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Development of Online Learning Quiz and Educational Game Using Word Walls in Mathematics for Grade 10

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Abstract: This research aims to produce and determine the feasibility of quiz and educational game using Word Wall that are suitable for online learning of quadratic inequality, rational, and irrational for grade X. This research method is Research and Development (R&D) with the ADDIE model (Analysis, Design, Development, Implementation, and Evaluation). This research result is learning media in quiz and educational game using Word Wall for quadratic inequality, rational, and irrational material. The feasibility test of materials and media on quiz and educational game resulted in a percentage of 77% and 79,1% with a decent category. The attractiveness of quiz and educational game resulted in a percentage of 81% in the limited trial and 82,2% in the field trial, both of which were in the very interesting category. The results of the correlation test obtained a positive and significant correlation between student responses and student learning outcomes. The implication is that this development product can be used as a student learning tool, and it is recommended that teachers can develop Quiz and educational game using Word Wall on other materials.

Keywords: research and development; online learning quiz; educational game; word wall.

A. Introduction

For half a year, Indonesia has been hit by the Covid-19 pandemic. This virus is growing very fast and spreading widely throughout the world. The country cannot be separated from this virus attack. More and more people have been exposed to the Covid-19 virus since the virus first entered Indonesia in early March 2020 (World Health Organization, 2020). This virus is getting worse and causing many sectors to be affected. One of them is the education sector, so the learning system that was initially implemented face-to-face becomes online learning. This change occurred due to recommendations from the government to stay at home, physical and social distancing, and always comply with health protocols (Kemendikbud, 2020).

The online learning system is a learning system between teachers and students without face-to-face directly but online using the internet network (Giatman et al., 2020; Kusumaningrum et al., 2020, 2021). The teacher's task during online learning is to ensure that the teaching and learning process continues, even though students remain at home (Sutarto et al., 2020). Therefore, designing learning media must be mastered by teachers as an innovation in the use of online media (Hilman & Dewi, 2021). In connection with the implementation of online learning, online learning media is also used so that it cannot be separated from technology (Nuha, 2016). According to (Korucu & Alkan, 2011), mobile technology contributes significantly to the world of education, including achieving distance learning goals. Media that can be used include WhatsApp, Google Classroom, Zoom Meeting, Google Meet, and many others (Anjani et al., 2018; Arigiyati et al., 2021; Pakpahan & Fitriani, 2020).

According to (Sudarsana et al., 2019), the critical thing in realizing the expected goals is the use of media when the learning process takes place. If this is realized, it will lead to an effective and efficient learning process. Based on this, it can be said that the learning media will affect teaching and learning (Puspitarini & Hanif, 2019). The purpose of using this learning media is as a variation so that students do not get bored with monotonous learning (Sari & Usop, 2022). In addition, this learning media is also helpful in increasing students' motivation and enthusiasm for learning until the lesson ends (Bulkani et al., 2022; Lin et al., 2020).

One online learning media that can be used is the Word Wall application (Oktariyanti et al., 2021). This website-based application can create learning media such as quiz, matchmaking, installing, pairing, anagrams, word randomization, word search, grouping, and so on. The advantage of the Word Wall application is that it can provide a meaningful learning system and be followed easily by elementary and higher-level students, the Word Wall can also be accessed via mobile devices owned by students (Mujahidin et al., 2021). In addition, Word Wall media can be used with different variations and is very flexible, attracts students' attention, and can direct students to be more active, think quickly, carefully, and precisely, and demand students to be more creative (Putri et al., 2021). The development of online learning quiz and educational game using Word Wall was carried out to address the learning gaps mentioned earlier. This research hopes that it will make learning more varied so that students do not feel bored during online learning and can increase students' learning motivation in learning Mathematics, especially in Quadratic, Rational, and Irrational Inequality Class X. This research was conducted to (1) develop learning media in the form of quiz and educational game using an online-based application, namely Word Wall, in learning Mathematics with Quadratic, Rational, and Irrational Inequality materials and (2) determine the feasibility level of learning media in the form of quiz and educational game developed.

B. Method

This research uses Research and Development (R&D) research methods, (Gall et al., 1996) state that this method is a process of developing and validating products used in learning. The products produced in learning include PowerPoint presentations, students' worksheets, learning videos, learning modules, quiz, online game, and other learning tools. The results of these products can be in the form of new products or developments from existing products (Sugiyono, 2015). The products developed in this research are quiz and educational game using Word Wall.

