DEVELOPMENT OF MATHEMATICS LEARNING EVALUATION INSTRUMENTS BASED ON WORDWALL FOR PHASE E STUDENTS

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Abstract. This research is motivated by the need for evaluation instruments because at SMKN 3, Pekanbaru does not hold school exams, so student assessments are taken from daily exercises at the end of learning. This study aims to determine the validity, practicality and learning outcomes of students using wordwall-based evaluation instruments. This type of development research uses the R&D (Reasearch and Development) model which has been modified into 8 stages, namely potential problems, data collection, product design, design validation, design revision, product trials, product revision and trial use. The data collection techniques used in this study were validation sheets, student and teacher response sheets and student learning outcomes tests using wordwall-based evaluation instruments. The research subjects were E phase students of SMKN 3 Pekanbaru. The results of the wordwall-based evaluation instrument validation test were 88.29% with a very valid category. The results of the practicality test of word wall-based evaluation instruments based on teacher and learner response sheets were 91.75% with a very practical category. The learning outcomes of students using wordwall-based evaluation instruments were 92.59% with a very good category.

Keywords: *R&D, Learning Outcomes, Learning Evaluation Instrument, Wordwall*

1. INTRODUCTION

Education is a complex effort with various interconnected components [1], [2]. Therefore, it is necessary to understand in advance the various elements that accompany education so that learning can be carried out in a directed and orderly manner [3]–[5]. Curriculum and teachers are factors that can have an impact on the education system. Therefore, teachers are required to be able to innovate for the quality of learning activities and the quality of education to improve [6], [7]. Curriculum adjustments are carried out in response to the needs of students and challenging times that continue to develop before the era of industry, agriculture, and technology 4.0 and 5.0, which are now developing in response to shifting demands and achievements.

The interaction between educators and students is a learning process, from this process, active interaction between teachers and students is created [8], [9]. Every level of

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formal education requires students to have a strong understanding of mathematics [10], [11]. Mathematics learning is expected to help meet the needs of Indonesian human resources who are trustworthy and able to think critically, methodically, logically, creatively, and carefully [12]. This is important in improving the quality of education because mathematics is an important science from various sciences. Currently, some students view mathematics teaching as a difficult subject. It can be said that teachers fail to teach students mathematics lessons [13]. The key to success in learning mathematics depends on the way teachers teach or introduce mathematics to students, so that learning mathematics is not difficult for students and learning mathematics becomes more meaningful. It was found that many students were not enthusiastic about learning, especially in the classroom. In this case, teachers fail to consider effective methods to support students to understand mathematics learning, which results in monotonous classroom activities. So that the motivation of students in learning mathematics decreases due to this situation [14].

Currently, advances in science and technology have proven to provide benefits for the field of education. The use of information and communication technology facilitates more effective and efficient learning [15]. Students' enthusiasm and desire to learn can be improved, and students' ability to enjoy the learning process more can be supported by the use of appropriate learning media. Information and communication technology is developing rapidly so that it has changed many industries, including education. The development of information and communication technology also brings a very high demand for mathematical skills [16], [17].

The development of science and technology inspires rejuvenation in the application of technological advances in the pursuit of science [18], [19]. The development of technology also helps teachers in overcoming difficulties in learning students [20], [21]. Teachers are required to guide students to be more active and help students solve learning problems, as well as guide students to actively use technology and understand its uses, applying the right learning media can advance information skills, learning skills, innovation, motivation, media and technology [22], [23]. One of the components of learning activities that has a big impact on the effectiveness of students learning in the classroom is learning media [24], [25]. The use of relevant and appropriate learning resources certainly serves the quality of student learning [26], [27]. The achievement of learning objectives can be conveyed by the accuracy of the use of appropriate learning media. One of the key components of effective learning is the availability of learning media that serves as the basis for delivering the main material. In supporting the learning process of students, the use of media in the classroom has a beneficial impact and provides extraordinary benefits [28]. Teachers need to be more innovative in creating teaching materials and be able to take advantage of the opportunities provided by information technology [29], [30]. Learning media is one of the aspects in teaching and learning activities that can affect the quality of student learning in the classroom [13], [31].

