3 show the result of expert rating as the result of the content validity of the media. It was revealed that the experts were in agreement on the structure of the media, syllabi, and material as well as the miniature as the medium to cultivate students' mathematical learning outcomes. The structure of the media was 4.00, the syllabi were 3.97, the material was 4.00, and the miniature was 3.80. All the means in each category are nearly at a maximum value of 5, indicating the acceptance of the expert on the aspect measured. Therefore, it can be stated that the experts agree on the content validity of the media. Furthermore, the experts' agreement was tested through the content validity index (CVI) that is displayed in Table 8.

Table 8. Content validity index

Item	Description	I-CVI	Std	Decision
exp1	Item 1 description	1	0.00	Very Valid
exp2	Item 2 description	1	0.00	Very Valid
S-CVI/Ave	Scale Average	1	0.00	Excellent

The results of the content validity analysis indicate that all items achieved an Item-Level Content Validity Index (I-CVI) of 1.00. This means that all experts rated each item as relevant (scores ≥ 3), reflecting complete agreement among the validators. In addition, the standard deviation of 0.00 suggests that there was no variation in the experts' judgements, further confirming the consistency of their evaluations. Furthermore, the Scale-Level Content Validity Index using the average method (S-CVI/Ave) was also 1.00, indicating that the overall media

possess excellent content validity. These findings demonstrate that the developed media are highly appropriate and relevant for measuring the intended construct.

The validated media were then tested in the real pedagogical practice in the classroom, which was then rated by the users, namely the teachers and the students. The teachers were asked to rate the media on eight indicators as depicted in Table 9.

Table 9. Teachers' practicality rating

NO	ITEMS	MEANS
1	The learning media has an attractive appearance that engages students in learning.	4.00
2	The learning media's appearance can enhance students' learning motivation.	4.00
3	The learning media is easy to operate.	4.00
4	Using the learning media is more cost-efficient in conducting learning activities.	4.00
5	Appropriate selection of image size	4.00
6	Clarity of images	4.00
7	The completeness of the labels on the parts of the traditional house miniature is in accordance with the material.	3.00
8	Suitability of the procedural steps of the activities	4.00

Based on the result of the practicality test, the teachers were in agreement that the learning media is attractive to engage students in learning (mean=4.00), the appearance of the media can enhance students' motivation (mean=4.00), the learning media is easy to use (mean=4.00), it is cost-efficient (mean=4.00), the selected image of the media is appropriate (mean=4.00), the clarity of the media's image is good (mean=4.00), the labels are appropriate to the material (mean=3.00), and the procedural steps of the media are suitable (mean=4.00). Overall the teachers agreed with the content and practical guidance of the media. Furthermore, to emphasize the media suitability in practice, the students were asked to rate the media after the learning with the media was carried out. The result can be seen in Table 10.

Table 10. Students' practicality rating

NO	ITEMS	MEANS
1	I can effectively utilize the Ende traditional house model as a learning medium.	4.00
2	I can understand the learning material through the use of the Ende traditional house model as instructional media.	4.00
3	I am interested in learning mathematics because I like the design of the Ende traditional house miniature learning media.	4.00
4	I can identify plane shapes by using the Ende traditional house miniature learning media.	4.00
5	I do not find it difficult to move the Ende traditional house miniature learning media.	3.90
6	I feel happy when using the Ende traditional house miniature learning media.	4.00
7	I can find the correct answers to math questions when using the Ende traditional house miniature learning media.	3.90
8	In my opinion, the Ende traditional house miniature learning media can be made by teachers or others.	4.00

Table 10 shows the result of students' ratings on the practicality of the media. The result shows overall acceptance of the students on the media. For example, the students stated they are able to effectively use the media (Mean=4.00); the students can understand learning material through the media (Mean=4.00); the students are interested in mathematical material as the result of the media design (Mean=4.00); students can identify plane shapes through the media (Mean=4.00); students do not find difficulties in using the media (Mean=3.90); the students feel happy when using the media (Mean=4.00); the students feel that they can answer mathematical questions correctly when using the media (Mean=3.90); and the students think that it can be made by other teachers (Mean=4.00). Therefore, the students think that the media are practically appropriate and can help them in learning mathematics.

Media effectiveness

The media effectiveness was examined through the comparison of the pre-test and post-test means of students' mathematics achievement tests. The result can be seen in Table 11.

Table 11. Mean difference

Group	N	Mean	Median	SD	SE
pre-test	10	64.2	65.0	15.6	4.93
posttest	9	77.0	75.0	10.6	3.53

Based on the result, there is an improvement in students' mathematics learning outcomes. The mean score increased from 64.2 in the pre-test to 77.0 in the post-test. Similarly, the median rose from 65.0 to 75.0. Additionally, the standard deviation decreased from 15.6 to 10.6, suggesting that students' performance became more consistent after the use of the media.

