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Development of Educational Game Learning Media with An Ethnomathematics Approach Based on Banyumas Culture to Improve Students' Mathematical Understanding Skills

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ABSTRACT

The background of this research is the low mathematical understanding skills of seventh-grade students at SMP Negeri 1 Ajibarang. This study aims to develop educational game learning media with an ethnomathematics approach based on Banyumas culture in Geometry material that is valid and effective in improving mathematical understanding skills. The research method used Research and Development (R&D) with the ADDIE model. The population of this study includes all seventh-grade students, and the sample used in this study consists of class VII-B as the experimental class and class VII-A as the control class, with each class comprising 34 students. The results of this study indicate that the educational game learning media with an ethnomathematics approach based on Banyumas culture in Geometry material is valid, with an average percentage of 90.48% from material experts, 92.50% from media experts, 83.08% from mathematics teachers, 93.67% from small group trials, and 88.13% from field trial. The educational game learning media with an ethnomathematics approach based on Banyumas culture is also declared effective in improving students' mathematical understanding skills in Geometry material, as evidenced by the t-test result Sig. (2-tailed) = 0.000 < 0.05. Since the average N-Gain score of the experimental class is 0.73, which is higher than the average N-Gain score of the control class, which is only 0.43, it can be concluded that the educational game learning media with an ethnomathematics approach based on Banyumas culture is effective in improving the mathematical understanding skills of seventh-grade students in Geometry.
Keywords: Banyumas Culture, Educational Games, Mathematical Understanding Skills, Learning Media.

ABSTRAK

Latar belakang penelitian ini adalah rendahnya keterampilan pemahaman matematika siswa kelas tujuh di SMP Negeri 1 Ajibarang. Penelitian ini bertujuan untuk mengembangkan media pembelajaran permainan edukatif dengan pendekatan etnomatematika berbasis budaya Banyumas pada materi Geometri yang valid dan efektif dalam meningkatkan keterampilan pemahaman matematika siswa. Metode penelitian yang digunakan dalam penelitian ini adalah Research and Development (R&D) dengan model ADDIE. Populasi penelitian ini mencakup semua siswa kelas tujuh dan sampel yang digunakan dalam penelitian ini terdiri dari kelas VII-B sebagai kelas eksperimen dan kelas VII-A sebagai kelas kontrol, dengan masing-masing kelas terdiri dari 34 siswa. Hasil penelitian ini menunjukkan bahwa media pembelajaran permainan edukatif dengan pendekatan etnomatematika berbasis budaya Banyumas pada materi Geometri adalah valid, dengan persentase rata-rata 90,48% dari ahli materi, 92,50% dari ahli media, 83,08% dari guru matematika, 93,67% dari uji coba kelompok kecil, dan 88,13% dari uji coba lapangan. Media pembelajaran permainan edukatif dengan pendekatan etnomatematika berbasis budaya Banyumas juga dinyatakan efektif dalam meningkatkan keterampilan pemahaman matematika siswa pada materi Geometri, sebagaimana dibuktikan dengan hasil uji t Sig. (2-tailed) = 0,000 < 0,05. Berdasarkan hasil ini, dapat disimpulkan bahwa terdapat perbedaan rata-rata nilai antara kelas eksperimen dan kelas kontrol. Karena rata-rata skor N-Gain kelas eksperimen adalah

0,73, yang lebih tinggi daripada rata-rata skor N-Gain kelas kontrol, yang hanya 0,43, dapat disimpulkan bahwa media pembelajaran permainan edukatif dengan pendekatan etnomatematika berbasis budaya Banyumas efektif dalam meningkatkan keterampilan pemahaman matematika siswa kelas tujuh pada materi Geometri.
Kata kunci: Budaya Banyumas, Game Edukasi, Kemampuan Pemahaman Matematis, Media Pembelajaran.

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Introduction

The world of education is greatly influenced by technological advancements. Educational practices that were initially focused on presenting information have shifted towards digital literacy, inquiry, creativity, and problem-solving, making technological advancements a new challenge for learning. The effectiveness and efficiency of learning need to be enhanced by utilizing technology in education. Educators are expected to use technology-based learning media to improve students' understanding of the material (Pratama et al., 2019).

An essential skill to possess is mathematical understanding. Solving mathematical problems is based on this ability, which also significantly influences the development of other mathematical skills. Mathematical understanding is a fundamental competency in mathematics education, encompassing the ability to absorb material, recall mathematical formulas and concepts, and apply them to simple or similar cases, estimate the accuracy of statements, and apply formulas and theorems to solve problems (Hendriana et al., 2018).

From interviews conducted by the researcher with the seventh-grade mathematics teacher at SMP Negeri 1 Ajibarang, it was found that the seventh-grade students still struggle with presenting concepts in various forms of mathematical representation and in developing the necessary or sufficient conditions of concepts. This indicates that the mathematical abilities of the seventh-grade students are still lacking. Additionally, the implementation of zoning in the New Student Admission (PPDB) at SMP Negeri 1 Ajibarang has led to a decline in the quality of incoming seventh-grade students compared to before the zoning system was implemented. This poses a challenge for teachers, especially mathematics teachers, to improve the mathematical understanding skills of seventh-grade students.

