

# KAHOOT ETHNOMATEMATICS: INNOVATIVE INTERACTIVE QUIZ MEDIA IN SPATIAL GEOMETRY LEARNING FOR NINTH GRADE STUDENTS

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**Abstract.** This study aims to develop an interactive Kahoot-based quiz tool that integrates ethnomathematics into the teaching of three-dimensional shapes. The background of this study is students' difficulty in understanding concepts and formulas, as well as the limited use of technology-based learning tools that highlight local wisdom. The method used is Research and Development (R&D) with a 4-D development model modified into a 3-D model (Define, Design, Develop). The study subjects included 4 mathematics lecturers and 3 junior high school teachers at the Assalam Islamic Boarding School in Pontianak. Data collection techniques used interviews and questionnaires, while validation analysis was conducted using Gregory's theory. Results from the define stage indicated a high need for innovative and enjoyable learning. In the design phase, the media was organized through a storyboard and then validated in the development phase. The analysis results showed a Content Validity Index (CVI) of 0.93 for the media aspect and 1.00 for the language and content aspects, which fall into the very high validity category. Thus, this interactive quiz media is deemed suitable for use in supporting competitive, meaningful, and contextual learning through the integration of culture and technology. However, this study is limited to the development phase and does not include a large-scale pilot test; furthermore, it has not measured the impact on student learning outcomes. Therefore, it is recommended that future research conduct a more extensive field trial and assess the effectiveness of the media on student learning outcomes, motivation, and engagement.

**Keywords:** Interactive Quiz, Kahoot Application, Ethnomathematics

**Abstrak.** Penelitian ini bertujuan untuk mengembangkan media kuis interaktif berbasis Kahoot yang terintegrasi etnomatematika pada materi bangun ruang. Latar belakang penelitian ini adalah kesulitan peserta didik dalam memahami konsep dan rumus, serta terbatasnya penggunaan media pembelajaran berbasis teknologi yang mengangkat kearifan lokal. Metode yang digunakan adalah Research and Development (R&D) dengan model pengembangan 4-D yang dimodifikasi menjadi 3-D (Define, Design, Develop). Subjek penelitian melibatkan 4 dosen matematika dan 3 guru SMP Pesantren Assalam Pontianak. Teknik pengumpulan data menggunakan wawancara dan angket, sedangkan analisis validasi dilakukan dengan teori Gregory. Hasil tahap define menunjukkan tingginya kebutuhan akan pembelajaran yang inovatif dan menyenangkan. Pada tahap design, media disusun melalui storyboard, kemudian divalidasi pada tahap develop. Hasil analisis menunjukkan nilai Content Validity Index (CVI) sebesar 0,93 pada aspek media dan 1,00 pada aspek bahasa serta materi, yang termasuk dalam kategori validitas sangat tinggi. Dengan demikian, media kuis interaktif ini dinyatakan layak digunakan untuk mendukung pembelajaran yang kompetitif, bermakna, dan kontekstual melalui integrasi budaya dan teknologi. Namun, penelitian ini terbatas pada tahap pengembangan tanpa uji coba luas serta belum mengukur dampak terhadap hasil belajar peserta didik. Oleh karena itu, disarankan penelitian selanjutnya melakukan uji coba lapangan secara lebih luas dan menguji efektivitas media terhadap hasil belajar, motivasi, dan keterlibatan peserta didik.

**Kata Kunci:** Kuis Interaktif, Aplikasi Kahoot, Etnomatematika

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## INTRODUCTION

Technology has developed rapidly in various fields, one of which is education. The world of education is a milestone in the advancement of human resources capable of creating technology itself. According to Hadidi et al., (2021), technological advances provide convenience and effectiveness in the learning process, enabling teaching and learning activities to be carried out remotely without being constrained by time or location. This progress has brought about various types of media that serve as the main tools in learning. According to Rumengan et al., (2019), the term “learning media” originates from the Latin word “medius,” which literally means an intermediary or a tool for conveying messages from the sender to the receiver. Media plays a crucial role as a tool for conveying ideas or concepts to the audience. With media, content can be presented in a more visual, interactive, and easily understandable manner. This makes media a bridge between technology and more effective and enjoyable learning processes. In teaching and learning activities, media also encourages active student participation. Novialdi & Thahir (2020) emphasize that the use of learning media greatly influences the development of science and technology, especially in the education sector. One example of appropriate and applicable learning media is interactive quizzes.

