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Development of Android-Based Learning as Interactive Learning Media in Reaction Rate Material on XI Class SMA Student

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Abstract: This aims of this study are to: (1) find out whether android-based interactive learning media that developed have met the feasibility standards based on the android-based integrated BSNP, (2) find out whether student learning outcomes taught using android-based interactive learning media that have been developed higher than the Minimum Completeness Criteria (KKM) score on the reaction rate material. This research is a Research and Development with the ADDIE (Analysis, Design, Development, Implementation and Evaluation) model which was carried out in the odd semester of the 2021/2022 academic year at SMAN 12 Medan. At the implementation stage, a one-group pre-test post-test design was used, with sampling using a cluster random sampling technique consisting of one XI science class at SMAN 12 Medan. The results of the validation of the android-based media obtained for the feasibility of the contents is 3.75; display feasibility is 3.83; language feasibility is 4, and graphic feasibility is 3.83. Overall, android-based learning media obtained a feasibility level of 3.85, with a very feasible category. Furthermore, android-based learning media on the reaction rate material is implemented in the learning process. The KKM scores and the students' average post-test scores were 78 and 85.6, respectively. The data obtained were analyzed using the right-hand t-test. The result of data analysis is that tcount is in the significant area, tcount > ttable = 4.146 > 1.711. So that Ha is accepted and H0 is rejected, it can be concluded that the learning outcomes of students who are taught using Android-based interactive learning media are higher than the KKM value.

Keywords: android-based; learning media; learning outcomes, reaction rate

1. INTRODUCTION

The impact of the COVID-19 pandemic has shifted to the world of education. A total of 577,305,660 students, ranging from pre-primary to high school levels are at risk of the COVID-19 virus. Many affected countries, including Indonesia adopted lockdown or quarantine policies to reduce the spread of this virus. Facing this condition, UNESCO provides distance learning solutions so that the learning process can continue[1]. However, many students and teachers are overwhelmed by this online learning model. During online learning, many students seem to be taking part in learning when in fact they are not. For example, students put up photos or videos that have been recorded beforehand, as if they were taking lessons in class when in fact they are not. This makes teaching and learning activities ineffective and student learning outcomes are low[2].

One of the sciences that develops along with the development of technology is Chemistry. In its application, chemistry is abstract, interrelated with one another and requires high reasoning. chemistry lessons given at Senior High School aim to make students have the ability to understand the concepts, principles, laws, and theories of chemistry as well as their interrelationships and applications to solve problems in everyday life. But the percentage of students who achieve Minimum Completeness Criteria (KKM) in chemistry subjects is still categorized as low. This is because the media used by teachers in learning activities is less varied[3]. One of the teaching materials in Chemistry that seems difficult for students is the rate of reaction. Students have difficulty with chemical concepts because they cannot visualize the processes that occur.

The use of interactive learning media is considered to be able to improve the teaching and learning process. With the interactive device it can support students' kinesthetics intelligence. This interactive learning media involves many senses in the learning process, so that the more senses involved, the more information received and last a long time in students' memories[4]. More interesting teaching can be supported by the use of varied learning media which can ultimately minimize student boredom. Students' motivation to learn chemistry is expected to be increased by the presence of interesting teaching media. Using an electronic module based on scientific literacy can increase student learning outcomes on teaching colloidal system[5]. A media can be said to be efficient if it is easy to use and precise and does not take up much time and space. Therefore, the application of interactive technology is needed to help students understand chemistry, especially in the Reaction Rate material.

2. RESEARCH METHOD

2.1 Location and Time

This research was conducted at SMAN 12 Medan. In this school, the use of learning media in the teaching and learning process is still lacking. The level of motivation of children in learning is also low because the teaching and learning process is only focused on teachers and books. Moreover, in the

current situation of the COVID-19 pandemic, which causes the learning process not to be fully face-to-face. Therefore, research on the development of learning media based on mobile learning is suitable to be carried out at SMAN 12 Medan. The research time carried out in November 2021 until January 2022, the 2021/2022 school year (odd semester).

2.2 Type of Research

The type of research used in this research is the type of development research (R&D) which refers to ADDIE development model developed by Dick and Carry. The stages in the ADDIE development model include: Analysis, Design, Development, Implementation, and Evaluation[6]. Due to the limit of time of researcher, the development carried out in this research up to the implementation stage.

2.3 Population and Sample

The population in this study were all of class XI SMAN 12 Medan in the odd semester of the 2021/2022 school year that divided into six classes, namely Class XI Science 1- XI Science 6. The characteristics of these class are in the same curriculum, the same semester, and the same school year are basically same. The sample studied was one of the class from six class XI Science SMAN 12 Medan, namely class XI Science 2. The sample in this study was assumed to be representative, so the sampling was done by using random sampling technique.

2.4 Research Variable

The variables used in this study are:

1. Independent Variable

The independent variable in this study is android-based interactive learning media on the reaction rate material.

2. Dependent Variable

The dependent variable in this study is the feasibility of learning media by media experts and material experts; student learning outcomes.

2.5 Research Design

The research design that will be carried out in this study uses a one sample t-test which is consist of one-group pre-test post-test design. This design is used because there is only one group (class) that is the sample and there is no control class for comparison.

