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Validity and Practicality of the Game-Based Learning Media for Mathematical Logic Using the Quiz whizzer Application

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ABSTRACT

This research aims to assess the validity and practicality of game-based learning media using the Quiz Whizzer application among 26 students' class XII at Muhammadiyah 1 Sleman Vocational High School. The product was developed based on a needs analysis and the issues faced by students, with data collected from student surveys and interviews with mathematics teachers. This study follows the ADDIE development model, which consists of five stages: Analysis, Design, Development, Implementation, and Evaluation. The product was refined based on the validation results from media and content experts. The game-based learning media using the Quiz Whizzer application was found to be very valid, with an average validation score of 3.05 for media and a score of 3.46 for content. Furthermore, student responses indicate that the product is very practical for use by XII students at Muhammadiyah 1 Sleman Vocational High School, with a practicality percentage of 84.93%. Based on these findings, it can be concluded that the game-based mathematical logic learning media using the Quiz Whizzer application is both very valid and very practical.

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1. Introduction

The rapid advancement of technology is an inevitable aspect of today's world. Technology has developed at an astonishing pace, leading to a wide array of innovative products, such as mobile phones, which were once merely communication tools but are now smart devices equipped with various features (Javaid et al., 2023). Most people today own smartphones, particularly Android-based devices, which are used in various sectors. In education, smartphones can facilitate students' understanding of material, helping to construct effective and enjoyable learning processes (Yogyanto et al., 2024).

Educators in the millennial era must be able to integrate teaching media with technology. According to Knaus (2023) and Wahyuni et al. (2024), teaching media can create a fun and engaging learning atmosphere, fostering students' enthusiasm and making it easier to achieve educational goals. Teaching media now come in many forms, including both printed and electronic media (Ambe et al., 2024). It is crucial that the chosen teaching media align with and support the learning objectives to ensure those objectives are met.

Mathematics is a critical subject that requires continual improvement because it enhances creativity in solving problems, which, in turn, helps develop students' reasoning skills (Goos et al., 2023). However, Cirillo et al. (2024) and Siswanto et al. (2024) note that mathematics remains one of the most challenging subjects for students to learn. To counter this perception, innovative approaches are needed to make learning more enjoyable and effective, such as developing mathematics learning media to complement the learning process. Despite this, the implementation of advanced technology in learning media remains rare due to the limited technological skills of teachers.

Interviews conducted with two mathematics teachers at Muhammadiyah 1 Sleman Vocational High School revealed several key insights. The first teacher noted that students enjoy playing games in class and are more enthusiastic when digital learning media, such as PowerPoint and Quizizz software, are used because these tools offer features that boost student motivation. However, the use of digital learning media in mathematics classes has not yet been fully optimized.

A similar conclusion was drawn from the second teacher, who explained that the teaching process still relies heavily on traditional instruction using the chalkboard, with smartphones being underutilized. As a result, many students use their phones during lessons without the teacher’s knowledge. This aligns with Slameto (2015), who states that if teaching methods and strategies remain simplistic, students are likely to become bored and disinterested in lessons.

One mathematics topic that can stimulate students' creativity is mathematical logic. However, test scores in the XII on this topic show that only five students scored above the minimum passing criterion of 75. Interviews with several students revealed that they still find mathematical logic difficult to understand and are often confused by its subtopics, such as conjunction, negation, implication, and other related concepts.

Additionally, the researcher distributed a pre-research questionnaire via Google Forms to 26 students from the XII Multimedia 1 class at Muhammadiyah 1 Sleman Vocational High School. The results indicated that the teaching media currently used by the teacher are insufficient for learning mathematics, and students

expressed a need for innovative learning media to help them better understand mathematical concepts and enhance their skills. This information is presented in Figure 1 below.