Interactive quizzes make it easier for teachers to deliver lesson material. They also encourage student participation and enthusiasm for learning because the method is more exciting and challenging. Centauri (2019) explains that interactive quizzes are applications that present lesson material in the form of questions. These applications are designed to help students deepen their understanding and expand their knowledge of the topics being studied. In mathematics education, the use of interactive quizzes can be combined with the ethnomathematics approach, which is a method that connects mathematical concepts with local cultural elements. According to Fauzi & Lu’luilmaknun (2019), ethnomathematics is a method of teaching mathematics that connects lesson material with the local culture around the school environment. One topic that is suitable for linking with culture is spatial figures. Therefore, teachers should not only focus on the culture in the school environment but also introduce various local cultures to students during the learning process.

Based on an interview with a junior high school mathematics teacher in Pontianak, it was found that students' learning outcomes in solid geometry were low. This was evident from the fact that only 30% of students achieved the minimum passing grade (70) in solid geometry. In addition, the teacher explained that students easily became bored in class and did not like having to memorize many formulas. Upon further investigation, the teacher mentioned that media and technology are rarely used in the learning process, and teachers almost never

integrate mathematics learning with local culture, especially in the spatial geometry subject. The quizzes conducted by teachers in class are limited to questions from the textbook. Learning media actually has a significant impact on educators in the teaching and learning process. This media is an important effort to encourage student knowledge, so that learning objectives can be achieved (Maryanti & Suwardi, 2024). And by integrating culture into the learning process, students not only learn abstract concepts but also understand that mathematics has a close relationship with daily life and local wisdom they are familiar with.

This study was designed to highlight the urgency of utilizing technology in education as a tool that facilitates and enhances the learning process. Learning media play a crucial role in conveying concepts visually and interactively to encourage active student participation. The integration of interactive quizzes (specifically the Kahoot app) with the ethnomathematics approach a method that links academic content to local cultural elements in the school's surrounding environment was employed. This is based on real-world conditions in the field where students' learning outcomes in mathematics regarding three-dimensional shapes remain low (only 30% achieve mastery), students feel bored with formula-memorization methods, and there is a lack of integration between technology and local wisdom in learning. By integrating Pontianak culture into a digital platform, this initiative is positioned as an innovative solution to create a learning ecosystem that is enjoyable, competitive, and capable of transforming abstract concepts into more concrete ones for students. Therefore, this study aims to develop an interactive Kahoot-based quiz that integrates ethnomathematics into the teaching of three-dimensional shapes.

## **METHOD**

This research was conducted using a Research and Development (R&D) approach. The R&D approach was chosen based on the main objective of the research, which was to develop an educational product in the form of an interactive quiz based on the Kahoot application that combines an ethnomathematics approach. This method was considered the most appropriate because it not only focused on research activities but also involved the process of designing and refining the resulting learning media. This study is based on the 4D development model, which is considered appropriate for meeting the criteria for designing a learning product. The 4D Model stands for Define, Design, Development, and Disseminate (Harjanto et al., 2022), which has been adapted into a 3-D model comprising the Define, Design, and Develop stages. This is due to the researchers' time constraints. All of these stages are interrelated and form a systematic process for creating effective instructional materials.

**Define**

The define stage aims to establish and identify instructional needs. At this early stage, an analysis is conducted to determine learning objectives and potential obstacles in developing teaching materials (Harjanto et al., 2022). There are five key steps in this process: initial and final analysis (front-end analysis), analysis of student characteristics (learner analysis), task analysis, concept analysis, and the formulation of specific and targeted learning objectives.

**Design**

The design stage is a process that begins with determining the media to be used, selecting the appropriate format, and designing the form of media to be developed (Zamsiswaya et al., 2024). In this study, the media designed was an interactive quiz using the Kahoot application, which was combined with an ethnomathematics approach as part of an innovation in the delivery of learning materials.

