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Contextualizing Geometry Learning for Elementary Students Through Ethnomathematics-Based Electronic Novels: A Developmental Research

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Abstract

Mathematics learning outcomes in elementary schools remain suboptimal, partly due to the lack of contextualized learning. There are not many alternative learning media options available for teachers to facilitate contextual mathematics learning. Therefore, this study aims to design and develop an e-novel for elementary school geometry. This research is a research and development, with the 4D development model. This research was conducted at SDN 038 Kanusuang, SDN 034 Rappang, and SDN 019 Sila-Sila, Poliwali Mandar Regency, West Sulawesi, Indonesia. The research subjects included two validators (media experts and material experts), three class teachers, and all fifth-grade students from three schools. After going through the 4D stage, an e-novel development product was produced. The characteristics of e-novel product possesses are a story-based digital media, containing narratives, dialogues, illustrations, and learning activities that connect mathematical concepts with the local Mandar cultural context. Based on the results of the validity test conducted by media experts and material experts, as well as the practicality test conducted by teachers and students, the product was deemed highly valid (average score 90%) and categorized as very practical (average score 95,47%). Thus, the developed ethnomathematics-based e-novel are valid dan practical for use as a learning medium for geometry in fifth-grade elementary schools. Although there are still weaknesses, it has not yet reached the stage of testing its effectiveness on the process and results of student learning achievement.

Keywords: Contextual learning; Ethnomathematic; E-novel; Geometry learning; Mandar cultural

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INTRODUCTION

Mathematics is a field of science that plays an important role in elementary schools. When learning mathematics, students are expected to be able to translate real-world problems into mathematical terms. Through mathematics learning, each student is expected to develop the ability to solve problems logically, critically, and rationally, as well as to communicate solutions clearly and effectively. Chasanah (2021) explains that there are three stages in the mathematization process: converting real-world problems into mathematical problems, applying mathematical concepts and skills to solve mathematical problems, and evaluating and validating the process and results.

However, the reality in the practice of mathematics learning in elementary school classes is that learning still cannot facilitate the three stages in the mathematization process. For example, teaching materials do not provide examples of applications, phenomena, or contextual questions related to students' daily lives. Learning is still textbook-oriented, both in terms of process and content. For example, textbook applications, phenomena, or questions are not necessarily the same as those encountered by students in their daily lives. Furthermore, the use of technology is still low, so it does not help teachers facilitate activities, processes, or the presentation of teaching materials. Typically, mathematics learning activities convey material concepts and require memorization of mathematical formulas without relating them to students'

daily experiences. Khasanah &Rigianti (2023) stated that learning activities that are monotonous, less interesting, or not relevant to everyday life can affect students' interest in the material being taught, as well as the quality of their learning. Learning activities like this can result in students having difficulty understanding the subject matter and problems related to daily life and their previous experiences. However, the NCTM (National Council of Teachers of Mathematics) has emphasized that learning mathematics should be through a deep understanding, where students actively construct new knowledge based on their experiences and prior knowledge (Alfatihah et al., 2022). Furthermore, Van Den Heuvel (Maskar, 2018) stated that mathematics must be related to reality, close to children, and relevant to the values in society. This emphasizes that mathematics is not only a teaching material. However, mathematics is part of the social activities found in everyday life.

Based on a literature review, an alternative solution to address the challenges of uncontextual mathematics learning is to bridge them with context-based learning media. This is because learning media are systematically designed as a source of information to facilitate a supportive learning situation, where students can learn effectively and successfully (Atapukang, 2016). Learning media can convey material that is difficult for teachers to explain with specific words or numbers, and can also concretize abstract concepts (Zainal et al., 2024). Learning media can also help students better understand key concepts, retain information for longer periods, and develop the necessary skills. Meanwhile, context-based learning emphasizes linking acquired knowledge to its application in everyday life, enabling students to understand and relate the material they learn to real-world situations (their environment) (Mauladaniyati & Kurniawan, 2018; Yudha et al., 2019). Media that is relevant to the actual context will help achieve learning objectives while encouraging students to provide feedback and actively apply their knowledge in real-life (Rosyida et al., 2018; Sasmita et al., 2021).

One approach to mathematics learning that serves as a basis for developing contextual learning media is ethnomathematics. Ethnomathematics is a learning study that connects mathematical concepts with local culture. Ethnomathematics acts as a bridge between students' real-life experiences and abstract mathematical concepts, further making learning more contextual, relevant, and meaningful (Wulandari et al., 2024). Through the application of ethnomathematics-based learning media, teachers can provide learning experiences that are contextual to the local social and cultural lives of students, thereby deepening their understanding and fostering their appreciation of mathematics subjects. (Zainovi et al., 2025). Furthermore, ethnomathematics can also foster a love of culture and serve as an effort to preserve local wisdom values (Sutarto et al., 2021). Furthermore, Sarwoedi et al. (2018) argue that the use of ethnomathematics in the classroom can enhance students' ability to master mathematics, as they are confronted with problems or issues related to their everyday culture during the learning process.