One arrangement to the issue of the need of numerical understanding aptitudes among seventh-grade understudies is the usage of learning utilizing technology-based learning media. Learning media includes all shapes and implies of conveying data and

is utilized to fortify students' consideration, considerations, readiness, and sentiments, custom fitted to learning hypotheses, serving as a implies to realize learning targets and as a channel for messages so that a great learning prepare can be energized to happen (Suryani et al., 2019).

Different innovations can be utilized to assist understudies get it concepts in learning (Huang et al., 2019), but the utilize of instructive recreations as learning media is still exceptionally uncommon (Pratama et al., 2019). Educational games are designed to stimulate children's thinking abilities, enhancing their concentration and problem-solving skills. The benefits of educational games include training on lesson material, improving concentration, motor skills, and understanding cause-and-effect concepts (Handriyantini, 2009). Additionally, educational games have been proven to introduce a new atmosphere in learning and increase children's interest in studying arithmetic (Yunus et al., 2015). Additionally, educational games have been proven to introduce a new atmosphere in learning and increase children's interest in studying arithmetic (Kasim, 2018; Setiawan, 2019). The quality of science learning and students' cognitive learning results can be improved through the utilize of instructive diversions (Satrio, 2020). Moreover, empowering students through the integration of mathematics material with culture, tailored to their life experiences, enriches their mathematical context, leading to more successful mathematics learning (Wulandari & Puspadewi, 2016).

Moreover, integrating mathematics with culture is crucial, as it not only helps students understand mathematical concepts but also allows mathematics education to play a role in preserving culture. The shift towards a more modern lifestyle in the era of globalization has led people to favor foreign cultures over local ones. Consequently, foreign cultures are often celebrated, while local cultures are gradually eroded (Nahak, 2019). Integrating mathematics learning with culture allows mathematics educators to contribute to cultural preservation. This integration of mathematics within culture is known as ethnomathematics.

D'Ambrossio, a Brazilian mathematician, presented the term ethnomathematics for the primary time (Pathuddin & Raehana, 2019). Ethnomathematics is an approach that interfaces the fabric learned in science instruction with students' neighborhood societies. It can serve as a means to build national character (Wahyuni et al., 2013). Ethnomathematics acts as a bridge between mathematics and culture, facilitating students' understanding by incorporating local cultural traditions into mathematics lessons (Putri, 2017). Furthermore, mathematics education becomes more enjoyable, which can enhance students' interest and mathematical abilities (Fajriyah, 2018).

Furthermore, Banyumas Regency is a culturally rich area consisting of 27 sub-districts (Banyumas, 2022). The culture of Banyumas can serve as a resource for learning, especially in mathematics, such as geometry (Ayu, 2020; Dewi & Kusuma, 2019; Kumala, 2022). The geometric concepts present in Banyumas' culture will be used as content for developing educational media in the form of Android (.apk) and computer (.exe) applications. These media do not require an internet connection, making them convenient for students during the learning process. The selected material is seventh-grade geometry, chosen based on discussions with mathematics teachers, who indicated that seventh-grade geometry tends to be more challenging for students to understand. Previous research on the development of educational games to enhance the understanding of mathematical concepts has been widely conducted. For example, Satrio (2020) developed the Android-based educational game "Math Kingdom" to improve junior high school students' understanding of exponents and roots. However, there have been no studies that integrate educational games with Banyumas culture, such as the educational game proposed in this research. This research aims to describe the development of educational game learning media based on Banyumas culture and an ethnomathematics approach to geometry material, assess the validity of these educational games as mathematics learning media with the aforementioned approach, and evaluate their effectiveness in enhancing students' mathematical understanding skills in class VII geometry at SMP Negeri 1 Ajibarang.

Research Methods

This research is a Research and Development (R&D) study aimed at investigating, designing, and producing a product, and testing the validity and effectiveness of that product (Sugiyono, 2020). The development will result in a new product in the form of educational media based on ethnomathematics of Banyumas culture for seventh-grade geometry, available as Android (.apk) and computer (.exe) applications. The development process of the educational game based on Banyumas ethnomathematics for seventh-grade geometry uses the ADDIE (Analysis, Design, Development, Implementation, Evaluation) model. Continuous evaluation and revision by the researcher will ensure the production of valid learning media (Cahyadi, 2019).

At analysis stage, the main activity conducted is to analyze the necessity for development (Cahyadi, 2019). The analysis in this research includes a preliminary observation by interviewing the seventh-grade mathematics teacher at SMP Negeri 1 Ajibarang. The results of the interview indicate that students' mathematical understanding skills are still low. Additionally, the learning media used is limited to textbooks and worksheets, with no available media to enhance students' mathematical understanding in the seventh grade at SMP Negeri 1 Ajibarang. Nowadays, students prefer playing games over studying. To address this issue, the researcher is developing

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educational game learning media with a Banyumas culture-based ethnomathematics approach to improve mathematical understanding skills in geometry for seventh-grade students.

The design stage includes several planning aspects for product development (Cahyadi, 2019). During this stage, the researcher creates the structure of educational game learning media based on the Banyumas culture and an ethnomathematics approach, determines the material, outlines the menu for the educational game application to be created, and prepares materials related to Banyumas culture that can enhance students' mathematical understanding. The references used by the researcher to compile the material include books, journal articles, scientific works, and so on.

At development stage, the product is created according to the objectives (Cahyadi, 2019). At this stage, the researcher aligns the educational game learning media based on the Banyumas culture and an ethnomathematics approach with the design established in the design stage.

