



Development of quizizz based interactive learning media using a contextual approach for ratio lesson

Ummatul Arifah^{*,1,a}, Rahma Ramadhani^a.

^a Mathematics Education, Faculty of Education, Hasyim Asy'ari University, Jombang

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ABSTRACT

Mathematics instruction requires innovative teaching materials to help students grasp concepts more easily and improve learning outcomes. However, the use of technology-based interactive learning media for ratio material at the junior high school/MTs level, particularly at MTsN 15 Jombang, is still not optimal, as evidenced by the results of observations and interviews conducted with seventh-grade mathematics teachers. Consequently, the learning process tends to be unengaging, student participation remains low, and learning outcomes are unsatisfactory. This issue is particularly urgent because ratio is a fundamental mathematical concept that serves as a prerequisite for learning more advanced topics, making students' conceptual understanding at this stage essential for their future mathematical achievement. Therefore, there is a need to develop engaging technology-based learning media that can enhance students' motivation, conceptual understanding, and learning outcomes. Therefore, this study aims to develop an interactive learning medium based on Quizizz for seventh-grade ratio material that meets the criteria of being valid, practical, and effective in improving student learning outcomes. This study employed the ADDIE research and development model, consisting of the stages of analysis, design, development, implementation, and evaluation. The study was conducted at MTsN 15 Jombang with seventh-grade Class B students as the participants. Product testing was carried out in two phases: a small-group trial involving 6 students and a large-group trial involving 29 students. Research data were collected through observations, questionnaires, and tests using media expert validation sheets, content expert validation sheets, student response questionnaires, and pretest-posttest instruments. Data were analyzed using validity and practicality percentages, as well as the N-Gain test to determine the effectiveness of the media. The results showed that the media obtained validity scores of 92.5% from media experts and 87.5% from content experts, both categorized as highly valid. Student responses reached 83.5%, indicating that the media was highly practical. Furthermore, the N-Gain score of 0.71 was classified as high, demonstrating that the developed media effectively improved students' learning outcomes. Thus, the Quizizz-based interactive learning media is valid, practical, and effective and can serve as an alternative learning medium for teaching ratio in junior high school mathematics.

1. Introduction

Mathematics plays a crucial role in supporting the development of science and technology in the modern era [1]. Mathematics education, in essence, is not merely oriented toward content delivery; rather, it must also be capable of building conceptual understanding, enhancing active engagement, and optimizing student learning outcomes [2]. In response to the educational challenges of

the 21st century, integrating information and communication technology into instructional media has become an imperative to visualize abstract mathematical concepts, rendering them more concrete, interactive, and meaningful [3]. Through the utilization of innovative digital media, the knowledge transfer process can become bidirectional and student-centered. This is supported by previous research showing that the use of digital learning

* Corresponding author.

E-mail address: rifaharifah31@gmail.com (Azin Taufik).

¹ These authors contributed equally to this work.

media can significantly improve students' mathematical understanding by facilitating more effective and engaging learning experiences [4].

However, the empirical conditions in the field often do not align with this ideal state. Based on observations conducted at MTsN 15 Jombang on September 22, 2025, the mathematics learning process was still dominated by the lecture method, characterized by a high dependency on whiteboards and textbooks as the primary media. Although the school's technological infrastructure was available, its utilization in supporting mathematics instruction remained suboptimal. This phenomenon caused students to become passive, less enthusiastic, easily bored, and to perceive mathematics as a complex subject. The impact of this low interactive engagement ultimately culminated in deficient student learning outcomes, particularly regarding the topic of ratios. The concept of ratios is frequently considered difficult by junior high school (SMP/MTs) students, as it demands strong visualization to connect mathematical concepts with real-life situations.

As an effort to address these problems, the utilization of digital educational platforms such as Quizizz has begun to be widely researched. Prior studies indicate that the use of Quizizz is capable of creating a pleasant and interactive learning atmosphere [5], as well as contributing positively to the improvement of student learning outcomes [6]. A study conducted by [7] demonstrated the effectiveness of Quizizz in enhancing learning outcomes for statistics. Furthermore, Rahim and [8] along with [9] asserted that Quizizz is a viable, practical, and effective tool, which is generally functioned as an assessment instrument or learning evaluation quiz to measure students' mathematical problem-solving skills.