**Development**

The development stage is the phase in which learning media begins to be realized or developed based on the design that was prepared in the previous design stage (Zamsiswaya et al., 2024). In this stage, a series of quality tests are carried out by experts, including validation by media experts, language experts, and subject matter experts to ensure that the media produced is suitable for use in the learning process. The technique used to collect data in this study was interviews with interview guides as instruments, as well as questionnaires using validation instruments. The study subjects included 4 mathematics lecturers and 3 junior high school teachers at the SMP Pesantren Assalam Pontianak. Interviews were conducted directly with a junior high school mathematics teacher in Pontianak to obtain information related to learning media needs. On the other hand, questionnaires were used as a tool to assess the feasibility of the products that had been developed. The data analysis technique applied was quantitative descriptive, which involved calculating and describing the validation results from the experts.

## **RESULTS**

### **Define**

#### *Initial and final analysis*

From interviews with teachers at SMP Pesantren Assalam Pontianak, it was found that the majority of students had difficulty understanding mathematical concepts. This was evident from the results of daily tests on spatial geometry, with 70% of students scoring below the minimum passing grade of 70. Student motivation was also low. This is because the mathematics taught involves too much memorization of formulas. Teachers also lack the use of learning media, even though students prefer to learn through play. Additionally, teachers rarely connect lesson materials with local cultural elements, such as the culture found in Pontianak City. Discussions on spatial geometry are typically limited to objects around the students.

#### *Student Analysis*

The teacher explains that the characteristics of the students include their attitudes, knowledge, skills, and learning styles. Many students still have low motivation to learn. In terms of skills, students show good abilities in the arts, but are weak in arithmetic. Their learning style tends to be kinesthetic, where they find it easier to understand material through hands-on practice than through theoretical learning.

#### *Concept analysis*

This analysis is conducted prior to designing learning media and conducting research, with the aim of ensuring that all material is conveyed in its entirety and organized systematically, thereby assisting students in understanding and discovering the meaning of the concepts being studied (Harjanto et al., 2022). The topic that will be used as the basis for the development of this media is material about spatial figures. In understanding the concept of spatial figures, students tend to only associate them with objects around them. Therefore, the researcher provides a new impression by introducing spatial figures using an ethnomathematics approach.

### **Design**

#### *Selection of learning presentation format*

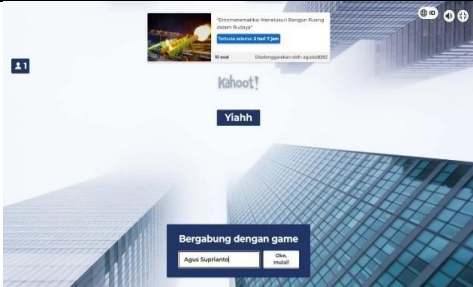



The basis for selecting learning media comes from the results of preliminary analysis and the characteristics of the students. The media used should be tailored to the individual needs and learning styles of the students. Therefore, interactive quizzes based on the Kahoot

application were selected as the learning media. The purpose of designing this media is so that students can learn in a fun atmosphere while gaining a deeper understanding of the culture of West Kalimantan.

### *Designing the interactive quiz using the Kahoot application*

The interactive quiz was designed using the Kahoot application by creating a step-by-step storyboard. The design of this medium was created directly by the researcher and can be seen in Table 1, which contains the design of the interactive quiz using the Kahoot application as presented below:

**Table 1. Storyboard**

Description	Visualization
<p>Initial display on the interactive quiz. At this stage, students are directed to join the quiz by entering their names in the column provided.</p>	
<p>The second screen of the interactive quiz. At this stage, a number countdown is displayed. To proceed to the next step, which is the quiz questions.</p>	
<p>The third screen in the interactive quiz. At this stage, the quiz questions that have been provided are displayed. The number in the upper left corner indicates the total number of questions. The number at the bottom indicates the duration of the question display.</p>	
<p>The fourth display on the interactive quiz. The interactive quiz uses multiple choice questions with rectangular answer boards. The image in the center of the media is a culture related to the interactive quiz material.</p>	

The fifth screen of the interactive quiz.