Table 1. Research Design

Group	Pre-Test	Treatment	Post-Test
Experiment	T_1	X	T_2

Description:
T1 = Pre-Test
T2 = Post-Test
X = Learning using android-based interactive learning media on the reaction rate material

The researcher gave a pre-test first to measure the students' initial ability before treatment. Then proceed with giving treatment, namely learning using android-based interactive learning media on the reaction rate material for a certain period of time and ending with giving a post-test.

2.6 Data Collection Technique

Data collection techniques used in this study are qualitative and quantitative data. Qualitative data were obtained based on suggestions for improvement from expert validators of android-based interactive learning media. Quantitative data were obtained based on tests (evaluation questions) of student learning outcomes using android-based interactive learning media on the reaction rate material and assessments from expert validators of android-based interactive learning media.

2.7 Research Instrument

2.7.1 Test Instrument

The test instrument used in this study was a test in the form of description questions, each of which included the levels C1, C2, C3 and C4. The test instrument questions first examined by an expert validator, to see the cognitive domain of each item from the test instrument. Furthermore, the instrument testing was carried out to determine the extent to which the instrument met the requirements in terms of validity, reliability, difficulty level, and different power of each item.

2.7.1.1 Validity

The instrument validation by students carried out in SMAN 12 Medan. The instrument test was given to one of class XII Science, consisting of 34 students, who had learned Reaction Rate. The researcher gave the test instrument that consist of 40 questions to the students, then the students work on the questions on the instrument. To calculate the validity of the items, biserial point correlation is used. The biserial point correlation coefficient is a statistical measure used to estimate the degree of relationship between data that has a dichotomous scale and those that have an interval/ratio scale. If the correct answer is given a score of 1, while if the wrong answer is given a score of 0. The formula that used:

$$r_{pbis} = \frac{M_p - M_t}{SD_t}\sqrt{\frac{p}{q}}$$

Description:
Rpbis = Coefficient correlation biserial point
Mp = The average total score who answered correctly on the items
Mt = Average total score
SDt = Standard deviation of total score
p = The proportion of students who answered correctly to the items being tested for validity.
q = Proportion of students who answered incorrectly (q = 1- p)

Table 1. Criteria of Question Item Validity

Index	Validity Level
$r_{pbi} \leq 0.19$	Items must be eliminated
$0.20 < r_{pbi} < 0.29$	Items require revision
$0.30 < r_{pbi} < 0.39$	Little or no need of repair
$r_{pbi} \geq 0.40$	Very good item

The calculation result of is compared with the critical table of r biserial, with a significant level of 5% if the value of is valid[6].

2.7.1.2 Reliability

The level of reliability of an instrument is known from the reliability coefficient symbolized by r11. Where the value of r11 ranges from 0.0-1.0. The analysis of the test items carried out to determine the reliability of the test used the Kuder Richardson formula:

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$$q = 1 - p$$

$$r_{11} = \left(\frac{K}{K-1}\right)\left(\frac{S^2 - \sum pq}{S^2}\right)$$

$$. S^2 = \frac{\sum X^2 - \frac{(\sum X)^2}{N}}{N}$$

To interpret the reliability value of the questions, the value is consulted to the critical value of the product moment table with $\alpha = 0.05$ with the criteria $r_{count} > r_{table}$ for the real level, then the test is declared reliable[7].

2.7.1.3 Problem Difficulty Level

A good question is one that is not too easy or not too difficult. The formula used to measure the level of difficulty:

$$P = \frac{B}{Js}$$

P = Difficulty level
B = Many students answered correctly
Js = The total number of students taking the test

A test item is said to be feasible if the P value is between 0.20 - 0.80. If P < 0.20 means the test item is too difficult and if P > 0.80 means the test item is too easy[7]. The criteria for level of difficulty are conducted in table 3.

Table 2. Criteria of Problem Item Difficulty Level

P Value	Difficulty Level
0.00 – 0.20	Difficult
0.20 – 0.80	Medium
0.80 – 1.00	Easy

2.7.1.4 The Distinguishing Power

The distinguishing power is determined by calculating the power difference index to determine the difference power of each item test, which can be calculated using the formula:

$$D = \frac{BA}{JA} - \frac{BB}{JB}$$

Description:

JA = The number of test takers in the upper group
JB = The number of test takers in the lower group
BA = The number of groups who answered correctly
BB = The number of the lower group who answered correctly

The number that shows the magnitude of the differentiating power of an item, is called the Distinctive Power Index, symbolized by "D". The values of D ranges from -1 to +1. A test item is declared feasible if D ranges between 0.2 - 1.0[7]. The criteria for level of distinguishing power are conducted in table 4.

Table 3. Criteria of Distinguishing Item Power

D Value	Distinguishing Power Level
0.00 - 0.20	Bad
0.21 - 0.40	Sufficient
0.41 - 0.70	Good
0.71 - 1.00	Very Good

2.7.2 Test Instrument

In this study, the non-test instrument was made in the form of a media validation questionnaire based on the BSNP which included aspects of content feasibility, language feasibility, presentation feasibility and graphics.

2.8 Research Procedure

The research flow for the adaptation of the ADDIE model is shown in figure 1. The figure shows the overall and simple stages in this research procedure.