Several studies have been conducted on the topic of contextual learning media previously. The use of CTL-based comics has been shown to influence students' learning outcomes (Khaidir et al., 2022; Lestari et al., 2021; Nurdin et al., 2020; Rosyida et al., 2018). In other research, Fatkurochman et al. (2024) developed context-based mathematics learning modules to improve students' mathematical literacy skills. Trimurtini et al. (2020) developed a CTL approach using geoboard media, which is sufficient for application in mathematics learning for fourth-grade students in public elementary schools. Research by Rahmadhani et al. (2022) demonstrates that the interactive mathematics e-module, based on Lampung cultural ethnomathematics, utilizing flat-sided solid shapes, can enhance the quality of learning and facilitate students' understanding of concepts interactively, while also introducing local Lampung cultural values.

Based on previous research studies, a research gap exists in the lack of context-based learning media available to facilitate mathematics learning, particularly geometry materials in the form of electronic novels, especially those that incorporate the Mandar cultural context. Specifically, the integration is based on real examples and phenomena related to geometry that

exist in the daily lives of students with a Mandar ethnic background, various learning activities (reading cultural illustrations, recognizing and identifying types of geometry in something characteristic of Mandar culture, identifying types of geometry through stories and character dialogues), and learning experiences utilizing digital assessments. For this reason, a development research is needed that can produce products to complement the literature on mathematics learning in elementary schools. E-novels, developed as a product, have the advantage of stimulating readers' imaginations because they rely on textual narrative, allowing readers to construct their own visualizations of the scenes, characters, and settings. Furthermore, e-novels enable deeper story and character development, offering a more complex presentation of emotions and narrative flow than visual media such as comics or informative modules. Furthermore, e-novels are practical because they are easily accessible on digital devices, more cost-effective, environmentally friendly, and offer a more focused and intimate reading experience.

Practically, the development product will complement the alternative learning media for elementary school teachers in teaching geometry material. Therefore, this study aims to answer the following research questions: (1) How is the design and development process of ethnomathematics-based e-novel learning media for geometry material in elementary schools? (2) What are the characteristics of ethnomathematics-based e-novel learning media for geometry material in elementary schools? (3) What is the validity and practicality of the development product of ethnomathematics-based e-novel media for geometry material in elementary schools?

METHOD

This type of research is Research and Development, which aims to produce a product and test its validity. The product developed is an e-novel learning media based on ethnomathematics for geometry materials in the fifth-grade elementary school. The development process applies the 4D Model (Reigeluth & An, 2020; Thiagarajan, 1974). However, this research only covers three stages, namely, Define, Design, and Development. Meanwhile, dissemination is not carried out directly to users on a large scale through an event; in this research, dissemination is limited to seminars on research results for teacher education students and to publications in scientific journals.

Table 1. Respondents Involved in the Needs analysis and Practicality Test

School	Students		Teachers		Total
	Male	Female	Male	Female	
SDN 038 Kanusuang	8	7	1		16
SDN 034 Rappang	9	9	0	1	18
SDN 019 Sila-Sila	8	8	0	1	17

This research was conducted at elementary schools in Polewali Mandar Regency, West Sulawesi, namely SDN 038 Kanusuang, SDN 034 Rappang, and SDN 019 Sila-Sila. The selection of research locations was based on the results of a previous survey, as the schools where the observations were conducted still rarely implemented culture-based learning (ethnomathematics). On the other hand, the use of technology in learning was still not optimally implemented due to limited access. This study employs four primary research instruments: observation sheets, interview guidelines, test sheets, and questionnaire sheets.

The indicators for the Media Aspect validation test are: cover design; selection of font type and size; layout; use and quality of images; ease of use; and availability of a user manual. Meanwhile, the indicators for the Material Aspect validation test are: availability of material identity; suitability with the curriculum; Compliance with the breadth and depth of learning materialsconcept; The suitability of the story to the learning material; suitability of Etnomathematica elements; suitability of learning activities; usefulness for mastering the material; suitability with good, correct language; ease of learning; and facilitation of curiosity. Finally, the indicators for the practicality test are: ease of use; layout; flow of use; ease of

learning Etnomathematica elements; availability of relevant illustrations; suitability with student characteristics; Interesting storyline for elementary school student; Interesting story characters and conversation; Challenging activities and learning experiences; ease of access; availability of learning experiences; and usefulness for students to learn the material.