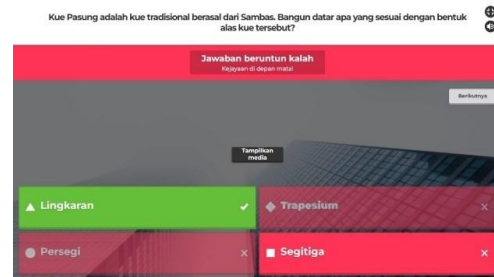
This screen shows the correct answer, marked in green on the multiple-choice board and in the rectangle above it.



The sixth screen in the interactive quiz

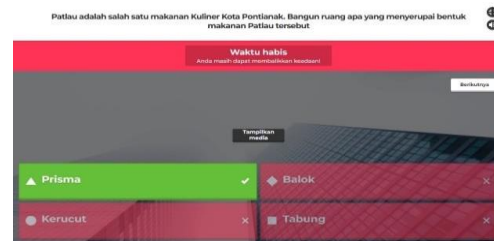
This screen shows the incorrect answer. It is exactly the same as the fifth screen, except for the color: if the answer is incorrect, it is red, and if it is correct, it is blue.

indicates the duration of the question display.



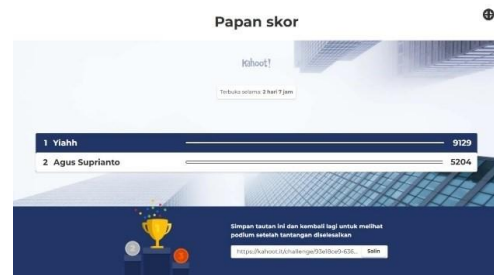
Seventh screen of the interactive quiz

This screen shows the time running out, which is counted as a wrong answer. The display remains the same, the only difference being the description.



Eighth screen of the interactive quiz

This screen shows the end of the interactive quiz. The name and number in the middle indicate the score of the interactive quiz participant.



## Develop

### *Media aspect*

The media was assessed through a validation process by two lecturers from the Faculty of Tarbiyah and Teacher Training, namely Mrs. RJ. and Mrs. KI. The following are the validation results provided by the two validators regarding the media aspect in the development of interactive quizzes. The validation results conducted by media experts using Gregory's scoring method (Gregory, 2015) showed that the Content Validity Index (CVI) obtained was 0.93. These assessment results place the interactive quiz in the category of very high validity, making it suitable for use in the learning process. However, there are several criticisms and suggestions from media experts that need to be considered for revision. One of these relates to the appropriateness of the theme (background), where media experts suggested using iconic elements of Pontianak City to align with the interactive quiz's topic. However, due to

limitations in uploading themes on the Kahoot app, adjustments were made by modifying the colors in the quiz. There is important feedback regarding the suitability of the visual theme. The validator suggested using iconic symbols of Pontianak City to give the quiz topic a contextual feel. The technical limitations of the Kahoot application, which do not allow for the upload of custom themes, were addressed by adjusting the quiz colors to better align with the local identity. This change demonstrates creative adaptation to platform limitations while maintaining the relevance of the content to the cultural context of the learners.

#### *Language Aspect*

The language aspect was validated by two validators. The first validator was Mrs. UI a teacher at SMP Pesantren Assalam, and the second validator was Mrs. Istmia Ubaydilah, S.Pd, a teacher at MAS Assalam Pontianak. The following are the results of the validation of the language aspect by the two validators. The validation results from the language expert validators indicate that the Content Validity Index (CVI) score obtained is 1. The score obtained indicates that the interactive quiz developed has very high validity, making it suitable for use as a learning medium. However, there are some suggestions and criticisms from the language experts that need to be considered for revision. One of them is the use of the word “hitunglah,” which is deemed inappropriate. The language expert suggested replacing it with words like “how much” because the question format uses multiple-choice and requires a faster answer.

This indicates that the sentences, grammar, and use of terms in the interactive quiz are in accordance with the rules of good and communicative language (Depdiknas, 2016). The feedback provided regarding the replacement of the word “hitunglah” with ‘berapakah’ demonstrates attention to the efficiency of understanding questions in multiple-choice format. This change is not merely a linguistic technicality but also relates to the psychological aspects of learners, where the word “berapakah” is considered to more quickly trigger a response.