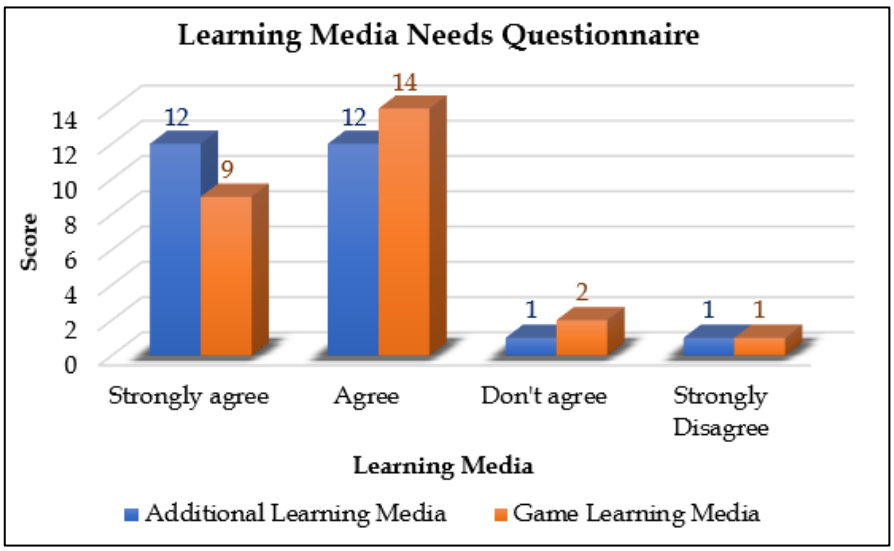

Figure 1. Results of the Pre-Research Survey on the Need for Learning Media

Based on the description above and considering the information that 22 out of 26 students prefer colorful and illustrated learning media because it is not boring, 17 out of 26 students enjoy playing games using their smartphones, and all students bring their smartphones to school, it can be concluded that students need innovative learning media presented through smartphones with colorful visuals and illustrations to help them learn mathematics. Therefore, this study aims to develop game-based learning media using the Quiz whizzer application.

Quiz whizzer is an educational game-based application that can be used to deliver material and serve as a learning evaluation platform in a competitive format. Students are motivated to earn as many points as possible to achieve the highest rank (Fatmawati & Izadi, 2024). To assist educators, Quiz whizzer offers features that allow questions to be formatted into engaging games, making it particularly suitable for teaching mathematics, as it boosts students' enthusiasm and curiosity about the subject. Quiz whizzer can be used both in the classroom and at home as part of students' homework assignments.

Additionally, Quiz whizzer provides features that enable users to run multiple games simultaneously, customize question types, set time limits for each question, assign scores, manage player movement, and adjust the game board (Faijah et al., 2022). Some of the advantages of Quiz whizzer include a variety of game templates, the ability to present questions in an engaging game format, and the option to review material at the end of the game. However, one limitation is that some of its advanced features require a paid subscription (Jeheman et al., 2019).

The pre-research survey revealed that 19 out of 26 students consider mathematical logic a difficult topic to understand. This is supported by an interview with one of the mathematics teachers at Muhammadiyah 1 Sleman Vocational High School, where it was noted that only five students scored above the minimum passing criterion. The difficulties are particularly pronounced in distinguishing between subtopics of mathematical logic, such as conjunction, negation,

implication, and other related concepts.

Mathematical logic is well-suited for game-based learning media using the Quiz whizzer application because it does not require students to focus on complex calculations or formulas. This allows them to answer questions without taking too much time. Therefore, this study will develop game-based learning media that optimizes the use of students' smartphones through the Quiz whizzer application, resulting in learning media that are both valid and practical.

2. Method

This study employs the ADDIE development model (Analysis, Design, Development, Implementation, Evaluation). The research subjects include subject matter experts, media experts, and 26 students from Class XII Multimedia 1 at Muhammadiyah 1 Vocational School in Sleman. The data analysis techniques used are validity and practicality analyses. The validity analysis is derived from the validation questionnaire results provided by subject matter experts and media experts, following the 4-point Likert scale scoring system developed by Widoyoko (2017), which includes four categories: strongly agree, agree, disagree, and strongly disagree, as detailed below. The categorization of validity results can be seen in the following table.

Table 1. Guidelines for Validity Categorization

Interval Score	Category
$3 \leq \bar{x} \leq 4$	Very Valid
$2 \leq \bar{x} < 3$	Valid
$1 \leq \bar{x} < 2$	Less Valid
$0 \leq \bar{x} < 1$	Invalid

Source: Riyani et al. (2017)

Meanwhile, the analysis of the practicality of the media is obtained from the results of the student response questionnaire, which is calculated using the formula.

Table 2. Guidelines for Categorizing Student Responses

Range of score categories	Category
75% ≤ RS ≤ 100%	Very Practical
50% ≤ RS < 75%	Practical
25% ≤ RS < 50%	Less Practical
0% ≤ RS < 25%	Impractical

Source: Sadewa et al. (2022)

3. Results and Discussion

Results

The development of educational game media is designed to meet the needs and challenges of mathematics learning in Class XII Multimedia 1 at Muhammadiyah 1 Sleman Vocational High School, utilizing the Quiz whizzer software. This product is designed online through the platform https://quizwhizzer.com. The steps of development carried out using the ADDIE model are as follows:

Analyze

The analysis was conducted to understand the initial conditions of the students, the teachers, and the types of media used in the learning process. Based on observations, it was found that some students often play games on their phones during lessons. Additionally, teachers frequently use less interactive learning media, which leads to passive student participation. Therefore, based on this analysis, the selected media is **game**-based learning media, aiming to engage students and encourage active participation in the teaching and learning activities. Educational media is beneficial for increasing learning motivation, making students less bored during the learning process (Suyahman et al., 2024).