Learning tools that meet academic criteria are called instruments or evaluation tools and can be used as a measuring tool or to collect information about a variable [32], [33]. One of the most important skills that educators and prospective educators need to have is the

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ability to carry out learning assessments [34], [35]. In essence, learning evaluation evaluates both the process that teachers and students go through during the learning process and the learning outcomes [36]–[38]. Evaluation is very important in education to understand whether the method used is correct or not and whether the learning objectives are achieved.

Judging from the condition of the school, namely at SMK Negeri 3 Pekanbaru which does not hold school exams, but the assessment of students is taken from daily exercises at the end of learning and there is no use of multimedia-based learning media by students and teachers. Based on the presentation that has been explained, the researcher intends to develop a *wordwall-based* mathematics learning evaluation instrument for phase E students. In addition, this *wordwall* application can help teachers in assessing students.

2. RESEARCH METHOD

This research is a type of *Research and Development* (R&D) research. Research and development method is a method that is applied to the creation of a certain product and tests the effectiveness of the product [39]. The development model in this study uses the *Borg and Gall* research and development model. The stages of this research include Potential Problems, Data Collection, Product Design, Design Validation, Design Revision, Product Trial, Product Revision, and Usage Trial.

The research procedures carried out include; 1) Potential Problems, At the stage of needs analysis, the function to analyze usability will have added value that can be used to overcome problems. 2) Data Collection, After analyzing the potential problems that may occur have been identified, then collect a series of data that will be the basis for developing products and compiling documents to deal with these problems. 3) Product Design, After completing the stage of identifying potential and problems and collecting data, the researcher will then design a product that can be used in the learning process. The product designed by the researcher is a *wordwall-based* evaluation instrument that can be used during the teaching and learning process. 4) Design Validation, The initial design of the wordwall-based evaluation instrument is given to experts to evaluate and validate the product if the product designed is feasible or not. 5) Design Revision, After the experts validate the product/initial design, then modifications are carried out to improve the product design before the product is tested. 6) Product Trial, Product testing is carried out with high school/vocational high school students in phase E or at the same level as high school/vocational school students in grade 10. The purpose of this test is to evaluate how practical the product is when used, as well as to identify possible shortcomings. Thus, after testing, the product will be modified again before widespread use. 7) Product Revision, After conducting a product trial, the product is then evaluated and checked for errors. Before proceeding to the trial stage, modifications were made to overcome all shortcomings found after receiving the evaluation findings. 8) Usage Trial, After the product undergoes satisfactory testing, the product will be useful according to its intended use.

The instruments used in data collection are; 1) The validation sheet is used to determine the validity of the evaluation instrument developed, the validation sheet is filled out by 2 mathematics education lecturers and 1 mathematics teacher. The aspects assessed

are the feasibility of the content, the media aspect, and the language aspect 2) The student and teacher response sheets are used to determine the practicality of the evaluation instrument developed. 3) The learning outcome test sheet uses *a wordwall-based* evaluation instrument to determine the effectiveness of the use of the developed evaluation instruments.

The data analysis carried out is an analysis of data on the validity, practicality and learning outcomes of students. The validation sheet data analysis was carried out by processing assessment data from validators on the developed product. Validity can be determined using the following formula [40]:

$$\mathrm{V_a} = \frac{TS_e}{TS_h} \times 100\%$$

With captions $\mathrm{V_a}$ is the validity of the expert TS_e is the total empirical score (validation result from the validator) TS_h is the maximum total score expected. By using descriptive validity analysis, it will be matched with the criteria for the level of validity to understand the validity of the product developed as follows [40]:

Table 1. Validity Criteria for Evaluation Instruments

Range	Criterion
85,01% - 100%	Highly Valid
70,01% - 85%	Valid
50,01% - 70%	Less Valid
0 % - 40%	Invalid

The data results from the questionnaire of the teacher and student response sheets were used to carry out a practicality analysis. The researcher used a modified formula to determine the value of each questionnaire [40]:

$$P = \frac{TSe}{TSh} \times 100\%$$

With captions P is the percentage of practicality, TSe is the total empirical score, TSh is the maximum total score expected. The criteria for assessing the practicality of media are presented below, which are obtained from the percentage of media practicality obtained from the questionnaire answers of each teacher and student.