*Material aspects.* In terms of media, there were two validators involved in the assessment process. The first validator was Mrs. Hidayu Sulisti, S.Si., M.Pd., a lecturer from the Faculty of Tarbiyah and Teacher Training, while the second validator was Mr. Mustaqim, S.Pd., a teacher at SMA Negeri 10 Pontianak. The following are the results of the validation of the material aspect by the two validators.

The results of the validation conducted by the material experts show that the Content Validity Index (CVI) score obtained is 1. This score reflects that the interactive quiz has high validity and is suitable as a learning tool. However, there are several suggestions and criticisms from the material experts that need to be taken into consideration for revision. One of them is

on question number 10, which is deemed inappropriate because it relates to finding the nets forming a cube and the wording is considered unclear. Therefore, the subject matter expert suggests changing it to a question about the number of squares arranged in the image. The change to the number of squares in the image is considered more appropriate, as it avoids potential ambiguity and improves the clarity of the concept being measured. This improvement is in line with the principle of clarity in learning evaluation instruments (Arikunto, 2018).

Overall, the results of the development stage show that the interactive quiz has met high feasibility criteria in all three aspects. The revisions made in terms of visuals, language, and material were intended to strengthen the quality of the instrument, rather than fundamentally overhaul it. This indicates that the initial design of the interactive quiz was on the right track. Additionally, the validation process with two validators for each aspect provides higher reliability in assessment, as it considers diverse perspectives. These results support the theory that involving experts from various fields in the development of educational media can enhance the quality of the final product (Borg & Gall, 1983).

## **DISCUSSION**

The definition phase revealed a significant gap between students' needs and the reality of mathematics learning at SMP Pesantren Assalam Pontianak, particularly regarding three-dimensional shapes. The data indicate that the low level of student learning achievement, with 70% of students scoring below the minimum passing grade, stems from a learning approach that remains conventional and tends to rely on memorizing formulas. In line with the principles put forward by Zamsiswaya et al., (2024), the identification of this problem serves as a crucial starting point, indicating that the lack of utilization of learning media has hindered the visualization of abstract geometric concepts. This aligns with the view of Siregar (2025), who state that mathematics learning often fails because it is separated from the cultural context and social reality of students, making the material feel foreign and difficult to understand.

The urgency of developing educational media becomes increasingly evident when considering students who have a dominant kinesthetic learning style and a strong interest in the arts, yet struggle with arithmetic skills. Ethnomatematics-based educational media serves as a methodological solution to bridge these characteristics with instructional content. By integrating elements of the local culture of Pontianak, this media serves not only as a visual aid but also as an instrument to provide a "new perspective" on learning. The use of this cultural context is supported by the views of D'Ambrosio (2021), the pioneer of ethnomatematics, who asserts that linking mathematics to local cultural practices can boost students' self-esteem and

interest in science. Through this approach, the concept of three-dimensional shapes is deconstructed from mere numbers into an exploration of cultural objects that are familiar to students.

As emphasized by Harjanto et al., (2022), the systematic organization of material through an ethnomathematics framework helps students discover the meaning of concepts independently. This is supported by the research of Charitas et al., (2020), which demonstrates that learning based on local wisdom is effective in improving mathematical literacy because students learn by moving from concrete to abstract situations. Thus, the integration of Pontianak culture into learning media serves not only as a means of knowledge transfer but also as an effort to revitalize culture and a solution to the low motivation of students who have long been trapped in monotonous teaching patterns. During the design phase, the primary focus is on transforming the needs identified in the define phase into a concrete media prototype. The selection of the Kahoot platform as the basis for the learning media was based on the technology's alignment with the psychological characteristics of students at SMP Pesantren Assalam, who prefer a learning-through-play environment. In line with the framework proposed by Zamsiswaya, et al., (2024), the selection of this presentation format aims to create an interactive and positively competitive learning ecosystem. The use of interactive quizzes is viewed as a strategic solution to accommodate students' kinesthetic learning styles, where active engagement in responding to visual challenges can enhance memory retention of spatial geometry material, which has traditionally been perceived as boring