The data analysis technique employed in this study involved a step-by-step and balanced approach, utilizing both qualitative and quantitative data. The qualitative analysis was conducted based on information gathered from the suggestions and comments of the expert validator team, as well as teachers and students. The quantitative analysis used numerical data or scores obtained from validity and practicality tests. The assessment scale ranges from 1 to 4 (1: Very Poor, 2: Poor, 3: Good, 4: Very Good). Meanwhile, specifically for students, the answers are only Yes (Score 1) and No (Score 0). The scores obtained are totaled, divided by the Maximum Score, and multiplied by 100%. To determine the feasibility/validity of the product being developed, the scores obtained from the assessment instrument will be categorized according to the criteria outlined in Table 1. To assess the practicality of the product, it will be categorized according to the criteria in Table 2.

Table 2. Product Eligibility/Validity Criteria

Total Score	Category
75,01% - 100,00%	Highly valid
50,01% - 75,00%	Valid
25,01% - 50,00%	Invalid
< 25,00%	Very Invalid

Table 3. Product Practicality Criteria

Total Score	Category
$\rho > 80$	Very Practical
$60 < \rho < 80$	Practical
$40 < \rho \leq 60$	Fairly Practical
$20 < \rho \leq 40$	Inpractical
$\rho \leq 20$	Very Inpractical

RESULTS

Define

The define stage aims to determine and clarify product development needs. The analysis of the results of the define stage can be seen in the Figure 1.

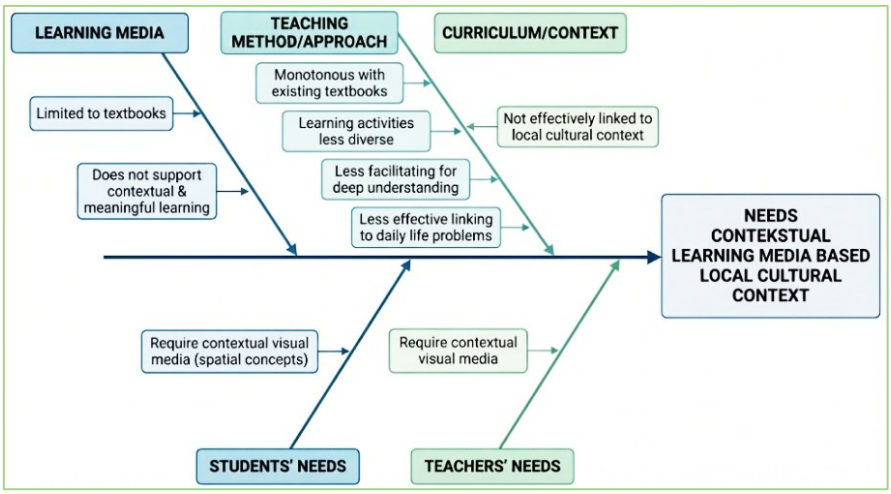

Figure 1. Results of the define stage

Based on the results of observations of mathematics learning and interviews with class teachers and students, geometry learning remains abstract. It has not been effectively linked to

the local cultural context. The learning media used are also still limited to textbooks, which do not support contextual and meaningful learning. This becomes an obstacle to optimizing students' mathematical learning abilities and outcomes. Being always monotonous with existing textbooks also makes learning activities less diverse, less facilitating for students to deepen their understanding of the material, and less effective in linking the material to students' daily life problems. Based on this analysis, both teachers and students require contextual visual media on the topic of spatial concepts, which includes cubes, cuboids, cylinders, cones, and pyramids.

Design and Development Process of E-Novel

The design process consists of four stages, namely, (1) preparation of test standards, namely the activity of designing an instrument in the form of an interactive quiz consisting of 10 questions to assess the level of students' understanding of the material on geometric shapes; (2) media selection, this activity must be based on the needs of students, material characteristics, and learning objectives; (3) format selection, this aims to ensure that the media can be presented systematically and attractively; and (4) initial design, including the creation of an e-novel framework before entering the whole development stage. This activity involves compiling an outline of the story content, chapter division, character determination, illustration sketches, and the placement of mathematical material within the context of Mandar culture.

Furthermore, the development process consists of three stages, namely (1) e-novel design, this activity begins with the preparation of a storyboard containing the storyline, characters, and cultural objects combined with spatial structures; (2) product assessment instrument design, aimed at compiling assessment instruments in the form of validation questionnaires (for material and media experts) and practicality questionnaires (for students and teachers); and (3) product development, where the e-novel is developed in an interactive digital format containing three main chapters with a total of 38 pages. In detail, the development of the e-novel can be described as follows: 1) Compiling the framework of the e-novel content (containing narrative, dialogue, illustrations, and insertion of geometric concepts), 2) Compiling a storyboard or storyline that integrates Mandar culture with spatial geometry material, 3) Designing an evaluation instrument in the form of a multiple-choice test of 10 numbers, 4) Creating an initial draft of the e-novel using the Canva application by combining stories, illustrations, and explanations of geometric material, 5) Revising the e-novel media according to suggestions from media expert validators and material experts, 6) Downloading the file in PDF format, then uploading it to the flipbook page, 7) Next, the design on the flipbook is adjusted and added with Mandar tambourine sound effects thus producing an ethnomathematics-based e-novel.