The process of developing quiz and educational game uses the ADDIE model reference in which there are five stages, namely (1) analysis, (2) design, (3) development, (4) implementation, and (5) evaluation (Arcana & Pardimin, 2020). The procedure carried out in this study is as follows.

The product trial was carried out at SMK Negeri 1 Alian with a sample of 8 class X PKM 3 and 31 students of class X PKM 1 in the even semester of the 2021/2022 school year. The data collection technique used in this study was a questionnaire using a validation questionnaire and a student response questionnaire. Validation is carried out to assess the feasibility of the product developed by materials and media experts using a material expert validation questionnaire and a media expert validation questionnaire. The student response questionnaire was used to determine student responses to the developing learning media. Meanwhile, to find out learning outcomes, researchers used questions that had been validated and then integrated into Word Wall.

The percentage of eligibility from the validation results by material experts and media experts is based on Table 1.

Table 1. The criteria for product eligibility level

Interval of Criteria	Criteria
81% – 100%	Highly eligible
61% – 80%	Eligible
41% – 60%	Quite eligible
21% – 40%	Less eligible
0% – 20%	Ineligible

(Damayanti et al., 2018)

Meanwhile, in the student response questionnaire, the total score obtained is then calculated using the attractiveness percentage formula to find out the percentage. The percentage obtained was then categorized in Table 2.

Table 2. The criteria of students' response interpretation

Percentage	Criteria
81% – 100%	Highly interesting
61% – 80%	interesting
41% – 60%	Quite interesting
21% – 40%	Less interesting
0% – 20%	Uninteresting

(Riduwan, 2011)

To strengthen the results of product feasibility, a correlation test was conducted to determine the relationship between the responses given by students to the developed learning media and student learning outcomes. This correlation test was conducted using SPSS to determine the r_{count} (Pearson correlation value) and its significance value. The response is said to have a relationship with learning outcomes if the value of r_{count} is greater than r_{table} and the significance value is less than = 0.05.

C. Result and Discussion

1. Results

The product of this study are quiz and educational game using the Word Wall application in mathematics learning materials for quadratic, rational, and irrational inequality for grade X. This product was developed based on the ADDIE model research procedure (Analysis, Design, Development, Implementation, and Evaluation) (Arcana & Pardimin, 2020; Wulandari et al., 2022).

a. Analysis

At this stage, observations and interviews were conducted to discover the problems during online learning. The observations and interviews showed that students still had difficulties understanding Quadratic, Rational, and Irrational Inequality material. Learning carried out online through the WhatsApp, Google Classroom, and Zoom Meeting applications causes students to feel bored and less enthusiastic due to less varied learning. Therefore, we need learning media that can solve these problems.

Based on these problems, researchers are interested in developing quiz and educational game using the Word Wall application for online learning of Quadratic, Rational, and Irrational Inequality materials. The selection of the Word Wall application was based on research references by (Sudarsono, 2021) and (Oktariyanti et al., 2021). Both studies stated that Word Wall was considered adequate and practical to use in learning. Practical online learning can be used anywhere and anytime (Nambiar, 2020).

b. Design

At this stage, the design for quiz and educational game on Word Wall is carried out. Planning includes templates and themes used in quiz and educational game. The templates used are gamehow Quiz for quiz, Find the Match for educational game 1, Group Sort for educational game 2, Maze Chase for educational game 3, and True or False for educational game 4. After planning the template, the researcher designed questions that will be included in the quiz and educational game. (Brassil & Couch, 2019) stated that multiple-choice, true-false, or matching are usually used in instruments that measure cognitive function. So, quiz and educational game are suitable for improving students' cognition.

At this stage, the research instrument design is also carried out. The instrument includes a validation questionnaire and a student response

questionnaire. The questionnaire was prepared considering the aspects needed to assess the quiz and educational game. In the validation questionnaire, learning media were assessed based on aspects of instructional media design, media presentation, and media design. Meanwhile, in the student response questionnaire, learning media were assessed based on the appearance, presentation, attractiveness, and usefulness aspects of quiz and educational game.

The teaching and learning processes can use media as a medium for information (Marsudi et al., 2021). An instructional message is provided through learning media when a tool is used to do so (Marpanaji et al., 2018). Learning environments are improved and made more interesting by learning media in general (Simamora, 2020).

c. Development

At this stage, a re-examination of the questions that have been prepared is carried out. This is done to avoid mistakes in the questions and answers after they are listed on the Word Wall. The next questions are arranged on the Word Wall according to the templates and themes that have been planned.