The implementation stage in the research is the phase for applying the developed product design in a real classroom situation (Cahyadi, 2019). The developed product must be tested first, namely content and ethnomathematics context expert testing and media expert testing. Before the product developed by the researcher is tested with students, the content material, ethnomathematics context, and geometry problems presented in the exercises and educational game must be validated by experts to determine whether the developed product can be used as a learning media. After being tested with the content expert, the developed product also needs to be tested by a media expert. The media expert is responsible for validating the design of the educational game learning media based on the Banyumas culture and an ethnomathematics approach developed by the researcher to ascertain its validity. The results of this media expert testing will provide feedback and suggestions to improve the educational game learning media before it is tested with students. After validating the developed product with experts, the product is tested with the seventh-grade mathematics teacher at SMP Negeri 1 Ajibarang using an attractiveness questionnaire. After validating the developed product with experts and the teacher, the product is then tested with a small group. After being tested with a small group, the developed product undergoes a field trial. The researcher conducts a field trial to determine whether the educational game developed as a learning media effectively enhances students' mathematical understanding. To assess the impact on students' understanding, a pre-test is administered before students use the developed product, followed by a post-test after they have utilized the developed product.

Evaluation is the final step of the ADDIE learning system design model, aimed at providing an assessment of the product's development in learning (Cahyadi, 2019). At this stage, the researcher conducts summative evaluation to comprehensively assess the products that have been developed and tested. The products that have been tested will receive feedback, which can lead to two possibilities. If the developed product, after being tested with validators, teachers, and students, receives positive feedback and is deemed suitable for use, then the development of educational game learning media with a Banyumas culture-based ethnomathematics approach has reached its final stage. If the developed product, after being tested, does not receive a positive response and is not considered suitable for use, then further improvements are needed to enhance the educational game learning media with a Banyumas culture-based ethnomathematics approach to achieve better results.

The research will be conducted at SMP Negeri 1 Ajibarang during the seventh-grade geometry lessons in the even semester of the 2022/2023 academic year. The population consists of all seventh-grade students at SMP Negeri 1 Ajibarang, totaling 242 students across seven classes: VII A with 34 students, VII B with 34 students, VII C with 35 students, VII D with 34 students, VII E with 34 students, VII F with 35 students, and VII G with 36 students. The sample will be randomly selected using a lottery method with papers indicating different classes. Two classes will be chosen, with VII A selected as the control class and VII B as the experimental class, each comprising 34 students.
The research instruments used in this study include: 1) Interview sheets with questions to be asked during interviews with teachers and seventh-grade students at SMP Negeri 1 Ajibarang; 2) Validation questionnaires provided to subject matter and ethnomathematics experts, as well as media experts, with statements on the validation questionnaire offering different scoring options; 3) Engaging quality surveys utilized to survey the level of engaging quality of the item amid trials with understudies and seventh-grade science instructors at SMP Negeri 1 Ajibarang; and 4) Test rebellious utilized to degree the numerical understanding aptitudes of seventh-grade understudies. Pretests and posttests will be managed to understudies in both the exploratory and control classes.

The researcher prepared 14 mathematical understanding test questions, which were administered to students in class VIII F to ensure the validity and reliability of the questions to be used. The formula used for validity testing is the product-moment correlation formula with a significance level of $\alpha = 5\%$. Questions are considered valid if the calculated $r_{xy} \geq r_{table}$ (Riadi, 2016). After testing with 33 students and using SPSS version 22, it was found that 4 questions were not valid, specifically questions number 2, 3, 6, and 7. The remaining 10 valid questions will then be tested for reliability.

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The test items will be evaluated for reliability. A test is considered reliable if it yields consistent results when administered multiple times (Widoyoko, 2022). The formula used for reliability testing is Cronbach's alpha. According to Litwin, a reliability coefficient of 0.70 or higher is acceptable for good reliability (Khumaedi, 2012). The researcher used IBM SPSS Statistics Version 22 to test the reliability of 10 items, resulting in a reliability coefficient of 0.760, which is greater than 0.70 and thus considered acceptable for good reliability.

The data analysis technique used involves analyzing quantitative data obtained from validation questionnaires provided to subject matter experts, ethnomathematics experts, and media experts using percentage formulas based on the given responses. Qualitative data is analyzed to draw conclusions regarding suggestions for improving the educational game media created (Lestari & Yudhanegara, 2017). The validity analysis of the validation sheets and attractiveness questionnaires is converted into percentages using the equation (1):

$$P = \frac{total\ answer\ score\ for\ each\ aspect}{N} \times 100\% \qquad (1)$$

with,

P : assessment percentage

N : maximum score for questionnaire answers in each aspect

The scores on the validation questionnaires have different scoring options. The rate of these scores will be categorized based on the criteria laid out in Table 1, as follows:

Table 1. Validity Criteria for Educational Game Learning Media

Percentage (%)	level of validity	Information
80 < score ≤ 100	Very Valid	Very Worthy
60 < score ≤ 80	Valid	Worthy
40 < score ≤ 60	Quite Valid	Quite Worthy
20 < score ≤ 40	Less Valid	Less Worthy
0 < score ≤ 20	Invalid	Very Unworthy