Characteristics of E-Novel

Media Content

The Figure 2 is an example page demonstrating geometric concepts integrated with a cultural context.

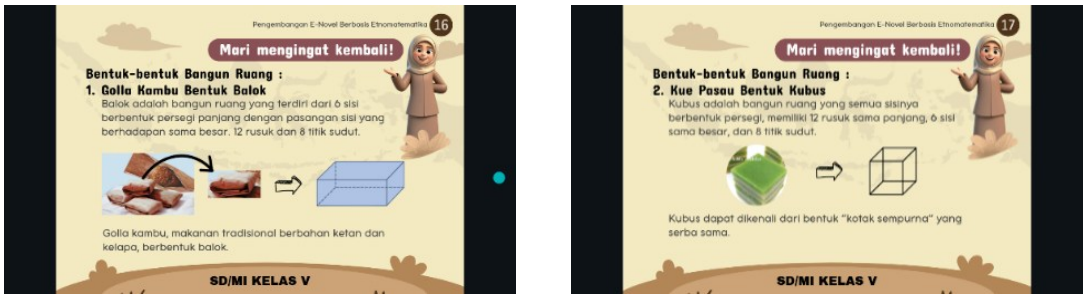

Figure 2. Media Content

The developed media is an ethnomathematics-based e-novel that presents simple narratives and dialogues highlighting local Mandar culture, particularly traditional foods and

the tambourine musical instrument. The story is divided into three chapters, each integrating geometric concepts (cubes, rectangular pyramids, cylinders, and cones) with a cultural context.

Features

The e-novel is presented in an interactive flipbook format that can be accessed digitally via a link or QR code. Key features include:

Page navigation

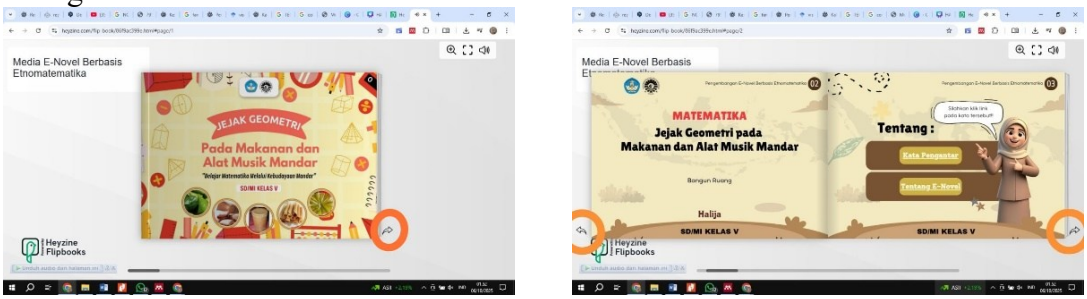

Figure 3. Example of E-Novel Page Navigation

Visual illustrations, which are simple images that support the understanding of narratives and spatial geometry material. Figure 4 is an example page that demonstrates this.

Figure 4. Example of E-Novel Visual Illustrations

Narration and dialogue, namely the presentation of culturally based stories, make learning more contextual. Figure 5 is an example page showing narrative and dialogue in e-novel.

Figure 5. E-Novel Narrative and Dialogue

Geometry material, namely explanations of the characteristics and examples of geometric shapes, is appropriate to local cultural contexts. Figure 6 is an example page that demonstrates this.

Figure 6. Geometry Material in E-Novels

Using an Ethnomathematics Approach

The developed e-novel has the distinctive characteristic of being a digital-based learning medium that integrates local Mandar culture with mathematical concepts, particularly in the geometrical concepts of solid geometry. The e-novel's content not only presents a fictional story but also combines narrative and character dialogue with cultural contexts, incorporating traditional Mandar foods and musical instruments that are connected to solid shapes such as cuboids, cubes, cones, rectangular pyramids, and cylinders. Each cultural object is directly linked to geometric concepts, for example, the shape of the rabana musical instrument and the shape of traditional foods, allowing students to see the real connection between mathematics and everyday life.

Supporting Geometry Learning in Elementary School

E-novels are beneficial and support geometry learning in elementary schools because they bridge the abstract nature of spatial concepts into something more concrete, understandable, and engaging for students. Through contextual storylines, characters, and dialogues that relate to everyday life, students can learn geometric concepts naturally without feeling burdened by complicated terminology. This e-novel aligns with the contextual learning principles of the Independent Curriculum because it connects learning materials to the sociocultural realities with which students are familiar (see. Figure 7) .