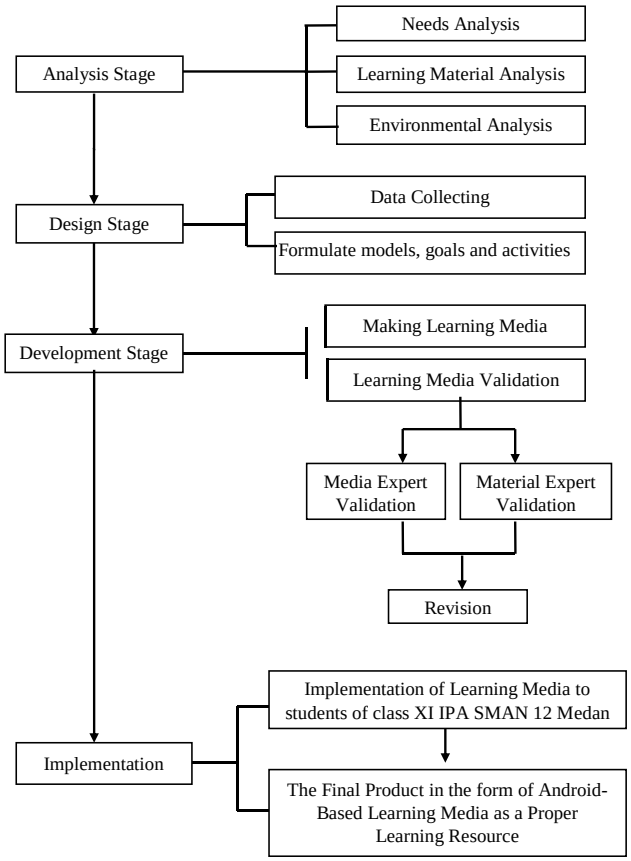

Figure 1. ADDIE Model Adaptation Research Flow

2.8.1 Analysis Stage

The initial steps taken in this research are needs analysis, learning material analysis and environmental analysis.

1. Needs Analysis

Needs analysis aims to identify products that fit the target. As part of the need analysis, the researcher observed the students of class XI science at SMAN 12 Medan through google forms and observed the chemistry teachers in class XI Science at SMAN 12 Medan through interviews. As the result, the product to be developed in this research is an Android-based interactive learning media with advantages consisting of several features, namely material; exercises integrated with sound, true or false answers with the discussion and score; homework integrated with comment and upload file feature; learning videos that support chemical calculations, and can be used both online and offline.

2. Learning Material Analysis

Analysis of learning materials includes determining learning materials adapted to the curriculum in high school and the needs of students. In this study, the material that will be developed in android-based interactive learning media is the Reaction Rate material. The subtopic of the material consists of Molarity Concept, Definition of Reaction Rate, Collision Theory; Factors Affecting Reaction Rate, Order and Equation of Reaction.

3. Environmental Analysis
Environmental analysis was carried out to identify the learning environment including the KKM value in the Reaction Rate material, the learning method used by the teacher in the chemistry lesson in the Reaction Rate material and how to motivate students.

2.8.2 Design Stage
The design stage is the stage of designing learning media. Researchers conducted discussions with chemistry teachers and chemistry lecturers who are in charge of general chemistry courses to compile forms for all menus that will be converted into the form of learning media.

1. Data collecting.
The purpose of data collecting is to get an overview in making learning media and its framework. Data needs include subject matter in accordance with learning environment that previously analyzed. Data collecting consist of collecting reaction rate material from book, website or other sources; collecting learning video of reaction rate calculation, collecting question that suitable with the competencies and learning objectives to be achieved.

2. Formulate models, goals and activities.
At this stage, the selection of models on learning media that are in accordance with activities that are integrated through interactive learning. After analyzing and collecting data, the learning media design that will be made is planned to consist of 3 main menus, namely home, score and account.

2.8.3 Development Stage
The development stage includes the creation of learning media and validation of learning media.
1. Making learning media
At this stage the researchers compiled an android-based reaction rate learning media in accordance with the BSNP. In the preparation of learning media, researchers also discussed with chemistry lecturers and teachers related to learning media prepared by researchers.

2. Learning media validation
Android-based interactive learning media developed will be validated of two media and two material expert validators who are selected by purposive sampling. Media and material expert validators are represented by 2 chemistry lecturers, FMIPA UNIMED with criteria lecturer in basic chemistry course and 2 teachers at SMAN 12 Medan with criteria teacher in chemistry lesson. Respondents will assess based on the validation assessment of learning media in accordance with the modified BSNP standard and provide advice on the quality of the learning media developed.

2.8.4 Implementation Stage
Android-based interactive learning media that have been developed and validated are then implemented in learning. Measurement of the implementation of learning media is by using pre-test and post-test instruments.

2.9 Analysis Data Technique

2.9.1 Learning Media Validation
The results of the validation of the feasibility of android-based learning media that have been obtained are then transformed into qualitative sentences. The rating scale used in the android-based integrated BSNP feasibility questionnaire is 1 to 4.1 as the lowest score and 4 as the highest score.