Table 2. Criteria for the Practicality of Evaluation Instruments

Range	Criterion
81% - 100%	Very Practical
61% - 80%	Practical
41% - 60%	Quite Practical
21% - 40%	Less Practical
0% - 20%	Impractical

Source: [41]

The analysis of students' learning outcomes was obtained from the average score after using *the wordwall application.* Calculation of the average score of the test results

after using *the wordwall* application using the following formula [42]:

$$Average = \frac{\sum x}{n}$$

With captions $\sum x$ is the number of students' scores, n is the number of students. The next step is to calculate the percentage of completeness of the learning results of the average test score after using *the wordwall* application using the following formula [42]:

$$p = \frac{\sum P}{\sum N} \times 100\%$$

With the caption P is a percentage, $\sum P$ is the number of students who have completed their studies $\sum N$ is the number of students. If the student's learning outcome exceeds or is equal to the value of the Learning Goal Achievement Criteria (KKTP) ≥ 80, the student is considered successful or complete. In addition, the complete criteria based on the opinion [43] are presented in the following table:

Table 3. Student Learning Outcome Criteria

Range	Criterion
85,01 – 100%	Excellent
70,01% – 85%	Good
50,01% – 70%	Pretty Good
0,10% – 50%	Not Good

3. RESULTS AND DISCUSSION

3.1 Results

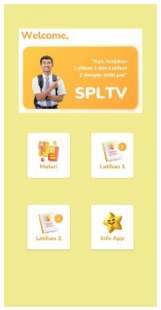
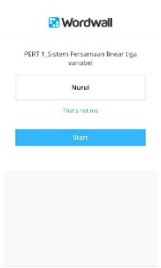
The first stage is potential and problems, in the development of *a wordwall-based* mathematics learning evaluation instrument, several potential problems were found through interviews and observations at SMKN 3 Pekanbaru. These findings include the lack of interest of students in working on the problems given by the teacher, as well as the lack of use of multimedia-based learning media by students and teachers. Using this *wordwall-based* mathematics learning evaluation instrument can attract students' attention so that they are interested in working on the problems provided.

The second stage is data collection, after obtaining information from potential problems, then collecting information used to design the product to be developed, namely a *wordwall-based* mathematics learning evaluation instrument which is expected to solve the problems that have been presented. To produce learning media, the necessary materials are collected through the analysis of the learning tools used by teachers, including Teaching Modules (MA), Learning Objectives Flow (ATP), and Learning Outcomes (CP). After analyzing the learning tools, the researcher obtained materials that will be used in making media, namely SPLTV materials.

The third stage is product design, the first step in product design is the design of learning materials by looking for teaching resources for SPLTV materials. The content of the material in the learning media is adjusted to MA and ATP in accordance with the

independent curriculum that applies at SMKN 3 Pekanbaru, followed by the design of questions to be presented in the *wordwall application.* Then the design of the quiz design on the *wordwall* website uses an interesting theme so that students are interested and enthusiastic in working on the questions. Wordwall design can be done by accessing the http://Wordwall.net *website*. Furthermore, to make a *wordwall* quiz into an android application, the help of a codular *website* is needed. Designing an android-based *wordwall* application can be done by opening the https://www.kodular.io/ *website*. Here's what *the wordwall* application looks like:

Table 4. *Wordwall-Based* Evaluation Instrument Display

Display	Criterion
	The start page, on the start page contains the logo, title, class, and "*Let's Go!!"* button To start the app.
	The menu page, on this page contains the *welcome icon* that is obtained from the training order, the material menu *icon, the* practice menu icon *1, the* practice menu icon 2, and the *app info* menu *icon*.
	Material page, material page appears when clicking the material menu *icon* on the menu page. This page contains material about SPLTV according to the material used.
	The initial display when opening the exercise 1 and exercise 2 menu *icons*. On this page, students can write their names before starting the exercise.

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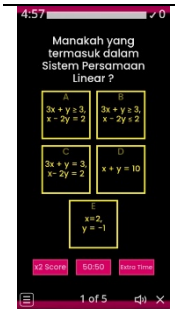
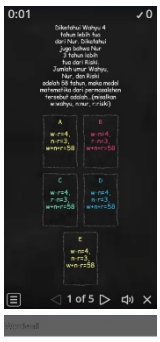
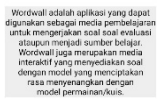


Theme view of exercise 1.