Despite the extensive research conducted on the use of Quizizz in mathematics, the majority of previous studies have utilized this platform in a limited capacity, specifically only as a post-learning evaluation medium or for independent practice. The utilization of interactive presentation features within Quizizz to deliver material comprehensively and systematically at the junior high school level remains largely unexplored. Additionally, previous studies have tended to segregate the platforms used for conceptual delivery, contextual visualization, and learning outcome evaluation. Similarly, previous studies on interactive mathematics learning media have demonstrated that digital applications can effectively increase students' learning interest and are considered highly feasible for classroom implementation. Nevertheless, these studies generally focused on developing stand-alone interactive media rather than integrating instructional materials, contextual learning resources, and assessment within a single learning platform [10]. No research has comprehensively integrated content presentation slides, contextual animated videos, and evaluation quizzes into a single, unified Quizizz platform for the topic of ratios. Yet, the integration of contextual animated videos within the instructional delivery process is vital to help students bridge the abstract concept of ratios with real-life

phenomena [11].

This research gap underscores the importance of conducting this study. The state of the art of this research shifts from a partial utilization of Quizizz (exclusively as an evaluation tool) toward the development of comprehensive interactive learning media (simultaneous material delivery and evaluation). The novelty offered in this study lies in the development of Quizizz-based interactive learning media for the topic of ratios, which simultaneously integrates three main features into a unified, all-in-one platform: content presentation slides, contextual animated videos, and interactive quizzes. The integration of these three features is systematically designed to facilitate all stages of student learning, beginning with initial conceptual understanding via contextual videos, deeper material exploration through presentation slides, to the direct measurement of comprehension via engaging interactive quizzes. Based on the aforementioned context, this study aims to develop Quizizz-based interactive learning media on the topic of ratios for seventh-grade junior high school (SMP/MTs) students that satisfies the criteria of validity, practicality, and effectiveness. The effectiveness of the media is measured based on the improvement of student learning outcomes, analyzed using N-gain scores derived from pre-test and post-test results before and after the implementation of the developed learning media. This evaluation

is consistent with previous development research indicating that well-designed mathematics learning media not only meet validity and feasibility criteria but also contribute to improving students' conceptual understanding and learning outcomes when implemented in classroom instruction [12]. Through the development of this integrated medium, it is expected to provide a methodological contribution for teachers in optimizing school technological facilities and to assist students in significantly improving their learning outcomes.

2. Method

2.1. Research design

This study employed a Research and Development (R&D) approach. The development framework utilized was the ADDIE model, which consists of five systematic phases: Analysis, Design, Development, Implementation, and Evaluation [13]. This model was selected because it provides a structured procedure that is highly suitable for developing educational products. The objective of this research was to produce and evaluate the validity, practicality, and effectiveness of interactive learning media based on the Quizizz application, which integrates content slides, contextual animated videos, and interactive quizzes for the topic of ratios.

2.2. Research Setting and Participants

This study was conducted at MTsN 15 Jombang. The research subjects were seventh-grade students from class VII-B, selected through a purposive sampling technique

based on the consideration of the need to improve mathematics learning interactions in that specific classroom. The product trial was executed in two distinct stages:

- 1) Small-Group Trial: Involving 6 students selected based on varying cognitive ability levels: 2 high-achieving students, 2 average-achieving students, and 2 low-achieving students. This selection criterion aimed to evaluate linguistic readability, navigation smoothness, and instruction clarity, thereby ensuring that the media could be comprehended by students of all ability levels prior to wider-scale application.
- 2) Field Trial (Large Group): Involving all 29 students in Class VII-B to measure the classical practicality and the effectiveness of the media on student learning outcomes.

2.3. Research Procedure

The research procedures followed the five sequential phases of the ADDIE model:

- 1) Analysis: The initial phase dedicated to identifying problems in mathematics learning, analyzing the characteristics and needs of seventh-grade students, and reviewing the availability of technological infrastructure and facilities at the school.
- 2) Design: Designing the structural framework of the interactive learning media [3]. The steps in this phase included selecting the ratio topic, drafting presentation slide layouts, gathering visual assets (text, images, and contextual animated videos), and designing the user interface layout within the Quizizz application.
- 3) Development: Realizing the design into a tangible product within the Quizizz platform. During this phase, the product was validated by material and media experts to assess its validity. Feedback from these validators was utilized to revise and refine the product before it underwent trials.
- 4) Implementation: Applying the revised learning media to a real classroom environment [14]. The implementation commenced with the small-group trial (6 students) and was subsequently followed by the field trial (29 students). In the field trial, a pretest was administered before the utilization of the media, and a posttest was conducted afterward to measure student comprehension.
- 5) Evaluation: Analyzing all compiled data obtained from the expert validation sheets, student response questionnaires, and learning outcome tests. This evaluation aimed to determine the final levels of validity, practicality, and effectiveness of the developed media