In the research on the development of android-based learning as a medium for learning reaction rate, 4 experts were involved: 1 chemistry lecturers, FMIPA UNIMED with criteria lecturer in basic chemistry course and 1 teacher of SMAN 12 Medan with criteria teacher in chemistry lesson as media expert; also 1 chemistry lecturers, FMIPA UNIMED with criteria lecturer in basic chemistry course and 1 teacher of SMAN 12 Medan with criteria teacher in chemistry lesson as material experts. As a result, the average formula can be used to obtain the overall percentage, as shown below:

$$\bar{X} = \frac{\sum X}{n}$$

Description:
X = Average value
$\sum X$ = Total of answers to the assessment of the validator/test subject
n = Total of validators/test subjects

The criteria for the validity of the average analysis used are seen in table 5.

Table 4. Criteria for the Average Validity of Learning Media

Average	Validity Criteria
3.26-4.00	Valid and does not need to be revised (very feasible)
2.51-3.25	Sufficiently valid and does not need to be revised (decent)
1.76-2.50	Invalid and some of the contents need to be revised (not feasible)
1.00-1.75	Invalid and need to be totally revised (not feasible)

2.9.2 Learning Outcomes Analysis
Student learning outcomes data at the implementation stage of interactive learning media were analyzed statistically using the right-hand t-test after first testing for normality and homogeneity. Normality and homogeneity test done in class XI Science SMAN 12 Medan, consist of 25 students, who have studied Reaction Rate using interactive of android-based learning media that have been developed.

2.9.2.1 Normality Test
Testing the normality of the data with the Chi Square Test is done by comparing the standard curve (A) in the normal curve formed from the collected data (B). If B is not significantly different from A, it is concluded that B is data that is normally distributed.

First, the pre-test and post-test given to the one of class XI Science SMAN 12 Medan, consist of 25 students, who have studied Reaction Rate using interactive of android-based learning media that have been developed. Then, the data that obtained test for the normality. The formula used to determine the level of normality of the data:

$$x^2 = \sum \frac{(Fo - fh)^2}{fh}$$

Description:

Fo = Frequency/amount of observation data

Fh = Frequency/expected amount of data (percentage of area of each field multiplied by the number of data)

If chi square count chi square table at = 0.05 with db = 5, then the data is normally distributed[7].

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2.9.2.2 Homogeneity Test

The homogeneity test aims to test whether a data group has the same variance among the members of the group. First, the pre-test and post-test given to the one of class XI Science SMAN 12 Medan, consist of 25 students, who have studied Reaction Rate using interactive of android-based learning media that have been developed. Then, the data that obtained test for the homogeneity. The formula used to determine the level of homogeneity of the data:

$$s^2 = \frac{\sum(Xi - \bar{X})^2}{n - 1}$$

$$s = \sqrt{\frac{\sum(Xi - \bar{X})^2}{n - 1}}$$

Description:

s^2 = Varian of sample

s = Deviation standard of sample

2.9.2.3 Hypothesis Test

To test the descriptive hypothesis that has interval or ratio data, a one-sample t-test is used with the following formula:

$$t_{count} = \frac{\bar{X} - \mu_0}{\frac{s}{\sqrt{n}}}$$

Description:

$\bar{X}$ = Average

μ_0 = Hypothesis value

s = Standard deviation

n = Total of sample

t_{count} = t value that counted

If the value of t_{count} is in the critical area ($t \geq t_{\alpha}$) so H_0 rejected or Ha accepted [7].

3. RESULT AND DISCUSSION

3.1 Android-Based Learning Media Development

This research and development resulted in a product in the form of an Android-based chemistry learning media on the reaction rate material with the name LydApps: Reaction Rate Chemistry Learning Application. This research uses the Research & Development (R&D) method and ADDIE development model. The ADDIE development model carried out in this study consisted of four stages including: (1) Analysis stage, (2) design stage, (3) development stage, and (4) implementation stage.

3.1.1 Analysis Stage

The results of the interviews that have been conducted are the use of learning media during the online learning process were still not optimal and active interaction between students and teachers had not been formed. This is because the teacher considers the limitations of students' internet packages during online learning if they empower interactive learning media. In addition, there are many calculations in chemistry lessons. Students sometimes do not understand the lesson and also become bored.

On the other hand, all of the students already have Android and are good enough in using Android. However, even though learning facilities are available, the use of android in learning process as a learning media has not been able to run effectively. Teachers only use a few applications as a place for students to collect assignments. The applications used by teachers in the learning process are WhatsApp groups, google classroom, and zoom meeting (the usage is still minimal). There is no free learning application provided by the school to help the online learning process.

The researcher also gave a questionnaire to the students of class XI Science, totaling 52 students. From a total of 14 questions, 12 questions were given related to needs analysis. From 52 students 90.4% can access learning media with personal android and 9.6% can access learning media with parent's android. The obstacles experienced by students (figure 2) are inadequate internet network (42.3%), limited communication with teachers (67.3%), limited access to smartphones (1.9%), teachers are still not good at using digital technology (13.5%). 88.5% of students agree that the learning media used by teacher did not vary and did not support active interaction between teachers and students during the learning process so that learning still seems monotonous. The lack of student interest in the learning process makes students not focus and causes low student learning outcomes. As many as 76.9% of students choose to use Android-based learning media which is equipped with attractively packaged material, video, animation, quiz/exercise, score ranking features.