The criteria for the attractiveness of the developed learning media can be found in the following Table 2. Information on adequacy is analyzed from the pretest and posttest scores of understudies by calculating the N-Gain esteem to decide any enhancement or decrease some time recently and after utilizing the item, utilizing the taking after equation (2), as follows:

$$N - Gain = \frac{post\text{-}test\ score - pre\text{-}test\ score}{ideal\ score - pre\text{-}test\ score} \qquad (2)$$

Table 2. Criteria for the Attractiveness of Educational Game Learning Media

Percentage (%)	Level of Attractiveness
80 < score ≤ 100	Very Interesting
60 < score ≤ 80	Interesting
40 < score≤ 60	Quite Interesting
20 < score ≤ 40	Less Interesting
0 < score ≤ 20	Not Interesting

The comes about of the N-Gain scores are at that point categorized as appeared within the taking after Table 3, as follows:

Table 3. N-Gain Value Category

Normalized Gain Value	Interpretation
-1,00 ≤ N-Gain < 0,00	There was a decline
N-Gain = 0,00	No Decrease Occurred
0,00 ≤ N-Gain < 0,30	Low
0,30 ≤ N-Gain < 0,70	Currently
0,70 ≤ N-Gain < 1,00	High

To decide whether there's a noteworthy distinction between the implies of two free tests, the analyst will to conduct a t-test, taking after ordinariness and homogeneity tests as prerequisites. The ordinariness test is performed utilizing the Kolmogorov-Smirnov test with the assistance of SPSS Adaptation 22, with the choice that information is ordinarily conveyed on the off chance that the noteworthiness esteem 5%. Following, the homogeneity test is conducted utilizing SPSS Adaptation 22, with the choice that information is homogeneous in case $F_{count} < F_{table}$ (Riadi, 2016).

Result and Discussions

Research and Development Results

In developing the product, the researcher used the ADDIE model according to Cahyadi with the following stages:

Analysis Stage

The analysis was conducted through interviews with the seventh-grade mathematics teacher and several seventh-grade students at SMP Negeri 1 Ajibarang. The findings revealed that the average student exhibits a low level of mathematical comprehension, struggling to establish the necessary or sufficient conditions for concepts and to convey ideas across different forms of mathematical representation. Additionally, the teacher has not used supportive media in mathematics instruction, relying solely on textbooks and Student Worksheets. Most students own a mobile phone or laptop and prefer playing games to studying mathematics. According to students, learning is boring,

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which leads them to prefer playing games; however, the teacher believes that games contribute to students' reluctance to study. Nevertheless, integrating games into mathematics education could attract students' attention, as they have not previously experienced educational games. This could boost their enthusiasm for learning and facilitate their understanding of the material. To address these issues, educational media in the form of an educational game with an ethnomathematics approach based on Banyumas culture has been developed. This instructional game is crucial for enhancing the learning experience. It is expected that integrating the educational game into the curriculum will improve students' mathematical comprehension and create a more engaging learning environment.

Design Stage

At this stage, the researcher undertakes several tasks, 1) Designing the Structure of the Educational Game Media: This includes creating the framework for the educational game with an ethnomathematics approach based on Banyumas culture, such as naming the game, designing the theme, selecting fonts, and other design elements. 2) Determining the Content: This involves defining the subject matter, describing the developed game, identifying the developers, providing instructions, presenting the geometry material, and including practice questions. 3) Preparing the Seventh-Grade Geometry Material: This step includes organizing and detailing the geometry content to be explained, covering both plane and solid figures. 4) Developing the Game: This involves creating the game related to geometry material integrated with Banyumas culture. 5) Creating the Storyboard: The storyboard for the educational game media, with an ethnomathematics approach based on Banyumas culture, is prepared using PowerPoint.

Development Stage

The product is developed using Adobe Flash Professional CC 2015. The educational game media developed will be available in two formats: an Android application (.apk) and a computer application (.exe). This dual format is designed to make it easier for students to access and use the educational media.

Implementation Stage

At this stage, the developed product must be tested to determine whether the educational game media is valid and suitable for use in seventh-grade mathematics instruction on Geometry. Validation is carried out by media specialists and subject matter experts. The average percentage score from the subject matter experts is 90.48%, which is categorized as "Very Valid" in Table 1. The media analysts' average percentage score is 92.50%, also categorized as "Very Valid" in Table 1. This indicates

that the educational game media is deemed appropriate for use in seventh-grade mathematics instruction on Geometry.

Throughout the validation process, feedback and suggestions were provided by the subject matter and media experts. Figure 1 and Figure 2 are the results of the revisions made based on the experts' suggestions.

Figure 1. The line segment AB is symbolized by $\overline{AB}$ Before Revision

Translate in English:
Observe the two points A and B above!
If we draw a line passing through points A and B, then there is no other line that also passes through both points A and B. However, there are many lines that pass through a single point A. In other words, there is only one line that passes through the two points A and B.
A line passing through two points A and B is called line AB.
For line AB, the part of the line from A to B is called the line segment AB.
A straight line extended toward B starting from point A is called the ray AB

Figure 1 explains the meaning of lines and angles. The explanation was accompanied by an illustration of the AB line segment. There are two different parts of the definition. The first definition describes the AB line segment and the second definition explains the angle of the AB line if the AB line segment is extended. Both definitions describe the basic properties of a flat building.

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The results of the improvement by the validator resulted in several important points, including those related to the line symbol. As shown in Figure 2, it is explained about the improvements made related to the use of line symbols. Initially, the AB line only wrote AB but was given the symbol $\overline{AB}$. The use of symbols or mathematical notations is very important because it characterizes a name or definition.