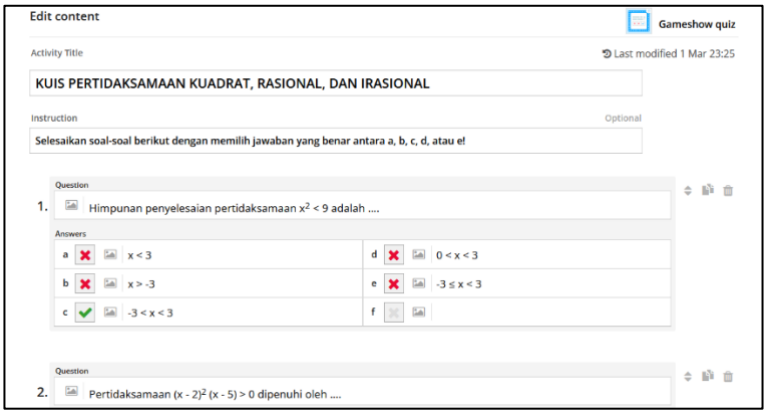

Figure 1. Preparation of Questions on the Word Wall

The questions that have been compiled are then adjusted to the theme and other settings on the Word Wall. The researcher again checked the quiz and educational Game that had been made to avoid writing errors in questions and answers. quiz and educational game that have been created contain an initial screen containing the title, the type of template used, the start button, and operating instructions as shown in Figure 1.

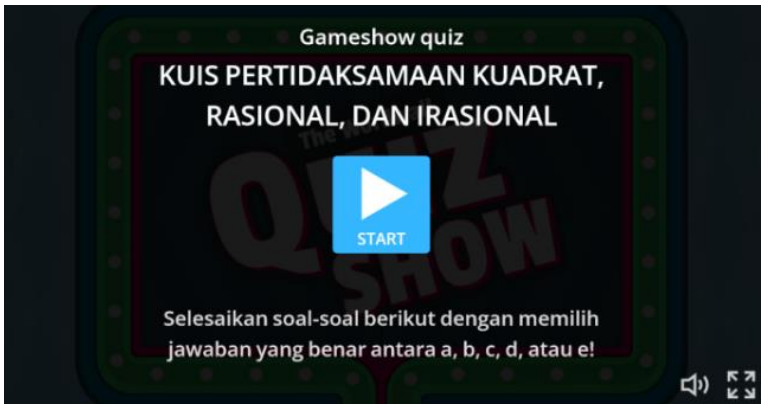

Figure 2. Example of Display Quiz and Educational Game

After the initial display of quiz and educational game appears, as shown in Figure 2, the start button can be pressed to continue to display the contents of quiz and educational game. Questions and five answer choices in the quiz will be displayed with the gamehow Quiz template.

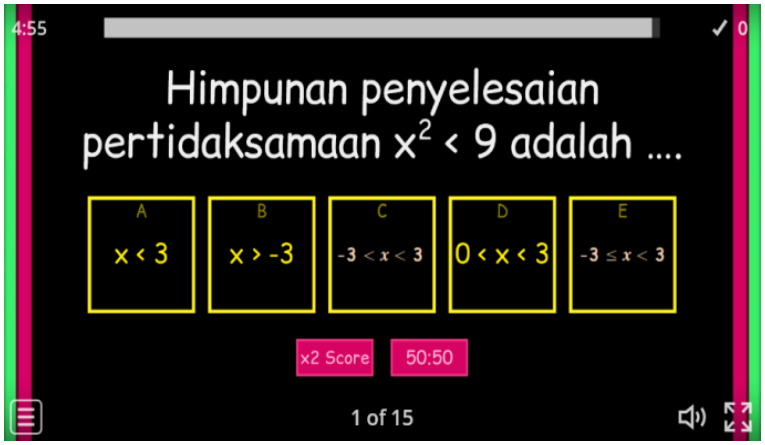

Figure 3. Quiz Display

Some features can be used are shown in Figure 3, namely the "×2 score" and "50:50" features. The "×2 score" feature is a feature that can be used to double the score obtained on that number. While the "50:50" feature is used to eliminate answers to only two answers so that the possibility of getting the correct answer is greater. Both features can be used on one number only.