Design

In the design stage, the objective is to create the educational media that will be developed. The design activities in this research involve crafting a design for interactive game-based learning media using the Quiz whizzer application. At this stage, the **researcher** needs to outline the framework for the interactive game learning media, which includes creating questions and answer keys, designing player icons featuring cartoon and fictional characters, setting the game background to resemble an adventure, and incorporating weapon features for the players. This design aims to engage students and encourage their active participation in teaching and learning activities. Below is the design created by the researcher.

Figure 2. Game Learning Design

Based on the image above, students can actively participate in learning through this game. With a fun and competitive format, students will be more motivated to learn. Quiz Whizzer allows students to compete in groups or individually, creating an interactive learning environment. Below is the evaluation using this media.

Figure 3. Final Learning Outcomes Using Media

Based on the image above, one of the main advantages of using Quiz Whizzer is the instant feedback provided after students answer questions, allowing them to understand their mistakes and improve their comprehension of mathematical logic concepts immediately. In addition, teachers can use the quiz data to evaluate students' understanding of the material taught, helping them identify areas that need reinforcement and design subsequent learning activities. Furthermore, students are taught to apply logic in everyday problem-solving, thereby enhancing their critical and analytical thinking skills.

Development

Development is the stage of interpreting the design into a tangible form, making the product the outcome of this stage. The development undertaken involves a game-based learning media product using the Quiz Whizzer application. This product was validated by media and content experts, followed by revisions to produce a product that is better than the previous version. The validation results from the media and content experts are presented as follows.

Table 3. Validation by Media and Content Experts

Media Expert Validation			**Material Expert Validation**		
Validator	Average score	Category	Validator	Average score	Category
I	3,00	Very Valid	I	3,23	Very Valid
II	2,83	Valid	II	3,33	Very Valid
III	3,33	Very Valid	III	3,83	Very Valid
Average	3,05	Very Valid	Average	3,46	Very Valid

Based on the table above, there are 3 media experts and 3 material experts who provide input, and scores related to the game media compiled by researchers, where in validation the media experts got the average score from the three media experts, namely 3.05 with a very valid category. In addition, in the media expert validation, the average score from the three material experts was 3,46 with a very valid category. So that the media can be continued at the next stage, namely implementation to students.

Implementation

During implementation, a trial process was carried out to see the practicality of the learning media for students. At this stage, product trials are carried out in large classes, after the product is revised based on input and comments from expert validators. At the trial stage the following results were obtained.

Table 4. Student Trials

Total Assessment Score for All Students in Each Aspect			Total Score	Precentage
Comprehensive View	**Presentation of Material**	**Benefit**		
96	90	97	265	84,93%

Based on the calculations from 26 questionnaires completed by students in the XII Multimedia 1 class, a total score of 265 was obtained, resulting in a percentage of 84,93%. Considering the guidelines for interpreting practicality, this percentage falls within the category of very practical (75% ≤ RS ≤ 100%).

Evaluation

Evaluation in this research is a continuous step performed at each stage of development to ensure that the Game-Based Learning Media for Mathematical Logic using the Quiz Whizzer application meets the standards of validity and practicality. Evaluation is conducted periodically to assess the quality and effectiveness of the media, as well as to identify areas that need improvement or enhancement. Throughout the development process, evaluations are carried out by various stakeholders, including content experts, media experts, and students, to provide useful input and feedback for improving the media. Each piece of input and feedback from the evaluation is utilized for revisions and enhancements to the media in accordance with the research objectives and students' learning needs. Thus, evaluation becomes an integral part of the media development process aimed at ensuring that the final product has high quality and can provide maximum benefits for students' learning processes.

Discussion

The use of technology in education continues to evolve alongside the increasing accessibility of smart devices such as smartphones (Astiwi & Siswanto, 2024). According to Yongshuna & Fernando (2024), in recent years, technological developments have introduced various innovations in teaching methods, providing educators with opportunities to create more interactive and engaging learning environments. In the context of mathematics education, technology significantly contributes to enhancing student engagement in the learning process. Through the use of technology, students become more involved and interested in teaching and learning activities, which can help improve their understanding of the material being taught (Sah et al., 2022; Pisriwati et al., 2024).