Figure 2. Revision Results for Improvements in Writing Symbols

Translate in English:
Observe the two points A and B above!
If we draw a line passing through points A and B, then there is no other line that also passes through both points A and B. However, there are many lines that pass through a single point A. In other words, there is only one line that passes through the two points A and B.
A line passing through two points A and B is called line $\overline{AB}$.
For line AB, the part of the line from A to B is called the line segment $\overline{AB}$.
A straight line extended toward B starting from point A is called the ray $\overline{AB}$

In Figure 3, there is no menu button on the practice questions feature and in Figure 4, There is a menu button on the practice questions feature. Figure 3 explains the menus displayed in the game media. The menu consists of the image section on the left and is accompanied by an illustration of the Cartesian field as well as a question. On the right there are several different menus including intersecting, crossing, parallel, and perpendicular. The fix is to add a menu button in the upper right corner, as seen in Figure 4. The whole initial part is not much different from the previous picture. To complete the game media menu, only a menu button was added.

Figure 3. Added Menu Button to the Practice Questions Feature Before Revision

Translate in English:
Observe the following image!
The positions of lines m and l are intersecting, skew, parallel, or perpendicular.

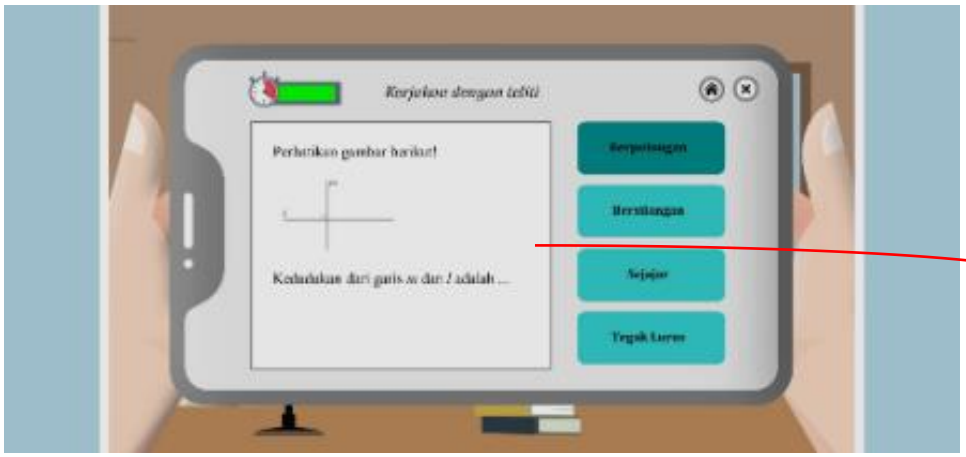

Figure 4. Revision Results Improvements to Add Menu Buttons to the Practice Questions Feature

Translate in Englsih:
Observe the following image! The positions of lines m and l are intersecting, skew, parallel, or perpendicular

In Figure 5, there is incorrect definition of diameter in educational games and Figure 6 show the correct definition of diameter. Figure 5 provides information related to the meaning of the diameter of the circle and its illustrations. The illustration of the image

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used is *tampah* (rice winnowing tray). First of all, it is explained that tampah Starting from the material, the meaning of the shape *tampah*, and its characteristics. After that, it is continued to the illustration of the circle on the *tampah*. Next, it is explained about the circle, radius, and diameter. Figure 6 is an improvement made based on the results of the review from the validator. The improvements made are about the definition of the diameter of a circle. The definition of diameter used is the distance between the farthest points from two different points in the circle.

Figure 7 and Figure 8 are the results of improvements as suggested by media experts. Figure 7 shows the use of small letters in the answer input box. The image explains the use of traditional fans, their meaning, and the mathematical constraints that exist on the object. An illustration of a picture in the form of a square was obtained, then a small blank box was given as a place to write the answer.

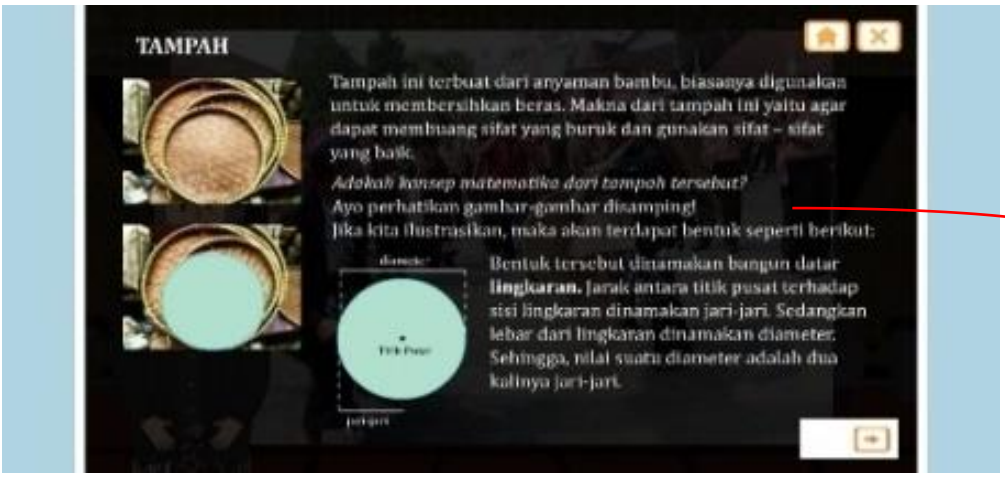

Figure 5. Definition of Diameter in Educational Games Before Revision

Translate in Englsih:
This *tampah* (rice winnowing tray) is made from woven bamboo and is usually used to clean rice. The meaning of this tampah is to remove bad traits and use good qualities.
Is there a mathematical concept in this tampah? Let's observe the images beside it! If we illustrate it, there will be a shape as follows:
This shape is called a circle. The distance from the center point to the edge of the circle is called the radius, while the width of the circle is called the diameter. Therefore, the value of a diameter is twice the radius.