The integration of an ethnomathematics approach into the design of this Kahoot! adds value that sets it apart from conventional digital quizzes. The researchers did not merely present math problems but designed them through a systematic storyboard by incorporating elements of West Kalimantan's local culture as the central narrative. This is supported by the findings of Alawadhi (2021), who state that media designs adopting local wisdom can enhance cultural awareness while simultaneously facilitating the understanding of geometric concepts through the visualization of concrete cultural objects. Thus, this design phase successfully formulated a learning instrument that is not only technically valid through the creation of storyboards but also possesses strong contextual value for students in Pontianak City.

Next is the development phase, which aims to produce a valid and suitable educational media product through a series of expert evaluations. Based on the validation results from six validators covering media, language, and content aspects, this Kahoot-based interactive quiz with an ethnomathematics approach was found to have a very high level of validity overall. This means that, overall, the design, appearance, and visual components of the interactive quiz

are in line with the criteria for effective learning media (Sadiman et al., 2014). According to Ulfah et al., (2025), this validation process is crucial to ensure that the developed media truly aligns with learning objectives and field needs before implementation.

The involvement of two validators in each aspect ensures a high level of assessment reliability through expert triangulation. This reinforces Borg & Gall's (1983) theory that interdisciplinary collaboration in the development of educational media is crucial to the quality of the final product. Although there were some minor revisions to the visual aspects, word choice, and clarity of the questions, overall this interactive quiz has been theoretically validated and is ready to be used as a meaningful mathematics learning tool for students in Pontianak. The findings of this study imply that the integration of ethnomatematics-based interactive media, such as Kahoot, has the potential to transform mathematics learning from a formula-centered approach into a contextual and student-centered experience. This shift not only supports conceptual understanding of three-dimensional geometry but also encourages teachers to adopt more culturally responsive pedagogies that align with students' characteristics and local contexts. In practical terms, the developed media can serve as a model for designing innovative learning tools that combine technology, culture, and active learning strategies to improve student engagement and motivation. Furthermore, this study highlights the importance of incorporating local cultural elements into digital learning environments as a means of strengthening both academic achievement and cultural identity, thereby contributing to more meaningful and sustainable mathematics education practices.

## CONCLUSION

This study successfully developed an interactive quiz medium based on the Kahoot app using an ethnomatematics approach to three-dimensional shapes through a 4-D development model modified into a 3-D model. The results indicate that the medium possesses a very high level of validity, with a Content Validity Index (CVI) of 0.93 for the medium aspect and 1.00 for the language and content aspects, thereby deeming it highly suitable for use. This achievement effectively addresses students' need for innovative, enjoyable, and competitive learning methods, while also serving as a practical solution to facilitate the understanding of mathematical concepts through the integration of local Pontianak cultural wisdom and digital technology. Despite its promising results, this study has several limitations that should be considered. First, the development process was limited to the *develop* stage (3-D model), without proceeding to the *disseminate* stage; therefore, the media has not been tested on a wider scale to examine its effectiveness across diverse educational settings. Second, the validation

focused solely on expert judgment (media, language, and content), without involving direct field trials with students, meaning that its actual impact on learning outcomes, motivation, and engagement has not yet been empirically measured. Third, the study was conducted within a specific local context, namely SMP Pesantren Assalam Pontianak, and integrated local cultural elements from Pontianak, which may limit the generalizability of the findings to other regions with different cultural backgrounds. Additionally, the use of the Kahoot platform requires adequate technological infrastructure, such as stable internet access and digital devices, which may not be equally available in all schools. These limitations indicate that further research is needed to test the practicality, effectiveness, and adaptability of the developed media in broader and more varied contexts.

## RECOMMENDATIONS

It is hoped that this media will make the learning process more interesting, enjoyable, and relevant to the local culture introduced to students. In addition, this media is also expected to increase student motivation to learn, given their learning style, which favors a play-based learning method. For researchers, this learning media can be continued to the dissemination stage by considering the needs of students and the local culture that is appropriate to the characteristics of each environment.

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