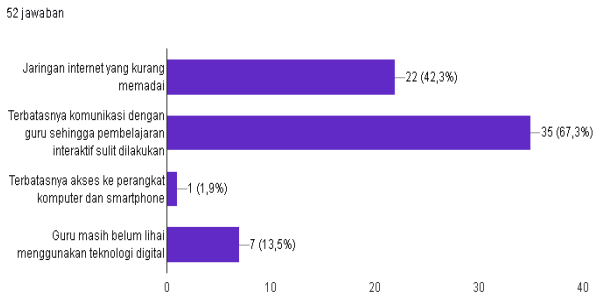

Figure 2. Result of Obstacles Experienced by Students During Online Learning

The curriculum that used in this study is 2013 Curriculum in Reaction Rate material. The analysis used is through the analysis of the Syllabus and Lesson Plan in online learning. Basic Competencies and Competency Achievement Indicators formulated can be seen in table 5.

Table 5. Basic Competencies and Competency Achievement Indicators

Core Competences	Indicators of Competence Achievement
3.1 Understand the theory of collisions (collisions) to explain chemical reactions	3.1.1 Calculating the concentration of a solution (molarity of the solution) 3.1.2 Explain the meaning of collision theory and the rate of reaction
3.2 Analyze the factors that affect the reaction rate and determine the order of the reaction based on experimental data	3.2.1 Determine the order of the reaction and the rate equation for the reaction 3.2.2 Understand the factors that affect the rate of a reaction 3.2.3 Process and

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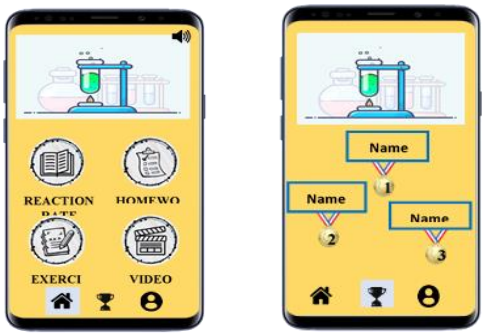
	analyzed data from an experiment on factors that can affect reaction rates

As the result, the product to be developed in this research is an Android-based interactive learning media with advantages consisting of several features, namely material with an attractive appearance so that students not feel bored; interactive exercises integrated with sound, true or false answers with the discussion and score; homework integrated with comment and upload file feature; learning videos that support chemical calculations. In addition, the learning media should be used both online and offline to avoid network and internet quota problems.

3.1.2 Design Stage

At this stage the researcher collects data and then formulates models, goals and activities to develop a good learning media and in accordance with the needs of teachers and students. The purpose of data collecting is to get an overview in making learning media and its framework. Data needs include subject matter in accordance with learning environment that previously analyzed. The selection of models on learning media that are in accordance with activities that are integrated through interactive learning. After analyzing and collecting data, the learning media design that will be made is planned to consist of three main menus, namely home, score and account.

The design on the home menu consists of material that contains previously collected material, exercise contains 10 multiple choice practice questions, homework contains questions related to learning videos and can be done at home; and a learning video consisting of 3 videos. The design on the score menu consists of students' ranking in doing the exercise. The student with the highest score will rank first at the top, followed by the second, third, and so on. In profile menu consists of feature log in and log out. If the students are entering the application for the first time, they will be directed to fill in their email, student name, class and password. If students already have an account, they only need to enter their email and password when logging in. The design of Android-Based Learning Media can be seen in figure 3.



(a) (b)

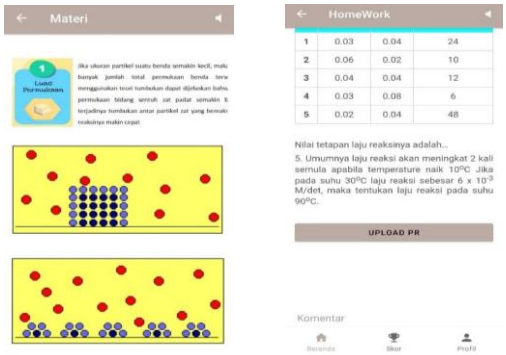
(c)

Figure 3. Design of Android-Based Learning Media. (a) home menu, (b) score menu, (c) profile menu.

3.1.3 Development Stage

Learning media was developed using the android studio application with the java programming language. The data that has been successfully collected at the data collecting stage is then inputted and compiled in the application based on a predetermined design. The output produced is the LydApps: Android-based Reaction Rate Chemistry Learning Applications which can be operated using Android devices and has a storage capacity of 40 MB. The menu contained in this application consists of 3 main menus, namely the home menu, score menu and profile menu.

The home menu consists of the researcher's profile which is located at the top of the page. In this home menu there are also several icons, namely reaction rate material, homework, exercise and video which are located under the profile. Reaction rate material is a page that contains basic competencies, learning objectives, concept maps and reaction rate materials that have been equipped with pictures, animations, examples of questions and solutions, and conclusions. Homework is a page that contains as many as 5 essay questions. This page is also equipped with features uploading comments and files. Exercise is a page that contains 10 multiple choice questions. This page is also equipped with a true or false feature. Video is a page that contains 4 videos that are linked to YouTube. Home menu content can be seen in figure 4.