Overall, the content is not much different from Figure 7. There is a minor improvement shown by Figure 8. In the image, the answer input is a blank box that initially uses an

uppercase prefix but is changed to lowercase. There is no need to use uppercase letters, but it is enough to use lowercase letters, for example "persegi".

Figure 6. Results of Revision of the Definition of Diameter in Educational Games

Translate in Englsih:
This *tampah* (rice winnowing tray) is made from woven bamboo and is usually used to clean rice. The meaning of this tampah is to remove bad traits and use good qualities.
Is there a mathematical concept in this tampah? Let's observe the images beside it! If we illustrate it, there will be a shape as follows:
This shape is called a circle. The distance from the center point to the edge of the circle is called the radius. Therefore, the value of a diameter is the distance between the two farthest points on the circle.

After the developed product is valid and suitable for use in seventh-grade mathematics learning on Geometry, it will be tested on a small group first to determine the product's appeal before being tested on students in the experimental class. In this case, the small group trial is given to class VIII-F with 15 student respondents, with the following results in Table 4.

Table 4. Results of Small Group Trials on Educational Games

No	Rated aspect	Score	Percentage (%)	Category
1	Interest	414	92,00	Very Interesting
2	Material	420	93,33	Very Interesting
3	Language	290	96,67	Very Interesting
Average Percentage Score			93,67	Very Interesting

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Based on Table 4, the aspect of attractiveness is in the "very interesting" category with a percentage of 92.00%, the aspect of material is in the "very interesting" category with a percentage of 93.33%, and the language aspect falls into the "Very Interesting" category with a percentage of 96.67%. The small group trial also received an average score of 93.67%, categorized as "Very Interesting." Therefore, it can be concluded that the educational game media with an ethnomathematics approach based on Banyumas culture is "Very Interesting" for use in seventh-grade geometry instruction.

Figure 7. Use of lowercase letters in the educational game answer input column before revision

Translate in English:
A fan symbolizes providing coolness. If one person is angry, the other is expected to help cool down the situation.
Is there a mathematical concept in this fan? Let's observe the images beside it! If we illustrate it, there will be a shape as follows:
What shape is that?

After the small group trial was conducted, the product was tested on the experimental class in a field trial. In this case, the experimental class is class VII-B with 34 student respondents, with the following results in Table 5, as follows:

Table 5. Results of Field Trials on Educational Games

No	Rated aspect	Score	Percentage (%)	Category
1	Interest	891	87,35	Very Interesting
2	Material	896	87,84	Very Interesting
3	Language	610	89,71	Very Interesting
Average Percentage Score			88,13	Very Interesting

Based on Table 5, the aspect of attractiveness received a score of 891 with a percentage of 87.35%, placing it in the "Very Interesting" category. The material aspect received a score of 896 with a percentage of 87.84%, also categorized as "Very Interesting." The language aspect received a score of 610 with a percentage of 89.71%, which falls into the "Very Interesting" category as well. Thus, it can be concluded that the product attractiveness questionnaire in the field trial achieved an average percentage of 88.13%, placing it in the "Very Interesting" category. The educational game media with an ethnomathematics approach based on Banyumas culture is considered "very interesting" by students for use in seventh-grade geometry learning.

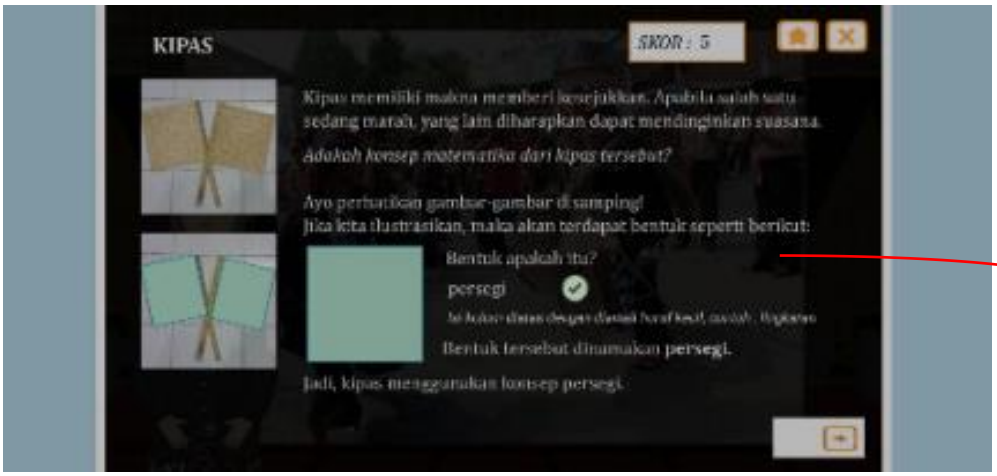

Figure 8. Revision Results for Using Lowercase Letters in the Input Column for Educational Game Answers

Translate in English:
A fan symbolizes providing coolness. If one person is angry, the other is expected to help cool down the situation.
Is there a mathematical concept in this fan? Let's observe the images beside it! If we illustrate it, there will be a shape as follows:
What shape is that?