2.4. Instruments and Data Collection

Data collection in this study utilized instruments

consisting of:

- 1) Expert Validation Sheets: A questionnaire utilizing a 1–4 Likert scale. It was employed by the media expert to evaluate design validity, technological suitability, and language appropriateness, and by the material expert to assess objective alignment, conceptual accuracy, and contextual examples of ratios.
- 2) Student Response Questionnaires: A questionnaire using a 1–4 Likert scale filled out by students post-instruction to measure the practicality of the media (encompassing satisfaction, attractiveness, and ease of use aspects).
- 3) Learning Outcome Tests (Pretest-Posttest): Comprising 5 essay items on the topic of ratios, designed based on C3 to C4 cognitive domains. To guarantee the validity of the test instrument prior to administration, these pretest and posttest questions underwent content validity testing. The content validity check was performed by the material expert/validator to evaluate the alignment of questions with achievement indicators, difficulty levels, and linguistic clarity. The validation results were used to revise the test items, ensuring that the instrument was valid and objective in measuring student learning outcomes.

2.5. Data Analysis

Data analysis was conducted quantitatively, encompassing tests for validity, practicality, and effectiveness.

1. Validity and Practicality Analysis: Data from the expert validation sheets and student responses were analyzed using the percentage formula [15]:

$$\text{Percentage}(P) = \frac{\text{Obtained Score}}{\text{Maximum Score}} \times 100\%$$

The percentage results were converted using the following interpretation criteria: $75\% < X \leq 100\%$ (Very High/Highly Valid), $50\% < X \leq 75\%$ (High/Valid), $25\% < X \leq 50\%$ (Low/Less Valid), and $0\% < X \leq 25\%$ (Very Low/Invalid). The media was declared valid and practical if it achieved at least the "High" category.

2. Effectiveness Analysis: Pretest and posttest data were analyzed to observe the improvement in learning outcomes through the following stages:
 - a) Normality Test: Utilizing the Shapiro-Wilk test (since $N = 29 < 50$) assisted by SPSS software. The data were deemed normally distributed if the Sig. value was greater than 0.05 [16].
 - b) Paired Sample T-Test: If the data were normally

distributed, a paired sample t-test was performed to examine the mean differences before and after the intervention. The null hypothesis (H_0) would be rejected if the Sig. (2-tailed) value was less than 0.05. If the data were not normally distributed, the non-parametric Wilcoxon Signed Rank Test would be employed instead.

- c) Normalized N-Gain Test: To measure the category of improvement, the N-Gain formula was applied [17]:

$$N - Gain (g) = \frac{Posttest\ Score - Pretest\ Score}{Maximum\ Score - Pretest\ Score}$$

The results were interpreted using the following criteria: $g \geq 0.70$ (High), $0.30 \leq g < 0.70$ (Medium), and $g < 0.30$ (Low). The learning media was deemed effective if the N-Gain achieved at least the "High" category.

3. Results and discussion

The result of the development research conducted is an interactive learning medium based on the Quizizz application, specifically designed for ratio material intended for seventh-grade students at MTsN 15 Jombang. This study aims to determine the feasibility, practicality, and effectiveness of the developed medium. The research used the ADDIE model, which consists of several stages, namely: analysis, design, development, implementation, and evaluation. The ADDIE model was chosen because it offers a systematic approach to the development of learning media. [18] The ADDIE model was used to create an effective and structured learning process. The following are the results obtained at each stage of the research.

3.1. Analysis Stage

During the analysis phase, an assessment was conducted of learning needs, student conditions, the learning process, ratio material, and facilities and infrastructure. The results of the analysis showed that mathematics instruction still predominantly relies on conventional methods using blackboards and textbooks, resulting in suboptimal student participation and students continuing to struggle with understanding ratio concepts, particularly in their application to everyday activities.

Given these conditions, an interactive medium developed using the Quizizz application integrated with instructional slides and contextual animated videos is

needed as an alternative solution to create a more engaging, interactive, and easily understandable learning method. This statement is supported by the Cognitive Theory of Multimedia Learning by [19], which states that the teaching and learning process will be more optimal if information is conveyed through a combination of text accompanied by images and processed through both verbal and visual channels simultaneously. Therefore, the integration of presentation slides and contextual animated videos within the Quizizz platform is expected to help students improve their understanding of the concept of ratios optimally.