(a) (b)

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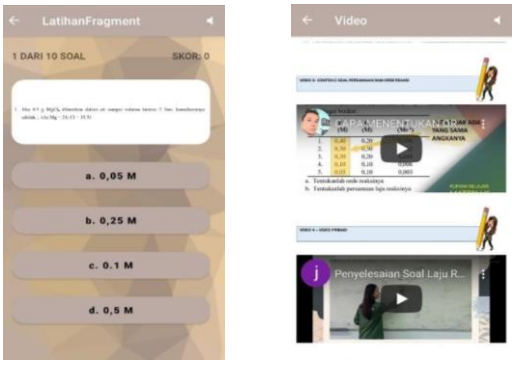

(a) (b)

Figure 4. Home Menu Content. (a) reaction rate material, (b) homework, (c) exercise, (d) video.

Score is a menu that contains the value obtained by students after doing the exercise (figure 5**).** In this menu, students with the highest and fastest scores in doing the exercise will be ranked 1, and so on will be sorted. This rating is visible to all app users.

Figure 5. Display of Score Menu

Profile is a menu that contains the identity of the account owner or user in the form of email and class (figure 6). In this menu there is also a logout feature that allows users to log out of their accounts. If the user wants to log back into the account, then simply enter the registered email and password.

Figure 6. Display of Profile Menu

3.1.4 Implementation Stage

After the media was validated and revised, the learning media in the form of LydApps: Chemistry Learning Applications Reaction Rates were then implemented for class XI students of SMAN 12 Medan. The class that became the sample in this study was class XI Science 2 as many as 25 students.

3.2 Learning Media Feasibility Result Based on Android Integrated BSNP

The feasibility of Android-based learning media is assessed from several aspects in accordance with the BSNP feasibility criteria. Based on the calculation results, the percentages for the aspects of content feasibility, display feasibility, language feasibility and graphic feasibility, respectively are 3.75, 3.83, 4, and 3.83. The final result obtained from the average value of the four aspects is 3.85. Based on this, the android-based learning media developed by the researcher is declared valid (table 6).

Table 6. Learning Media Assessment Results Based on BSNP Integrated Media Android

Assessment Component	Validator		Average	Validity Criteria
	L	T		
Content Feasibility	3.71	3.79	3.75	Valid (doesn't need revision)
Display Feasibility	3.77	3.89	3.83	Valid (doesn't need revision)
Language Feasibility	4	4	4	Valid (doesn't need revision)
Graphic Feasibility	3.85	3.81	3.83	Valid (doesn't need revision)
Average	3.83	3.9	**3.85**	Valid (doesn't need revision)

3.3 Data Analysis of Research Test Instrument

The analysis of the test instrument carried out by the researcher was to provide a test instrument of 40 questions in the form of multiple choice. Data analysis of research test instruments was processed using Microsoft Excel 2019.

3.3.1 Validity Test

The criteria used in the validity test is rcount > rtable, then the question is said to be valid. For N = 34 at the significance level α = 0.05, the rtable is 0.399. Based on the calculation (appendix 12), it's obtained rcount = 0.682. So based on the analysis, 0.682 > 0.399, 26 valid questions were obtained and there were 14 invalid questions. Furthermore, as many as 26 questions that have been declared valid, were further tested to determine the level of reliability, level of difficulty and distinguishing power. Item test validity can be seen in table 7.

Table 7. Item Validity Test

Nu	Criteria	Question Number	Total
1.	Valid	1, 2, 3, 5, 6, 7, 8, 10, 11, 13, 14, 17, 19, 20, 22, 23, 24, 25, 26, 29, 30, 32, 33, 36, 37, 38	26
2.	Invalid	4, 9, 12, 15, 16, 18, 21, 27, 28, 31, 34, 35, 39, 40	14

3.3.2 Reliability Test

For N = 34 at the significance level α = 0.05, the rtable is 0.399. Based on the analysis of the data in the appendix 13 obtained the level of reliability of the test instrument (rcount) = 0.824. By comparing the value that have been obtained, it

can be seen that 0.824 > 0.339 or rcount > rtable. Thus, it can be concluded that the item test is Reliable.

3.3.3 Problem Difficulty Level Test

A good question is one that is not too easy or not too difficult. A test item is said to be feasible if the P value is between 0.20 - 0.80. Based on the analysis of the difficulty level of the test items in the appendix 14, from the 26 valid questions, as many as 24 questions were declared feasible, while two questions are not feasible and categorized as too easy question. Item problem difficulty level test can be seen in table 8.

Table 8. Item Problem Difficulty Level Test

Nu	Criteria	Description	Question Number	Total
1.	Medium	Feasible	1, 2, 3, 5, 6, 7, 8, 10, 11, 13, 14, 17, 19, 20, 23, 24, 26, 29, 30, 32, 33, 36, 37, 38	24
2.	Easy	Not Feasible	22, 25	2

3.3.4 Distinguishing Power Test

A test item is declared feasible if D ranges between 0.2 - 1.0. Based on analysis of distinguishing power of the test item in the appendix 15, from the 26 valid questions, 21 questions were declared feasible with the criteria of 13 sufficient questions and 8 good questions. Meanwhile, there are 5 questions that are not feasible because they are categorized as bad. Item distinguishing power test can be seen in table 9.