Theme view from exercise 2.

The "*app info*" display contains information about the application.



The fourth stage of design validation, after the design process of the *wordwall-based* mathematics learning evaluation instrument is completed, then the validator will carry out validation using the validation sheet as an assessment tool. This stage was held to understand and revise the shortcomings obtained in the *wordwall-based* mathematics learning evaluation instrument in accordance with the validator's suggestions. In this study, 2 lecturers and 1 high school mathematics teacher were obtained who became validators in this study by assessing 3 aspects, namely: the feasibility of the content, the media aspect, and the language aspect.

Table 5. Results of Validation of Evaluation Instruments

Validators	Assessed aspects			Validity %	Validity criteria
	Content eligibility	Media	Language		
V1	30	62	36	76,19%	Valid
V2	38	74	48	95,24%	Highly Valid
V3	34	76	47	93,45%	Highly Valid
Total Combined Average				88,29%	Highly Valid

Based on the table above, the value obtained from validator 1 is 76.19% included in the valid category, validator 2 is 95.24% included in the very valid category, validator

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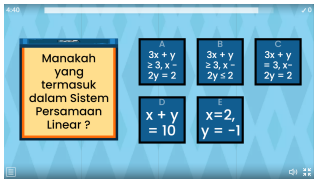
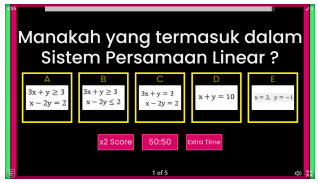
3 is 93.45% included in the very valid category. So that the combined average score of validators was obtained of 88.29% which was included in the very valid category. Thus, the learning media developed by the researcher, namely *the wordwall-based* mathematics learning evaluation instrument, is included in the very valid category.

The fifth stage is design revision, In the learning media validation stage, the researcher obtained several suggestions from validators to obtain better *wordwall-based* mathematics learning evaluation instruments. The suggestions from the validators and the results of the product revision are described, namely:

Table 6. Results of the Design Revision of the Evaluation Instrument

Suggestion	Revision
Answer choices should not be written truncated. 	Researchers have changed the answer research so that it is not cut off. 
In the first evaluation instrument, questions that have been answered but the answer is wrong should not be repeated. 	The researcher has changed the *template* used so that the wrong answer is not repeated 

The sixth stage is product trials, students work on questions on *wordwall-based* evaluation instruments which are given then after students finish working on the evaluation instrument, then students give suggestions on the instruments tested. The test of this product intends to assess the practicality after development. The results of practicality are presented in the following table:

Table 7. Practicality Test Results

Questionnaire	Percentage	Practicality Criteria
Teacher Response	93,33%	Very practical
Student response	93,33%	Very practical
Combined average total	91,75%	Very practical

Based on the table above, the average percentage of practicality of *wordwall-based* mathematics learning evaluation instruments in phase E students is 91.75% with very practical criteria.The seventh stage is product revision, based on the results of the teacher and student response sheets, the category is very practical which means that the product can be used with light corrections. The corrections that need to be revised are:

Table 8. Results of the Design Revision of the Evaluation Instrument

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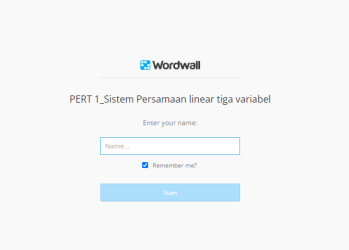
Suggestion	Revision
On the initial display of *the wordwall*, the name of the student who worked on the question did not appear	The researcher has replaced the initial appearance of the wordwall by appearing a study of the student's name before working on the question 

The eighth stage is a trial of the use, a *wordwall-based* mathematics learning evaluation instrument for phase E students that has been validated and tested for practicality. Thus, this evaluation instrument can be used in the teaching and learning process. At this stage, the researcher also directly applied it to phase E students*:*

Table 9. Results of Analysis of Students' Answer Scores

Number of completed students	Number of students	Classical thoroughness	Completeness criteria
25	27	92,59 %	Excellent

Based on the table above, the results of 27 students who took the learning outcome test were obtained, 25 of them obtained scores with complete criteria so that a percentage of learning outcomes of 92.59% was obtained with very good criteria.