Discussion

The current research confirms the validity and effectiveness of the ethnopedagogical material of Ende Traditional House Miniatures on primary school students' mathematical achievement. Content validity through experts' judgment and practicality tests through teachers' and students' ratings confirm the validity and suitability of the media to be effectively used in mathematics teaching at the primary level. Expert judgment is common practice and significant to examine developed media, as it may focus on examining the integrity of the content in the media, the design of the instruction, and the quality of the media (Suryawati et al., 2024). Therefore, when the content validity is strong, the media possess alignment with the curricula and the targeted users (Zainuddin et al., 2024). The current research confirms the content validity of the media through the appropriate CVI result. Specifically, experts agreed on certain aspects of the media, such as the structure of the media, syllabi used along with the media implementation, the material, and the miniature of the media. It confirms the alignment and content faithfulness in reflecting the intended competencies and core concept that are essential for construct validity and curriculum coherence (Badarudin et al., 2023). Therefore, based on the experts' judgment, the content of currently developed media is confirmed.

The practicality test emphasizes the alignment and appropriateness of the media for the targeted users, as the media's practicality was confirmed with the teachers' and students' ratings. Testing the practicality is important, as the value of the content validity is contingent on the practicality test (Amran, 2023). The practicality test emphasizes the content alignment with the users. Therefore, it supports the adoption decision and smooths the implementation. When the practicality test gains high value, it indicates that the developed media is relevant to be used by the users (Mulyani et al., 2024). In the current research, the teachers agree on certain aspects of the media, such as the attractiveness of the media, usability, and content clarity of the media. These aspects are significant. For example, attractiveness of the media captures students' attention, reduces initial resistance to use, and stimulates curiosity that facilitates deeper focus and engagement (Hu et al., 2025). In terms of usability, it determines how users can navigate, access, and interact with the media without limited barriers. In this case, high usability decreases cognitive strain associated with interface issues, allowing learners to focus on learning tasks rather than overcoming obstacles (Morato et al., 2023). Other than by teachers, the media was also rated by the students. The result indicates the students' agreement on certain aspects of the media, such as their ability to practically use the media, convenience in understanding the material through the media, students' interest and feelings about using the media, and the effect of the media on their comprehension and ability to answer mathematical questions as the result of the media. It confirms the coherence and effectiveness of the media for students.

The significance of this research is that it provides a valid and reliable media-based Kupang ethnopedagogy material for elementary school students' mathematical achievement. It is significant, as the media may help students to link the abstract mathematical concept of mathematics to a more concrete representation (Etcuban et al., 2019). Research indicates that

teaching aids that strengthen students' conceptual understanding and retention are significant to improving mathematical achievement (Okafor et al., 2023). The current developed and validated media is Ende Traditional House Miniatures. This media provides visual representation for students that allows students to do hands-on activities to observe the geometrical form, measurement, ratio, and proportion. It directly links the learning from abstract concepts of mathematics to visual representations, which may empower students' engagement, motivation, and agency in learning. Etcuban et al. (2019) stated that media richness may promote curiosity, collaboration, and exploration, all of which are associated with higher motivation and longer task engagement. Mandala & Sukartono (2023) emphasize that when media is employed with constructivist methodologies, students show increased mathematical thinking and problem-solving tendencies. It is the reason for the availability of the media to support the Kupang primary school students' mathematical achievement.

Furthermore, the significance of this media is an effort to empower students' mathematical achievement in Kupang, as Kupang students are known to have less ability in this material. Primary school students in Kupang were found to struggle with foundational mathematical skills such as number sense and place value (Jempol, 2017). Contributing variables typically noted in the research include restricted availability to effective instructional materials, inconsistent teacher preparation in mathematics pedagogy, and limits in classroom resources that impede regular, high-quality practice with basic ideas (Manu et al., 2020; Anam et al., 2023; Uslan et al., 2024). Given the condition, well-designed media can serve as cognitive scaffolding that transforms abstract mathematical ideas into physical, tangible representations. This strengthens conceptual understanding and retention for various students. The media will be more efficient when it adopts the local values as its culturally relevant ones that can provide more equitable access to the mathematical curriculum in Kupang classrooms (Jonathans, 2018). When integrated with learner-centered pedagogies, such media fosters differentiation, motivation, and inquiry-based reasoning, which aligns with Merdeka Curriculum ideals that advocate real, context-rich learning experiences (Oktaviah et al., 2023). Therefore, the current developed media is significant to contribute to the educational landscape in Kupang.

CONCLUSION

The current research validates the Ende Traditional House miniatures-based learning media. Preliminary observations highlighted the necessity for accessible and appropriate learning media. Expert evaluations confirmed the media's initial content validity, while teachers and students confirmed its preliminary practicality, including usability, clarity, attractiveness, and engagement. The findings conclude that the media demonstrates initial content validity and preliminary practicality, and there are indications of students' mathematics score improvement. It demonstrates the media's effectiveness in enhancing students' mathematical comprehension and problem-solving abilities. Therefore, this media is recommended for use in primary-level mathematics education to improve both teaching practices and student learning outcomes. However, its effectiveness needs to be further tested through more rigorous experimental designs to examine the empirical evidence of the media on students' mathematics improvement.

CONFLICTS OF INTEREST

The authors declare that there is no conflict of interest.

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