Figure 7. Mathematics and Culture

Contains a Variety of Student Learning Activities

Learning activities in the e-novel include observing and reading cultural illustrations of traditional Mandar food and musical instruments to identify geometric shapes. Students recognize and identify types of geometric shapes, such as cuboids, cubes, cones, rectangular pyramids, and cylinders, and describe the characteristics of each shape. In addition, students are also involved in discussions through stories and character dialogues to understand the relationship between culture and geometric concepts, and then directed to draw conclusions based on the learning outcomes they have obtained. As reinforcement, the e-novel is equipped with activities that allow students to work on problems together through the Quizizz platform. Figure 8 is an example of an e-novel page that demonstrates this.

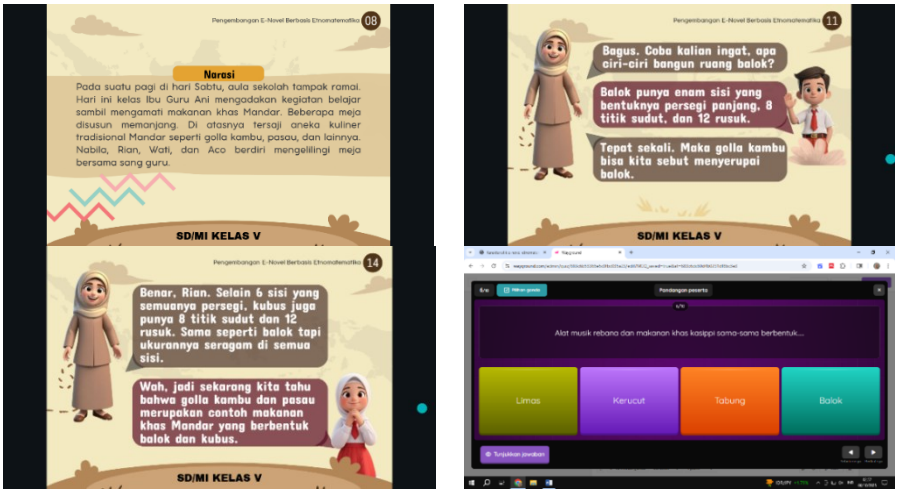

Figure 8. Various Activities in E-Novels

Usage Steps

First, Media access involves opening the e-novel via the provided link or QR code. Figure 9 is the link/ QR code e-novel, https://heyzine.com/flip-book/1e62230532.html

Figure 9. E-Novel QR Code

Second, Reading narratives/stories packaged with local cultural nuances. Third, Observe illustrations/pay attention to images relevant to the material on geometric shapes. Figure 10 is an example page that demonstrates this.

Figure 10. Example Illustration/Image

Fourth, Study the material, then discuss and reflect on the relationship between the Mandar culture and the spatial structures studied. Figure 11 is an example page that demonstrates this.

Figure 11. Example of Discussion & Reflection on the Relationship between Ethnomathematics

Fifth, Work on interactive quizzes together. This is the final stage of learning using e-novels. This feature is available as part of measuring student understanding after studying geometry material.

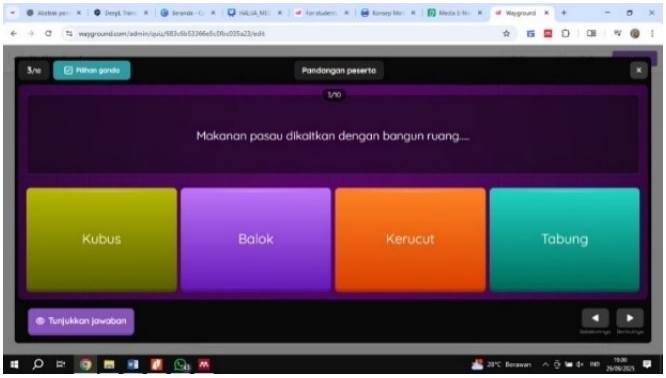

Figure 12. Example of Interactive Quiz

Advantages

This developed product has several advantages, including: 1) Accessible without the need to carry a physical book, 2) Cost-effective and environmentally friendly, 3) Supporting a digital learning style that suits the characteristics of the current generation, who are familiar with technology, can increase learning motivation, and 4) Students learn mathematics while getting to know the local culture, making the learning experience more meaningful.