3.2. Discussion

Research carried out by researchers is classified as research *and development*. The product developed is a *wordwall-based* mathematics learning evaluation instrument for phase E students. The model used in this development research is the *Borg and Gall* model and modified by the researcher into 8 stages, namely: potential problems, data collection, product design, design validation, product trials, product revisions, and usage trials in the hope of understanding how validity, practicality, and student learning outcomes from the evaluation instruments that have been made.

The problem with the potential problem is that the researcher has conducted interviews and observations, there are findings of a lack of interest in students in working on the questions given by the teacher, and there is no use of multimedia-based learning media by students and teachers. After understanding the existing problems, the researcher collected materials to overcome the problem by looking for CP, ATP, and Teaching Modules to make appropriate questions for the *wordwall-based* mathematics learning evaluation instrument that the researcher developed and hoped that this *wordwall-based* mathematics learning evaluation instrument could overcome the existing problems. According to [18]

understanding concepts and definitions, developing concepts, and drawing conclusions to solve contextual challenges of SPLTV are aspects of challenges in SPLTV materials. Therefore, the researcher uses SPLTV material as material in the development of mathematics learning evaluation instruments The use of CP and ATP in the educational environment serves to facilitate the application of theoretical concepts to formative assessment questions, because this concept functions as a framework for compiling test questions.

The next activity is at the product design stage, in this step the researcher designs *a wordwall* application using a *website* http://Wordwall.net assisted *by a* *https://www.kodular.io/* website so that it becomes an android application that can be run on *a smartphone.* The designed product is then validated at the design validation stage. The validation stage uses a validation sheet questionnaire consisting of three aspects, namely the content feasibility aspect, the media aspect, and the language aspect. Furthermore, the validation sheet was filled out by three validators, namely two mathematics education lecturers and one vocational school mathematics teacher with the intention of the researcher to carry out validation, namely to understand the validity of a product. According to Table 5, the validity percentage of validator 1 is 76.19% with the valid category, the validity percentage of validator 2 is 95.24% with the very valid category, the validity percentage of validator 3 is 93.45% with the very valid category and the combined average validity of the three validators is 88.29%, showing that this media is included in the "very valid" category.

After the researchers carried out validation, the next stage was to revise the wordwall-based mathematics learning evaluation instrument products for phase E students according to the comments and suggestions of the validators, before conducting product trials with students. Furthermore, researchers conducted product trials to students. This trial took place in the hall room of SMKN 3 Pekanbaru with a total of 27 students with the intention of understanding the level of practicality of the wordwall-based mathematics learning evaluation instrument developed by the researcher by providing a student and teacher response questionnaire. According to Table 7, the practicality of the teacher's response is 93.33% with a very practical category, the practicality of students is 90.18% with a very practical category and the average combined practicality is 91.75% with a very practical category. In line with research [20] which shows the average level of practicality by obtaining results of 84% with a very feasible category. Based on the response sheets from teachers and students who show very practical results, this product can be used with minor corrections and has been revised by researchers.

Furthermore, the final stage is the trial use of the product, at this stage, the product can already be used in the teaching and learning process. Researchers also conducted a learning outcome test for 27 students to understand the learning outcomes of students held in the fashion classroom. According to Table 9, the percentage of students' learning outcomes was 92.59% with a very good category. This is in line with research shows the percentage value of learning outcomes of 81% with very good criteria [44]. Therefore, it can be concluded

that this wordwall-based math learning evaluation instrument has been tested for validity, practicality and obtained very good learning outcomes.

4. CONCLUSION

Based on the results and discussion, it can be concluded that a wordwall-based math learning evaluation instrument has been produced for phase E students that is valid, practical and has excellent learning outcomes. The results of the percentage of validation of wordwall-based mathematics learning evaluation instruments amounted to 88.29% with a very valid category. Furthermore, the percentage of practicality of wordwall-based mathematics learning evaluation instruments is 91.75% with a very good category. While the percentage of student learning outcomes is 92.59% with a very good category.

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