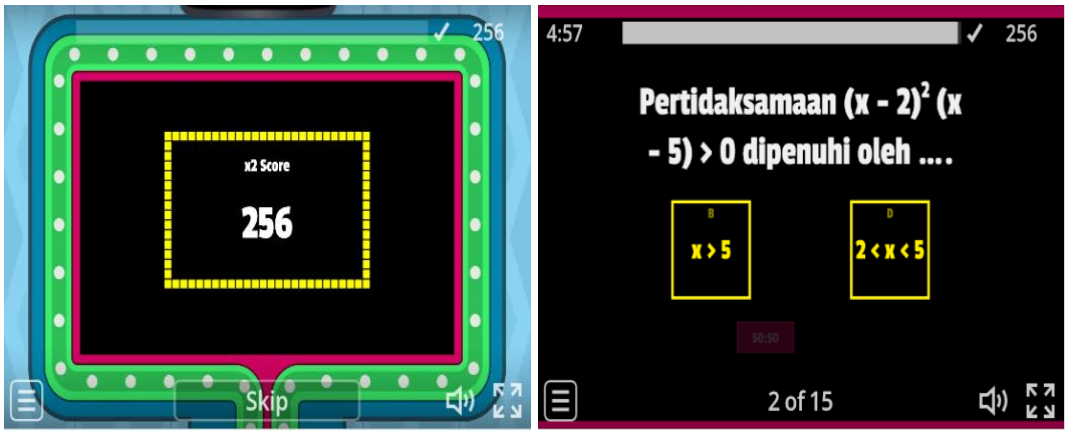

Figure 4. Display Features "×2 score" and "50:50"

Figure 4 respectively shows when the buttons "×2 score" and "50:50" are selected. In educational game 1 (see Figure 5), the template used is Find the Match. In this template, all the answer choices will appear on the screen, while the questions will appear one by one. Questions can be answered by choosing the correct answer from all the available answer choices.

Figure 5. Display of Educational Game 1

In educational game 2 (see Figure 6), the template used is Group Sort. In this game, several examples of inequalities and answer columns are presented and divided into three groups: Quadratic Inequality, Rational Inequality, and Irrational Inequality. This game can be solved by placing an example of inequality in the right group from the three available groups.

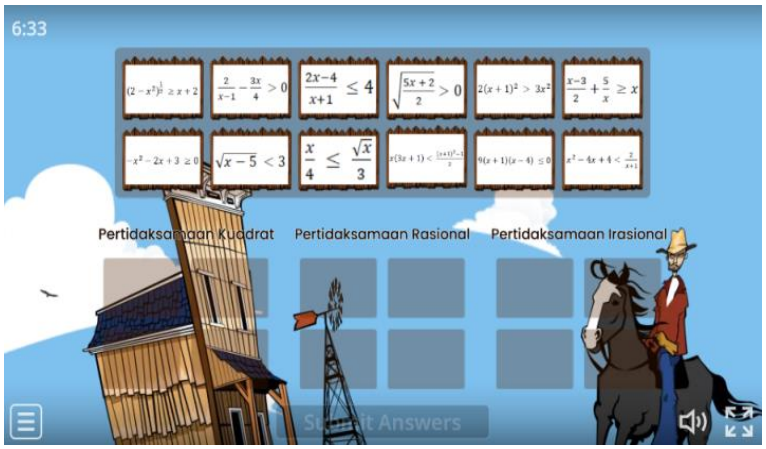

Figure 6. Display of Educational Game 2

In educational game 3 (see Figure 7), the template used is Maze Chase. In this game, a question and a maze are displayed in which there are red characters and blue characters. To answer the question, the red character must be moved to the correct answer box and avoid the blue character, who is the enemy. The characters in this game can be directed using the navigation keys on the keyboard. In one game, a player has three wrong chances. At the end of the game, the score ranking of this game will be shown.

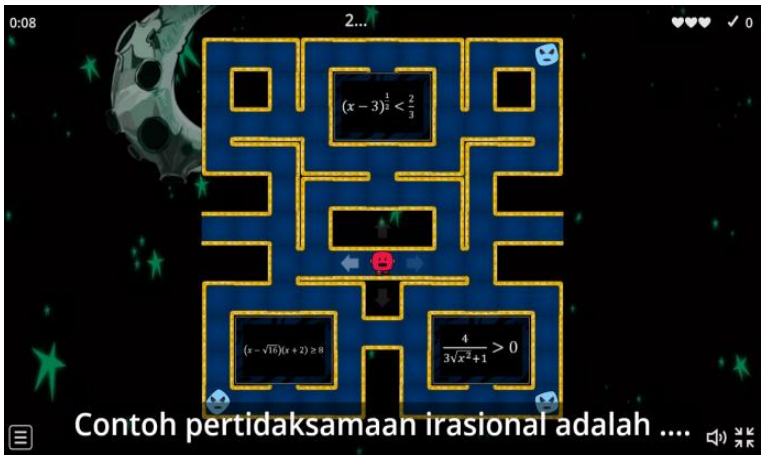

Figure 7. Display of Educational Game 3

In educational game 4 (see Figure 8), the template used is True or False. The questions in this game are in the form of statements, with true and false choices. This game can be solved by choosing between true or false on the given statement.