Today, educators are expected to combine instructional media with technology to **make** the learning process more effective and enjoyable. As stated by Fuaddi et al. (2020) and Siswanto et al. (2024), the use of appropriate learning media can create a more enjoyable learning environment and motivate students to be more

active in learning. The use of technology in education also provides space for teachers to develop innovative teaching strategies that meet students' needs. In this regard, this research aims to develop game-based learning media using the Quiz Whizzer application to support mathematics learning at Muhammadiyah 1 Sleman Vocational High School.

The development of game-based learning media is based on needs analysis results, which indicate that most twelfth-grade students at Muhammadiyah 1 Sleman Vocational High School are more enthusiastic about learning using digital media than conventional media. Observations and interviews revealed that students tend to be more responsive and actively participate when using digital media. Games are considered an effective medium to attract students' attention and increase their participation in learning. Game-based learning media is expected to accommodate students' needs to learn in a fun yet educational way (Iswara et al., 2023; Putri et al., 2024).

Interviews with two mathematics teachers at Muhammadiyah 1 Sleman Vocational High School revealed that many students tend to play games during the learning process. This phenomenon indicates a tendency for students to prefer activities involving game elements, even outside the context of learning. Therefore, game-based learning media is seen as an effective solution to address this issue. By providing learning media that combines game elements, students can continue learning without feeling bored or losing interest.

In the design process of this learning media, the Quiz Whizzer application was chosen as the platform to be used. Quiz Whizzer allows the creation of mathematics questions presented in the form of interactive games (Fatmawati & Izadi, 2024). Some features offered by Quiz Whizzer include player avatars, adventure backgrounds, and score competitions. With these features, students can learn mathematics in a more competitive and enjoyable environment, which ultimately enhances their motivation to learn.

One of the advantages of Quiz Whizzer is its ability to provide instant feedback after students answer questions (Faijah et al., 2022). This feature allows students to immediately know their mistakes and correct them quickly. Instant feedback is crucial in the learning process as it helps students correct their understanding immediately. Thus, students can gain optimal learning benefits and do not have to wait long to see the results of each question they answer.

In the development stage of this media, the researchers involved media and content experts to validate the product's effectiveness and feasibility. The validation process aims to ensure that the developed learning media meets the necessary quality standards. The validation results show that this game-based learning media is highly valid, with an average score of 3,05 from media experts and 3.46 from content experts. These results indicate that the media is suitable for implementation with minor revisions based on expert feedback.

The implementation of this learning media was tested on 26 students in a large class. This trial shows that the game-based learning media is highly practical, with a total score of 265 and a percentage of 84,93%. These results align with the findings of Tanikawa et al. (2024) and Smit et al. (2023), who state that students respond positively to game-based learning media, making them more engaged in the mathematics learning process. The trial results indicate that game-based learning

media effectively increases student participation and improves their motivation to learn.

The use of Quiz Whizzer as game-based learning media not only enhances student engagement but also helps them understand complex mathematical logic concepts, which are often challenging for students. Based on interviews with teachers, mathematical logic material frequently presents challenges for students. However, with game-based media, students can more easily distinguish sub-materials such as conjunctions, negations, and implications. This finding is consistent with the research by Goos et al. (2023) and Tytler et al. (2023), which shows that mathematics is one of the most challenging subjects for students.

This research makes an important contribution by introducing broader technology use in learning, especially in mathematics, which students often consider difficult. Implementing technology in mathematics learning enables a transformation from traditional teaching methods to more modern and engaging approaches. With technology, teachers have more options to present material in dynamic and contextual ways, allowing students to more easily grasp abstract concepts that often hinder their understanding of mathematics (Pisriwati et al., 2024; Syah et al., 2024).

4. Conclusions

Based on the results and discussion, the game-based mathematics learning media using the Quiz Whizzer application for twelfth-grade students at Muhammadiyah 1 Sleman Vocational High School has been developed using the ADDIE model, which includes the stages of Analysis, Design, Development, Implementation, and Evaluation. In the analysis phase, observations and interviews were conducted to identify problems and determine the necessary learning media. Subsequently, in the design phase, the game-based learning media was designed according to the identified needs and validated by media and content experts. The media was then developed based on feedback from the experts, and in the implementation phase, trials were conducted with students. The validation and revision results indicate that the game-based learning media using the Quiz Whizzer application falls within the category of highly valid, with an average validation score of 3,05 from media experts and 3,46 from content experts. Student responses also show that the developed product is very practical to use, with a practicality percentage of 84,93%.

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