Table 9. Item Distinguishing Power Test

Nu	Criteria	Description	Question Number	Total
1.	Bad	Not Feasible	20, 22, 25, 29, 30	5
2.	Sufficient	Feasible	2, 3, 7, 11, 13, 14, 17, 19, 23, 26, 32, 33, 38	13
3.	Good	Feasible	1, 5, 6, 8, 10, 24, 36, 37	8

Based on the validity, reliability, difficulty level and distinguishing power tests, it was concluded that 21 items were suitable for use as a test instrument.

3.4 Analysis of Android-Based Learning Media Implementation

The data from the implementation of android-based learning media in this study were student learning outcomes data in the form of pre-test and post-test which were tested for normality and homogeneity.

3.4.1 Pre-Test and Post-Test Data

Based on the calculation of students learning outcomes, it is obtained that the average value of the pre-test is 59.2 and the average value of the post-test is 85.6. The KKM used in this study was 78, in accordance with the KKM that had been determined at SMAN 12 Medan. Thus, it can be stated that the students' average pre-test scores are lower than the KKM scores, while the students' post-test averages are higher than the KKM scores. Diagram of students learning outcomes can be seen in figure 7.

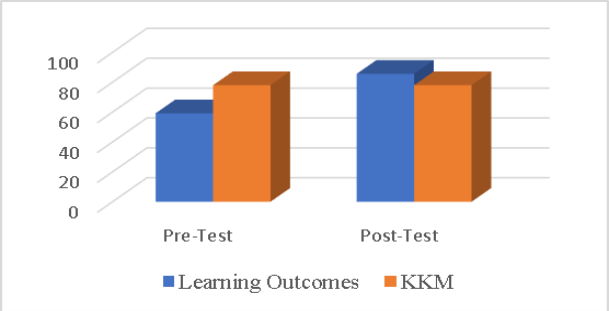

Figure 7. Diagram of Comparison of Student Learning Outcomes with KKM value

3.4.2 Normality Test

The normality test using the Chi Square method was first carried out by dividing the data into six classes and entering them into the auxiliary table. The complete calculation of the normality test for pre-test and post-test data summarized on the table 10.

Table 10. Normality Test Calculation

Data	X^2 count	X^2 table	α	Description
Pre-Test	10.78	11.070	0.05	Normally Distributed
Post-Test	8.78	11.070	0.05	Normally Distributed

As shown in table 10, the Chi Square count (X^2) of pre-test and post-test is 10.78 and 8.78, respectively. Chi Square table at α = 0.05 with db = 5 is 11.070. By comparing the value that have been obtained from pre-test and post-test data, it can be seen that 10.78 < 8.78 or $t_{count} < t_{table}$. Thus, it can be concluded that the pre-test and post-test data is Normally Distributed.

3.4.3 Homogeneity Test

The homogeneity test aims to test whether a data group of pre-test and post-test has the same variance among the members of the group. The homogeneity test carried out in this study was the homogeneity test of one sample group. To calculate the variance and standard deviation of one sample group, a supporting table is needed as attached in the appendix 19. The complete calculation of the homogeneity test of pre-test and post-test data can be seen in the appendix 19 and summarized in table 11.

Table 11. Homogeneity Test Calculation

Data	Squared Deviation $(Xi - X)^2$	Variance (s^2)	Standard Deviation (s)
Pre-Test	4584	191	13.820
Post-Test	2016	84	9.165

Based on table 11, the variance and standard deviation values obtained from the pre-test data are 191 and 13.820, respectively. While the value of variance and standard deviation of the post-test data obtained is lower than the pre-test data, namely 84 and 9.165.

3.4.4 Hypothesis Test

Hypothesis testing is done by using one sample t-test. Prior to testing, the determination of the hypothesis is done first. The hypothesis formulated by the researcher is as follows:

Ha : Student learning outcomes who are taught using interactive learning media on the reaction rate material that has been developed are higher than KKM value.

H_0 : Student learning outcomes who are taught using interactive learning media on the reaction rate material that has been developed are lower than KKM value.

Based on the hypothesis calculation on the appendix 20, it is obtained the value of t_{count} is 4.146. The value of t_{table} at α= 0.05, db = 24 is 1.711. By comparing the values that have been obtained, it can be seen that 4.146 > 1.711 or $t_{count} > t_{table}$. Thus, it means that Ha accepted or H_0 rejected. So, the conclusion is student learning outcomes who are taught using interactive learning media on the reaction rate material that has been developed are higher than KKM value.

3.5 Discussion

The first stage carried out by the researcher was the analysis stage. Based on the results of observations of teachers and students conducted through interviews and questionnaires, the use of learning media, especially android-based learning media in the learning process has not been able to run effectively. The teacher stated that the lack of use of android learning media was due to network barriers and internet packages that often occurred so that the teacher preferred to carry out the learning process by giving assignments to students. Furthermore, this statement is supported by the results of the questionnaire, the biggest obstacles experienced by students are limited communication with teachers (67.3%) continues with inadequate internet network (42.3%), 88.5% of students agree that the learning media used by teacher did not vary and did not support active interaction between teachers and students during the learning process so that learning still seems monotonous.