Figure 8. Display of Educational Game 4

Learning media in quiz and educational game makes it possible to answer questions correctly or incorrectly. If the selected answer is correct, a green check mark will appear. Meanwhile, a red cross will appear if the answer is wrong. The final display of quiz and educational game contains the final score obtained and several other menus such as show answers, leaderboard, and start again (see Figure 9). The leaderboard menu shows the top ten rankings based on the scores obtained. The show answers menu brings up the answers that have been given previously. Meanwhile, the menu is again used to restart quiz and educational game currently being opened.

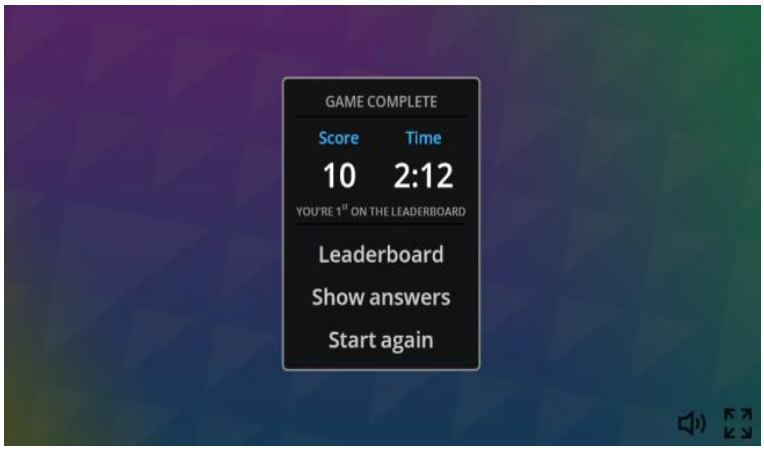

Figure 9. Final Display of Quiz and Educational Game

Material experts and media experts then validated the quiz and educational game by three validators: two lecturers of Mathematics Education at Sarjanawiyata Tamansiswa University and one Mathematics teacher at SMK Negeri 1 Alian. The validation of learning media by material experts obtained a total score of 82, 88, and 61 from validator 1, validator 2, and validator 3. Based on the three scores, 77% was obtained with the 'Eligible' criteria. In comparison, the validation of learning media by media experts obtained a total score of 70, 63, and 45. Based on the three scores, 79.1% was obtained with the 'Eligible' criteria. So, it can be concluded that quiz and educational game are feasible. This study's results align with (Sudarsono, 2021), where the validation of online-based learning media using Word Wall is declared feasible to be used in learning activities.

d. Implementation

The implementation of this learning media is carried out in class X SMK Negeri 1 Alian. In a limited trial, a trial was conducted on eight students of class X PKM 3 on February 18, 2022. In comparison, a field trial was conducted on 31 students of class X PKM 1 on February 25, 2022. The trial was carried out by providing opportunities for students to operate the learning media first. Students were then given a student response questionnaire and their assessment regarding the learning media that had been operated.

The results of the limited trial by eight students showed a percentage of 81%. The attractiveness criteria of the learning media developed are Very Interesting. At the same time, the results of field trials by 31 students showed a percentage of 82.2% with the criteria of Very Interesting. In addition, student comments on student response questionnaires indicate that students are interested in the learning media developed because it can help make learning easier, fun, and motivating. (Nasrudin et al., 2018) states that a good game is fun, motivating, and challenging.

(Ahyani & Eddy, 2021) states that learning media are intermediaries and messengers. Using the media, the delivery of material can be uniform; the learning process will run more attractively, students will become more interactive, learning time will become more efficient, and the quality of learning will improve.

e. Evaluation

Evaluation in this study includes formative evaluation and summative evaluation. A formative evaluation was carried out on (1) quiz materials and educational game before questions were made, (2) quiz questions and educational game before being included in the Word Wall, (3) research instruments before being used for media validation and testing, and (4) learning media before being validated. In comparison, the summative evaluation is carried out on the learning media after being validated by the validator. In the summative evaluation, the researcher revised the learning media according to the suggestions and input from the validator. At this stage, a correlation test was conducted to determine the correlation between student responses to learning media and learning outcomes.