Table 4. Summary Results of Product Validity From Media Aspect

Indicators	Results
1. Cover design	4
2. Selection of font type and size	4
3. Layout	4
4. Use and quality of images	4
5. The ease and Interest of storyline	4
6. Ease of use	4
7. Availability of a user manual	4
Total score	(28/28) x 100% = 100%
Category	Highly Valid

Table 5. Summary Results of Product Validity From Material Aspect

Indicators	Results
1. Availability of material identity	3
2. Suitability with the curriculum	3
3. Compliance with the breadth and depth of learning materialsconcepts	3
4. Suitability of Etnomathematica elements	4
5. The suitability of the story to the learning material	4
6. Suitability of learning activities	3
7. Usefulness for mastering the material	3
8. Suitability with good correct language	3
9. Ease of learning	3
10. Facilitation of curiosity	3
Total score	(32/40) x 100% = 80%
Category	Highly Valid

Validity and Practicality of E-Novel

The validation process aims to determine whether the developed e-novel product is valid and suitable for use in educational contexts. The assessment scale ranges from 1 to 4 (1: Very Poor, 2: Poor, 3: Good, 4: Very Good). Meanwhile, specifically for students, the answers are only Yes (Score 1) and No (Score 0). The scores obtained are totaled, divided by the Maximum Score, and multiplied by 100%. The scores obtained from this assessment are then converted into percentages to assess the validity and feasibility criteria of the product. Small group trials are conducted to determine the practicality of product use in the field. The Table 4 to 6 is a summary of the results of the product validity and practicality tests.

Table 6. Summary Results of Product Practicality From Media Aspect

Indicators	Average Results From 3 Schools	
	Teachers (N= 3)	Sudents (N=51)
1. Ease of use	3,67	0,93
2. Layout	4,00	0,94
3. Flow of use	4,00	0,94
4. Availability of learning Etnomathematica illustrations	4,00	0,94
5. Availability of relevant illustrations	4,00	0,94

Indicators	Average Results From 3 Schools	
	Teachers (N= 3)	Sudents (N=51)
6. Suitability with student characteristics	4,00	0,94
7. Interesting storyline for elementary school students	3,67	0,93
8. Interesting story characters and conversations	4,00	0,92
9. Challenging activities and learning experiences	4,00	0,86
10. Ease of access	4,00	0,91
11. Availability of learning experiences	4,00	0,91
12. Usefulness for students to learn the material	4,00	0,91
Total Score	(47,33/48) x 100% = 98,61%	(11.08/12) x 100% = 92,32%
Category	Very Practical	Very Practical

DISCUSSION

This research has undergone a series of research and development stages, to produce results and develop a product in the form of an ethnomathematics-based e-novel, which facilitates the learning of geometric shapes in Grade V of Elementary School. E-novel media uses a 4D development model has four stages: define, design, development, and disseminate (Reigeluth & An, 2020; Thiagarajan, 1974). However, in this study, the researchers only reached the development stage.

The development of learning media was based on the problems identified by researchers in mathematics learning, particularly geometry, for elementary school students at SDN 038 Kanusuang, SDN 034 Rappang, and SDN 019 Sila-Sila. This research was conducted through design and development stages based on validation and revision results from material experts and learning media experts.

Define and Design

The define stage identifies the need for enhanced product development in geometry learning, which remains abstract and disconnected from local cultural contexts. Observations and interviews reveal that current reliance on textbooks limits meaningful learning and understanding. To address this, both teachers and students require engaging visual media focused on spatial concepts such as cubes, cuboids, cylinders, cones, and pyramids. E-novel meets learning needs by integrating geometry with a cultural context. Linking mathematics to culture can make learning more enjoyable and meaningful (Civil, 2002; d'Entremont, 2015). Furthermore, a good storyo books, picture books, e-novel or visual novel game combines material with local cultural elements, making mathematics learning more meaningful (Azima et al., 2025; Qi et al., 2025).

In this case, the culture being promoted is the Mandar culture, which is closely related to the students' lives. The presentation of digital media, complete with stories, illustrations, and interactive activities, makes learning more engaging and motivates students to be active. This media aligns with the Kurikulum Merdeka because it not only conveys knowledge but also connects mathematical concepts to local culture, providing a contextual and meaningful learning experience for both students and teachers.

The e-novel was designed using Canva and presented in flipbook format because this combination has been proven to support engaging, interactive, and motivating digital learning for students. This finding aligns with research who stated that digital flipbook media can enhance motivation and early reading skills in elementary school students (Aisyah & Wibowo, 2025). Research by Meilinda et al. (2024) also suggests that the application of flipbooks in learning can increase students' learning motivation due to their interactive appearance and ease of access.

Furthermore, a literature review on the use of Canva in elementary school learning concluded that Canva-based digital media has proven effective, innovative, and worthy of reference in elementary school mathematics learning. Canva itself offers a range of features, templates, and visually appealing designs that can help teachers present abstract material in a more concrete, understandable, and engaging way for students (Sihombing et al., 2024). Thus, the use of Canva and flipbooks in e-novels makes learning media more relevant to students' needs while also keeping pace with the latest developments in educational technology.