3.2. Design Stage

The initial activities in the design phase involved developing an interactive Quizizz-based learning tool before testing it with students. In this phase, the researcher determined the format of the tool by utilizing the Quizizz platform as a medium for presenting content, quizzes, and other learning features. The learning content was first created using the Canva application by combining text, images, and audiovisual elements, and then integrated into the presentation feature on Quizizz.

During the design process, the researcher used bright colors to align with the students' characteristics, ensuring the media's appearance was more engaging and less monotonous. The content of the Quizizz-based interactive learning media consists of a cover, learning objectives, a content menu, learning materials, contextual animated videos, essay-style questions, and quizzes.

In addition to creating the learning media, the researcher also prepared several research instruments, namely media expert and subject matter expert validation sheets organized in a checklist format using a 1–4 Likert scale [15]. and a student response questionnaire used to assess student feedback. toward the instructional materials developed, while the pretest and posttest are used as tools to measure students' achievement levels.

3.3. Development Stage

During this development phase, the Quizizz-based interactive learning media underwent refinement so that the resulting product would be more effective and better aligned with learning needs. Before the revision process began, the learning media first underwent an evaluation conducted by media experts and subject matter experts to gather feedback and ensure that the final product would be suitable for use in the learning process.

This Quizizz-based interactive learning media presents comparative material in a systematic and interactive manner through text, images, and contextual animated videos, with the aim of increasing students' interest,

engagement, and learning outcomes. Table 1 below shows the design results for the development of Quizizz-based interactive media. At this development stage, the media was designed in accordance with learning needs.

Table 1

Components of Instructional Media

	Components and illustrations	Information
Slide 1		It includes an opening greeting, the title of the lesson, and the class.
Slide 2		Learning objectives for the lesson on ratios.
Slide 3		List of topics students will study
Slide 4		Titles of the topics to be taught to students
Slide 5		Explains the concept of a ratio.
Slide 6		an interactive video in the form of a contextual animated video about examples that involve ratios

Slide 7		Show images that are not examples of ratios by using contextual images.
Slide 8		Definition of equivalent ratios
Slide 9		An interactive video in the form of a contextual animated video showing examples of equivalent ratios.
Slide 10		An interactive video in the form of a contextual animated video about examples of inverse ratios
Slide 11		Explains the concept of the inverse ratio.
Slide 12		An interactive video featuring contextual animations illustrating examples of inverse ratios.
Slide 13		An interactive video, in the form of a contextual animation, comparing equivalent values.

Slide 14



An interactive video featuring contextual animations that compare direct and inverse proportions.

Slide 15



Acknowledgments as the final slide in a PowerPoint presentation

Before being pilot tested with students, this resource was validated by media experts and subject-matter experts. The validation was conducted by mathematics education faculty members and mathematics teachers using a 1–4 Likert scale validation sheet. The results of the learning resource validation conducted by media experts and subject matter experts are presented in Table 2 below. mathematics teachers using a 1–4 Likert scale validation sheet. The results of the learning media validation conducted by media experts and subject matter experts are presented in Table 2 below.

The feasibility (or practicality) percentage of the learning media is calculated using the following formula [15]:

$$P = \frac{\sum x}{\sum x_i} \times 100\%$$

Where:

P = The percentage of media feasibility/practicality.

$\sum x$ = The total empirical score obtained from validators or respondents.

$\sum x_i$ = The maximum possible score (ideal score).

Table 2
Survey Results

Validation types	Percentage	Category
Media expert	92%	Well worth it
Subject expert	87,5	Well worth it

Based on Table 2, the results of the validation by media experts and content experts indicate that the Quizizz-based interactive learning media received a rating of “highly suitable” for use in the learning process. In the media expert validation, the assessment covered aspects such as media presentation, clarity of text and images, color appropriateness, completeness of media components, and the media’s suitability for student characteristics and current technological advancements. Meanwhile, the content expert validation covered aspects

such as the alignment of the content with learning objectives, clarity of language, the appropriateness of using relevant examples in the context of daily life, and the accuracy of images in relation to the terms used. The results indicate that the developed media meet the characteristics of good instructional media, both in terms of presentation and content. Good instructional media must have an engaging presentation, be easy to understand, and support effective learning activities [3].