The correlation test results show that the Pearson correlation value or r_{count} = 0.791. Based on table r with a significance of 5% or =0.05, the value of r_{table}=0.355 is obtained so that $r_{count}>r_{table}$, while the significance value of Sig. (2-tailed) shows the number 0.000, so 0.000<0.05. These results indicate a correlation between student response questionnaires and learning outcomes tests. Based on the interpretation of the correlation values, it is known that the relationship between the two variables is strong. The positive Pearson correlation indicates that the better the student's response to the learning media, the better the learning outcomes.

2. Discussion

Students' results of this media development are expected to be used as study material and self-evaluation in their respective homes. In addition, this learning media is expected to increase students' enthusiasm and motivation to learn. However, online learning can also create problems (Dhawan, 2020). One of the problems is that the teacher must prepare learning tools integrated with technology (Starkey, 2020). Therefore, before learning online, teachers must know how to use online applications and prepare electronic learning tools (Yusuf & Ahmad, 2020). In learning mathematics, especially on quadratic, rational, and irrational inequality, students have difficulty solving these problems. Reflecting on these conditions, it is necessary to develop electronic learning media to make it easier for students to understand the material during online learning during the pandemic. One alternative, teachers can develop online learning quiz and educational game using Word Wall.

Teachers have to use technology or anything related to students in the digital era as a means of the learning process, such as game, films, and so on (Fauziyyah, 2020). Thus, educators can present meaningful learning. According to (Puspita et al., 2022) to create student-centered learning, learning designs that integrate technology during education must also pay attention to activities that teachers can use as a foundation for activities that will be carried out with students. Furthermore (Puspita et al., 2022) emphasizes that technology's effectiveness can increase student engagement, assist in developing deep conceptual understanding, and bridge the digital divide between how technology is used at home and school.

The advantage of Word Wall as an online learning quiz and educational game is that it can make students interact, strengthening the teaching and learning process (Safitri et al., 2022). The interactive Word Wall provides an opportunity to incorporate effective learning instructional strategies (Auliya et al., 2021). The product of developing interactive learning media is in the form of online learning quiz and educational game that have been developed, considering aspects of learning and media as principles of learning message design.

This product development research aims to produce a product in interactive learning media on quadratic, rational, and irrational inequality materials. The benefits obtained from the use of online learning quiz and educational game are that the concepts presented are easy to learn, understand, and systematic. This learning media provides opportunities for students to learn at their own pace and independently (Sabella & Hasan, 2022). The media does not cause boredom because it is equipped with pictures, animations, and varied practice questions (Nenohai et al., 2022). The existence of repetition that must be done when the answer is wrong makes students understand the material better. This interactive learning media can also be an alternative to classical or individual learning media (Dhaifi et al., 2020).

The use of interactive learning media in mathematics allows students to interact directly and exercise direct control over information sources so that students can control and obtain what they need (Kaplar et al., 2022). Students can also work on practice questions that have been equipped with feedback and discussion to find out the mistakes made in working on the practice questions (Auliya et al., 2021; Vesel & Robillard, 2013). Learning using interactive media allows teachers to be free to interact with students so that learning is interactive, making learning focused on the information being studied (Safitri et al., 2022). Learning using interactive learning media also has a higher level of effectiveness.

D. Conclusion

The product produced in this research is learning media in the form of Quiz and educational Game using Word Wall on the material of Quadratic, Rational, and Irrational Inequality. This learning media is considered suitable after the material and media validation process. The validation results show a percentage of 77% and 79.1% in terms of materials and media, both of which are in the 'Eligible' category. Based on limited trials and field trials, the results of the attractiveness test were obtained with a percentage of 81% and 82.2%, both of which were in the 'Very Interesting' category. Meanwhile, in the correlation test of student response questionnaires and learning outcomes tests, the values of r_{count}=0.791 and r_{table}=0.355 so that $r_{count}>r_{table}$, and a significance value of 0.000 so 0.000<0.05. These results indicate a correlation between student responses and learning outcomes. The results of the positive Pearson correlation indicate that the better the response given, the better the learning outcomes obtained.

Based on the results of the development of online learning quiz and educational game using Word Wall, the suggestions that can be given are (1) teachers can use Word Wall as a learning media that is more innovative and attracts students' interest during teaching and learning (2) for other researchers it can utilize Word Wall as an interactive learning medium with different grade levels, materials, and subjects.

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