Development

The development resulted in an ethnomathematics-based e-novel learning medium. In the process, researchers combined elements of Mandar culture with concepts of geometric shapes to create a more contextual and meaningful learning experience for students. The development of this ethnomathematics-based e-novel is in accordance with the principles of ethnomathematics learning. Students' learning transcends theoretical knowledge as they are able to link, translate, elaborate, and build patterns in order to find different mathematical answers for the cultural issues they encounter (Chahine & Naresh, 2025; Payadnya et al., 2025; Rosa & Orey, 2021). Additionally, they are able to come up with their own formulas, patterns, and methods for addressing mathematical problems, which promotes group learning, creativity, and practical application while deepening understanding and establishing pedagogies. Every cultural artifact has the potential to bridge the gap between theory and practice by teaching and learning (Jackson, 2021), include on mathematical concepts learning (Novikasari et al., 2024; Novitasari et al., 2024). Students will be able to honor their cultural wisdom, feel proud of who they are, and continue to uphold their culture and mathematics educational techniques if we do this. Ethnomathematics-based mathematics learning can make learning in schools closer to the context of students' daily lives, so that students can realize that mathematics learning in schools is actually often found in various objects or events around them (Verner et al., 2019).

Product Characteristics

Based on the results of the research that has been carried out, the process of developing this research has produced an ethnomathematics-based e-novel that contains student learning activities on the material of geometric solids (cubes, blocks, cones, rectangular pyramids, and cylinders). In general, the characteristics of ethnomathematics-based e-novels can be explained as follows:

Media content

The e-novel presents simple narratives and dialogues that highlight local Mandar culture, particularly traditional foods and the tambourine musical instrument. The story is divided into three chapters, and each chapter integrates geometric material (cubes, cuboids, cones, rectangular pyramids, and cylinders) with a cultural context. Simple visuals, clear explanations of materials, and examples of application in everyday life complement the presentation. This aligns with (Handhita et al., 2016) who stated that visual novels are a medium that emphasizes the story aspect, making it easy to incorporate learning materials. Visual novels are characterized by using a storytelling style similar to novels, but with relevant character images that support the novel's storyline (Mukhtar, 2018).

Features

The e-novel is presented in an interactive flipbook format, accessible digitally. Key features include page navigation, visual illustrations, culturally based narratives and dialogues, and explanations of geometric material. An additional feature, a Quizizz-based quiz, is used to strengthen students' understanding through interactive activities. Visual or electronic novels consist of narrative, illustrations, simple animations, hyperlinks, and quizzes (Camingue et al., 2020, 2021; Fernanda & Suprayitno, 2025).

Using an ethnomathematics approach

The e-novel integrates Mandar culture with geometric concepts. Cultural objects, such as traditional foods, are associated with specific shapes, enabling students to understand the

concrete relationship between mathematics and everyday life. This approach aligns with Lie et al. (2020) and Budiarto et al. (2022), who argue that ethnomathematics can bridge the gap between culture and education. Furthermore, Putri et al. (2022) state that linking mathematics to culture can make learning more enjoyable, enhance the fun and significance of learning (d'Entremont, 2015; Sunzuma & Umbara, 2025). Additionally, a good storybook, picture book, e-novel, or visual novel game blends content with regional cultural characteristics, which enhances the significance of learning mathematics (Azima et al., 2025; Qi et al., 2025).

Supporting geometry learning in elementary school

E-novels help bridge the abstract nature of spatial concepts into something more concrete, understandable, and engaging. Contextual stories allow students to learn naturally without being burdened by complex terminology. This aligns that local culture in learning media can provide a more meaningful mathematics learning experience and reduce the abstract nature of mathematical concepts (Akbar et al., 2025; Chahine & Naresh, 2025; Pratama & Yelken, 2024; Rosa & Orey, 2021). Students who received learning using ethnomathematics-based media had a higher level of geometric understanding compared to students who learned without using such media (Sunzuma & Umbara, 2025; Utami & Irawati, 2024). In ethnomathematics-based geometry learning, many concepts of plane and solid shapes were identified that naturally appear in local cultural motifs, allowing the use of local culture as a learning context to help students relate mathematical concepts to real objects with which they are familiar (Widebdo et al., 2024; Zainovi et al., 2025).

Contains a variety of student learning activities

Learning activities include observing cultural illustrations, recognizing the shape of a raung, describing its characteristics, discussing it through stories, and drawing conclusions about the learning outcomes. These activities are reinforced with Quizizz quizzes, which serve as fun and interactive exercises. This aligns with Marselina & Muhtadi (2019), who argued that interactive digital mathematics books in soft file format contain text, images, videos, animations, and interactive quizzes that can be used both in class and independently. Furthermore, Sukma & Kholiq (2021) produced a Visual Novel media equipped with learning menus, character elements, and adventure missions in a labyrinth to train students' higher-order thinking skills.