The challenge that must be faced in implementing electronic learning media in online learning is the availability of internet services and the costs required to buy internet packages are also quite large so that students feel burdened by it[8]. Learning media using the internet also has a disadvantage, namely that it depends on the network. If the network and signal do not support it, then learning media based on Android and computers will be difficult to implement[9]. Learning media must consider the obstacles experienced by students. As the result, the product to be developed in this research is an Android-based interactive learning media with main advantages which has a low capacity for using internet packages and can be used online and offline. In addition, several additional advantages of the Android-based interactive learning media are composed of several features, namely material with an attractive appearance so that students not feel bored; interactive exercises integrated with sound, true or false answers with the discussion and score; homework integrated with comment and upload file feature; learning videos that support chemical calculations.

The second stage is design, the data collected is in the form of teaching materials for chemistry, reaction rates and animations; 4 learning videos consisting of 3 YouTube videos and 1 personal video; 40 questions about the reaction rate which will then be validated, then from 40 questions 15 questions will be taken to be inputted into the learning media. Furthermore, the researchers designed the layout for each menu and icon that will appear on this learning media.

The differences between the media developed in this study and previous research are the media that will be developed in this research is Learning Application Based on Android which can be used both online and offline, the media uses sound that can be turned on or off according to the user's wishes, the material is integrated with moving images and animations, the exercise not only can state a true or false answer but also consist of the discussion of the problem, the homework consists of the comment feature and uploads file, a score ranking feature and a log out feature.

The third stage is development, the researchers compiled an android-based learning media in reaction rate material and in accordance with the BSNP. Learning media was developed using the android studio application with the java programming language. The output produced is the LydApps: Android-based Reaction Rate Chemistry Learning Applications with 40 MB storage capacity. Furthermore, this learning media was validated by material experts and media experts. The results of media validation for the aspects of content feasibility, display feasibility, language feasibility and graphic feasibility are 3.75, 3.83, 4, and 3.83, respectively. The final result obtained from the average value of the four aspects is 3.85 and declared valid with the criteria doesn't need revision. This is in accordance with the BSNP eligibility criteria which is divided into 4 criteria, namely valid and does not need to be revised in the range 3.26-4.00, valid and does not need to be revised in the range 2.51-3.25, invalid and some of the contents need to be revised in the range 1.76-2.50, invalid and need to be totally revised in the range 1.00-1.75[10].

The fourth stage is implementation. At the first meeting, pre-test was conducted to students. After giving the pre-test, students will be taught several subtopics on the reaction rate material using android-based learning media. At the second meeting students will continue the subtopic on the reaction rate material that has not been studied at the first meeting using android-based learning media. After that, students will be given a post-test. The results obtained for the average pre-test score of students were 59.2 with a minimum score of 30 and a maximum score of 80, while the average post-test score of students was 85.6 with a minimum score of 60 and a maximum score of 100. The KKM scores of students in this study is 78.

Based on the data obtained, it can be seen that the average score of the students' pre-test is lower than the KKM score.

This is because the learning media has not been applied to students. Students are still learning online independently and only do the assignments given by the teacher. This makes students not master the material as a whole. Meanwhile, the average post-test score of students is higher than the KKM score. This is because the android-based learning media has been applied in the learning process. This android-based learning media provides an effective learning space for students because it has been equipped with interesting features. Students no longer have difficulty understanding the material because this learning media is also equipped with interesting videos, and is equipped with interactive practice questions that help students find the right solution to the problem.

The learning media used for the learning process has not been varied and has not supported active interaction between teachers and students during the learning process so that learning still seems monotonous. The concept of material that is abstract, difficult to visualize, and the use of learning media has not been maximized, causing a lack of student interest in the learning process so that students do not focus on the online learning process and lead to low student learning outcomes[11].

Furthermore, hypothesis testing is carried out to draw conclusions from this study. Hypothesis testing was carried out using one sample t-test. The data used in hypothesis test in this research is post-test data. If the value of t_{count} is in the critical area ($t \geq t_{\alpha}$) so H_0 rejected or Ha accepted. The value of t_{count} that obtained is 4.146. The value of t_{table} at α= 0.05, db = 24 is 1.711. By comparing the values that have been obtained, it can be seen that 4.146 > 1.711 or $t_{count} > t_{table}$. Thus, it means that **Ha accepted or H_0 rejected.** The conclusion is student learning outcomes who are taught using interactive learning media on the reaction rate material that has been developed are higher than KKM value.

The disadvantages of this research are the limitations in developing the comment feature and uploading files on homework. This limitation is in the form of comments and files sent by users will enter the programming system so that comments and files can only be seen by researchers (media creators) after being extracted from the system and have minimal capacity of file uploaded.

4. CONCLUSION

1. Android-based interactive learning media been developed met the feasibility standards based on the android-based integrated BSNP in value 3.85 with criteria valid and doesn't need revision
2. Student learning outcomes taught using android-based interactive learning media that have been developed higher than the KKM value.

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