In addition, learning materials should be designed in accordance with learning objectives, using clear language and relating to real-life contexts so that the material can be understood more easily and accurately [2].

3.4. Implementation Stage

The implementation of Quizizz-based interactive learning media for the topic of ratios was carried out through a pilot study involving small and large groups to assess the feasibility, practicality, and effectiveness of the media to be developed. In the small-group trial, students were given a response questionnaire to determine the media’s practicality before it was applied to the large group. Subsequently, in the large-group trial, students were given a pretest, posttest, and response questionnaire to assess both the practicality and effectiveness of the media. Table 3 presents the following implementation results. The percentage calculation is conducted using the following formula [15]:

$$P = \frac{\sum x}{\sum x_i} \times 100\%$$

The results of these calculations are subsequently interpreted based on the practicality criteria presented in Table 3.

Table 3
Practicality Criteria

Percentage Range	Criteria
$75\% < X \leq 100\%$	Very High (Highly Practical)
$50\% < X \leq 75\%$	High (Practical)
$25\% < X \leq 50\%$	Low (Less Practical)
$0\% < X \leq 25\%$	Very Low (Impractical)

Table 4 presents the practicality evaluation results from both the small-group and large-group trials, calculated using the aforementioned formula.

Table 4
Survey Results

No	Implementasi	Percentage	Category
1	Small-group student response survey	79,8%	Very practical
2	Large-group student feedback survey	83,5%	Very practical

The calculation of the normalized N-Gain [17] is performed using the following formula:

$$N\text{-Gain } (g) = \frac{\text{Posttest Score} - \text{Pretest Score}}{\text{Maximum Score} - \text{Pretest Score}}$$

Following the analysis utilizing this formula, the N-Gain calculation results are summarized in Table 5 below:

Table 5

Test Results

No.	Aspects analyzed	Value
1.	Average Pretest Score	56
2.	Average posttest score	87,4
3.	Average N gain score	0,71
4.	N-gain Category	High

Based on the results of the implementation, the Quizizz-based interactive learning medium was found to be practical and effective for use in teaching mathematics on the topic of ratios. This is supported by the improvement in student learning outcomes, as evidenced by a comparison of pretest and posttest scores, as well as students' positive responses to the developed learning medium. This is in line with [20-27], which states that the effectiveness of a learning medium can be measured through students' learning achievements as well as their positive responses to learning using the interactive medium employed [28].

3.5. Evaluation Stage

This evaluation phase was conducted to assess the quality of the Quizizz-based interactive learning media on ratios in terms of feasibility, practicality, and effectiveness. The results of the media expert validation showed a percentage of 92.5%, and the subject matter expert validation showed 87.5%, indicating that the criteria were met at a "highly feasible" level. Student questionnaires from the small-group pilot test showed 79.8% and the large-group pilot test showed 83.5%, indicating a "highly practical" category. Meanwhile, the N-gain calculation result of 0.71 falls into the high category, indicating that this interactive learning media can enhance learning outcomes [29]. These findings are supported by prior research revealing that the use of Quizizz-based interactive learning media is rated as highly feasible based on expert validation results, receives positive student feedback in the highly practical category, and it can improve students' learning outcomes through the use of media in the learning process. These results confirm that the use of Quizizz-based learning media can be adopted as an effective tool to support students' academic success [30-33].

4. Conclusion

Based on the results of research and development of an interactive learning medium using Quizizz on the topic of ratios for Class VII-B at MTsN 15 Jombang, the following conclusions were drawn:

- 1) The medium was rated as "highly suitable" based on validation by media experts (92.5%) and subject matter experts (87.5%).
- 2) The medium received student feedback indicating it was "highly practical" in both small- and large-group trials.
- 3) The media was found to be effective in improving student learning outcomes, as evidenced by an N-Gain score of 0.71, placing it in the high category.

CRedit authorship contribution statement

Ummatul Arifah: Conceptualization, methodology, Data Collection, Formal Analysing, Writing – original draf. **Rahma Ramadhani:** Supervision, Validation, Weiting – review & editing.

Declaration of Competing Interest

The authors declare that this study did not involve any conflicts of interest that could potentially influence the research process, data analysis, presentation of results, or preparation of the article.

Data availability

The data supporting the findings of this study were obtained from tests and questionnaires administered at MTsN 15 Jombang. The research data are available from the corresponding author and may be provided upon reasonable request, while adhering to the principles of research ethics and the confidentiality of the research participants' data.

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