Product validation and practicality

Based on the validation and practicality results, ethnomathematics-based e-novel media is highly valid and very practical for use in learning. The feasibility of using an ethnomathematics-based e-novel aligns with research conducted by (Marselina & Muhtadi, 2019), which demonstrates that the use of interactive digital media can enhance student engagement and understanding in learning geometry material. Furthermore, Jabali et al., (2020) stated that the development of ethnomathematics-based visual novel game media can improve the understanding of algebraic concepts. Ethnomathematics-based learning can make mathematical concepts more meaningful and easier to understand for students. Ethnomathematics not only preserves local cultural values but also contributes to improving students' mathematical literacy skills (Pratama & Yelken, 2024).

The suitability of digital media is not just about the content, but also whether teachers can use and integrate it into the learning process. The e-novel product developed is accompanied by a teacher's guide, making it easy for both teachers and students to use. Fernanda (2025) explain that easy-to-use media will likely receive a positive response from users and can help them understand the material, thereby increasing student engagement. Validation results by media and material experts indicate that the developed ethnomathematics-based e-novel meets the criteria for appropriate content, presentation, and suitability to the characteristics of elementary school students. This aligns with Fernanda (2025), who stated that a development product is considered valid if there is a match between the content, language, presentation, and learning objectives that can be proven to be accurate and scientific.

An e-novel has several advantages because this medium is designed to be attractive, interactive, and tailored to the needs of students. In terms of content, the material presented is relevant to the curriculum and linked to the local Mandar cultural context, making learning more meaningful and contextual. This aligns with (Jabali et al., 2020; J. H. Putri et al., 2025; Sastrawati et al., 2025; Yuniawati et al., 2025) who stated that effective e-novel media or e-comic and other visual novel games possess characteristics that combine a storyline with local cultural elements, making mathematics learning more meaningful. In terms of appearance, an e-novel is composed of an attractive and easily accessible visual design, accompanied by interactive quizzes, thus increasing learning motivation. In line with this, Fernanda (2025) stated that good visual novels possess characteristics of appearance that combine story narrative, illustrations, material presentation, and quiz activities.

However, in terms of process and results, this research still has various weaknesses. In terms of development, the product was only validated by two media and materials validators. The sampling of schools used for the practicality test was also very limited, with only three schools in one district. After the product was developed, there was no dedicated dissemination phase to introduce it to teachers and students as widely as possible. Finally, there is still no empirical test to measure the product's effectiveness.

CONCLUSION

This research has undergone a series of research and development stages, starting from the Define, Design, and Development stages, to produce results and develop a product in the form of an ethnomathematics-based e-novel, which facilitates the learning of geometric shapes in Grade V of Elementary School. The ethnomathematics-based e-novel media have characteristics that are packaged in the form of story-based digital media, accessible through electronic devices such as laptops, tablets, PCs, mobile phones, and others. The content is not only presented in the form of narrative text and dialogue, but also supplemented with illustrations, learning materials, and learning activities that connect mathematics to local Mandar culture. Based on the results of the Validation and Practicality Tests conducted, it can be concluded that the product is declared highly valid and very practical, making it suitable for use in facilitating the learning of geometric shapes in Grade V of Elementary School.

The significance of this research finding is that to bring mathematics learning closer to the context of students' daily lives, teachers need to make an effort to provide relevant learning resources, including contextual learning media. Using an ethnomathematics approach is one relevant solution for developing contextual learning media. An approach that prioritizes students' everyday culture will make mathematics learning material more concrete for elementary school students, thus having the potential to improve their understanding and learning achievement. One effort to facilitate contextual learning media with an ethnomathematics approach is through electronic novels, which students can easily access through their devices, both during school and for independent learning at home.

RECOMMENDATION

The recommendation is that teachers should utilize this literature as an alternative for teaching mathematics, particularly geometry, in elementary schools. For schools, the resulting product could serve as a learning medium and resource to facilitate learning. The research still has various weaknesses, future research can continue with similar studies that develop more innovative products, employ a more robust validation process, and expand the population reach and sample size to be more representative. Furthermore, future research is needed that fully implements the 4D model, including actual dissemination. Finally, future research can also refine it by testing the product's effectiveness through experimental research.

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AUTHOR CONTRIBUTIONS STATEMENT

Name of Author	C	M	So	Va	Fo	I	R	D	O	E	Vi	Su	P	Fu
Zaid Zainal	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓		✓	✓
Halija	✓	✓		✓			✓			✓	✓	✓	✓	✓
Wawan Krismanto	✓	✓		✓			✓	✓		✓	✓	✓	✓	✓

CONFLICT OF INTEREST STATEMENT
Authors state no conflict of interest.

DATA AVAILABILITY
The data that support the findings of this study are available from the corresponding author upon reasonable request.

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