Next, to obtain effectiveness data, the researcher administered pretest and posttest questions to the class and the control class as a comparison with the following results in Table 6. Based on Table 6, the highest pretest score in the experimental class is 63, the lowest score is 17, and the average is 41. In the control class, the highest pretest score is 63, the lowest score is 21, and the average is 44. Additionally, the highest posttest score in the experimental class is 96, the lowest score is 75, and the average is 84. In the control class, the highest posttest score is 88, the lowest score is 33, and the average is 68.

Table 6. Score Pre-test and Post-test

No	Information	Pre-test		Post-test	
		E	C	E	C
1	Highest Score	63	63	96	88
2	Lowest Score	17	21	75	33
3	Average	41	44	84	68

Evaluation Stage

The evaluation organize is the ultimate organize of this investigate. At this arrange, a summative assessment is conducted to assess the generally handle and comes about of the improvement. From the pretest and posttest scores gotten, the normal N-Gain will be calculated to decide the effect of utilizing the created instructive amusement, which can be clarified afterward. In this ponder, the analyst utilized four tests. The N-Gain test and the free t-test with prerequisite tests for normality and homogeneity. N-Gain statistics are presented in Table 7, as follows:

Table 7. Statistics N-Gain

Information	Experiment	Control
The number of students	34	34
Highest Score	0,92	0,77
Lowest Score	0,60	0,06
Average	0,73	0,43

Based on Table 7 over, the normal N-Gain score of the exploratory course is 0.73, which, concurring to Table 3, falls into the "Tall" category. Besides, the normal N-Gain score of the control lesson is 0.43, which, concurring to Table 3, falls into the "Medium" category.

Test-t (Independent Sample t-Test)

Normality Test

The information to be tried for ordinariness are the N-Gain information from classes VII A and VII B, which serve as the control and test classes, individually. The Kolmogorov-Smirnov typicality test will be conducted utilizing SPSS form 22. Information is regularly dispersed on the off chance that the importance esteem is > 0.05. The comes about of the ordinariness test can be seen in Table 8 as takes after.

Based on Table 8, it is known that the noteworthiness esteem of the N-Gain for the control course is 0.117 > 0.05 nd so it can be concluded that H0 is acknowledged. In other words, the N-Gain information in both the control and exploratory classes are ordinarily dispersed.

Table 8. Normality Test Results

	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	Df	Sig.	Statistic	df	Sig.
NGain_Control	.135	34	.117	.938	34	.054
NGain_Experiment	.132	34	.142	.930	34	.031

a. Lilliefors Significance Correction

Homogenity Test

The reason of this test is to decide whether the N-Gain change within the test and control classes is the same. The analyst will conduct this test utilizing SPSS adaptation 22. The comes about of the homogeneity test is the importance esteem for the Levene's test is 0.00 < 0.05 so it can be concluded that H0 is rejected After conducting the prerequisite tests, the following step is theory testing utilizing the Free Test t-Test. Based on Table 8, the noteworthiness esteem is 0.000 < 0.05 so H0 is rejected. This demonstrates that there's a distinction within the normal N-Gain between the control and exploratory classes. Thus, the educational game media with an ethnomathematics approach based on Banyumas culture is effective in enhancing students' mathematical understanding in seventh-grade geometry at SMP Negeri 1 Ajibarang.

Discussion

The researcher conducted a study on the development of educational game media with a culturally-based ethnomathematics approach from Banyumas, concentrating on geometry content to improve seventh-grade pupils' comprehension of mathematics at SMP Negeri 1 Ajibarang, Banyumas Regency. The study population includes all seventh-grade students, totaling seven classes with an overall count of 237 students. The sampling for the experimental and control classes was done by lottery. The lottery results designated class VII A, with 34 students, as the control group and class VII B, with 34 students, as the experimental group. The material used in this study is geometry because it remains a challenging topic for seventh-grade students.

In the experimental class, learning was conducted using educational game media with a culturally-based ethnomathematics approach from Banyumas, while the control class was taught without this media. The focus of this study is the students' mathematical understanding. The purpose of this study is to develop valid and effective educational game media with a culturally-based ethnomathematics approach from Banyumas for geometry material to improve seventh-grade students' mathematical understanding.

The test instruments used are pretest and posttest questions, which were first tested for validity and reliability on classes other than those used in the study before being administered to the experimental and control classes to assess their suitability. The

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class used for testing validity and reliability was class VIII F, which has 33 students. The results showed that four questions were invalid: questions number 2, 3, 6, and 7. The remaining 10 valid questions were deemed suitable as research instruments.

The ADDIE approach (Analysis, Design, Development, Implementation, Evaluation) was applied in the development of the instructional media. Analysis is the first step. Interviews with various seventh-grade students and seventh-grade mathematics instructors at SMP Negeri 1 Ajibarang were conducted during this phase. The results indicated that the average seventh-grade students have low mathematical understanding, with pupils finding it challenging to establish the required or sufficient conditions for concepts and to communicate ideas across various mathematical formats. Additionally, teachers had not been using supportive media for mathematics instruction, relying solely on textbook resources and Student Worksheets. Most students already own mobile phones or laptops and prefer playing games over studying mathematics. According to students, learning is boring, so they prefer playing games; however, teachers believe that games contribute to students' reluctance to study. Nonetheless, integrating mathematics education with games could capture students' attention, as they have not previously used educational games, potentially increased their motivation and aided in their understanding of the subject. To address these issues, educational game media with a culturally-based ethnomathematics approach from Banyumas was developed. This educational game plays a crucial role in assisting students in the learning process. By linking the material with the educational game, it is hoped to create a new learning environment and enhance students' mathematical understanding.

The second stage is Design. In this stage, the researcher undertakes several tasks: 1) designing the framework for the educational game media with a culturally-based ethnomathematics approach from Banyumas, including the game name, theme design, fonts, and more. 2) Determining the material, describing the developed game, developer identity, instructions, presentation of geometry material, and practice questions. 3) Structuring the seventh-grade geometry material to be explained, including flat shapes and solid shapes. 4) Developing a game related to geometry material connected with Banyumas culture. 5) Creating a storyboard for the educational game media with a culturally-based ethnomathematics approach from Banyumas using PowerPoint.

The third stage is Development. In this development stage, the product is developed using Adobe Flash Professional CC 2015. The developed educational game media comes in the form of an Android application (.apk) and a computer application (.exe), facilitating students' use of the educational media.

The fourth stage is Implementation. In this stage, the developed product must be tested to determine whether the educational game media is valid and suitable for use in seventh-grade mathematics instruction on Geometry. Validation was conducted by material and media experts. The validation results showed an average percentage of 90.48% from the material expert assessment, which falls into the "Very Valid" category. The average percentage from the media expert assessment was 92.50%, also categorized as "Very Valid." These results indicate that the educational game media is suitable for use in seventh-grade mathematics instruction on Geometry. After revising the product based on expert suggestions, it was then tested in a small group trial, involving 15 students from class VIII-F. The results showed that the interest aspect was categorized as "Very Interesting" with a percentage of 92.00%, the material aspect was "Very Interesting" with a percentage of 93.33%, and the language aspect was "Very Interesting" with a percentage of 96.67%. The small group trial yielded an average score percentage of 93.67%, categorized as "Very Interesting." Thus, the educational game media with a culturally-based ethnomathematics approach from Banyumas is deemed "Very Interesting" for use in seventh-grade Geometry instruction.

Evaluation is the final phase. At this stage, the researcher utilized the N-Gain exam to assess whether students' mathematical comprehension had improved or decreased. To determine if there were significant differences in the average scores between the experimental and control classes, a t-test was conducted alongside the N-Gain test. The t-test results were analyzed to address the research question regarding the effectiveness of educational gaming media in enhancing students' mathematical knowledge. Additionally, the N-Gain test was used to evaluate any changes between the pretest results, obtained before instruction, and the posttest results, obtained after instruction. Based on the N-Gain results, the experimental class was categorized as "High" with an average score of 0.73, as shown in Table 3, while the control class was categorized as "Moderate" with an average score of 0.43, as shown in Table 3. Additionally, a t-test was conducted with the decision criterion that the educational game medium is considered successful in enhancing students' mathematical comprehension of geometry if the probability value (Sig.) is less than 0.05. The t-test results, which revealed a Sig. (2-tailed) = 0.000 < 0.05, indicate that the instructional gaming media effectively improves students' geometric mathematical comprehension.

The results of this research align with research conducted by (Komarudin et al., 2019) which concluded that MATCOM-based teaching materials are feasible, interesting, and effective for improving the mathematical understanding of class VII junior high school students in Bandar Lampung. Apart from that, (Satrio, 2020) also produced the educational game "Math Kingdom" which is suitable from the aspects of validity and effectiveness so it is hoped that the resulting learning tools can be used in learning

activities and can make it easier for teachers and students to carry out the learning process. Furthermore, (Febriani et al., 2023) also proved that the effectiveness of the mathematics educational game assisted by RPG maker Mv flat building material on the mathematical problem-solving abilities of class VII students at SMP Negeri 6 Kayan Hilir reached the effective criteria by calculating the posttest results using the average formula 71.43%. In addition, the application of problem-solving methods and jigsaw cooperative learning can also improve students' understanding of mathematical concepts (Turrizkiyah & Utomo, 2016; Widyastuti, 2015). The results of this research are in line with research conducted by (Azizah & Kumala, 2023) which can also improve the ability to understand mathematical concepts by using Geogebra software which is taught using the demonstration method.

Conclusion

Based on the research conducted, it can be concluded that the educational game media is considered valid according to the validation results from material and media experts. The material expert gave an assessment with an average percentage of 90.48%, categorized as "Very Valid," while the media expert gave an average score of 92.50%, with the same category. This result is also supported by the product attractiveness questionnaire, which shows an average score of 88.13% with the category "Very Interesting." The math teachers gave an assessment with an average of 83.08%, also in the "Very Interesting" category. In addition, the educational game media has proven effective in improving students' mathematical understanding. This is evidenced by the average N-Gain score in the experimental class being 0.73 (in the "High" category), higher than the control class which has an average N-Gain of 0.43 (in the "Medium" category).

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