Development of Android Based Application as an Instructional Media on Reaction Rate Chapter for 2ⁿᵈ Grade Senior High School Student

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Abstract—Since the spread of the Covid-19 outbreak, face-to-face learning activities in class have been stopped and changed to online learning. This sudden change raises several new problems in the educational world. Therefore, the appropriate instructional media is needed for students to be able to learn independently and participate actively. The purpose of this study was to develop and determine the level of validity of Android-Based Applications as instructional media on reaction rate chapter for 2nd grade Senior High School Student. This research is Educational Design Research with Plomp development model. The subjects of this study were 2ⁿᵈ grade students and chemistry teacher of SMAN 7 Padang, chemistry department lecturers and engineering department lecturers. The research instrument was a validity sheet to examine the validity. The result have been obtained from this study were from eight construct experts and three media experts. The construct aspect has a validity level with a validity value of 0.85 and the media aspect has a validity level with a validity value of 0.988. The results of this study indicated that Android-Based Application as instructional media on Reaction Rate chapter for 2nd grade Senior High School Student was valid.

Keywords—*Application, Android, Instructional Media, Reaction Rate, Validity.*

I. INTRODUCTION

The spread of the Covid-19 outbreak made learning carried out remotely is called online learning based on the regulation of the Directorate general of Higher Education of the Ministry of Education and Culture Republic of Indonesia No. 1 of 2020 regarding the prevention of the Covid-19 outbreak [1]. This requires all the elements involved in the educational world to replace teaching-learning methods and systems. This sudden change raises several new problems in the educational world. Yuangga et al [2] state that one of the problems on online learning is the unpreparedness of students and teachers. This can happen because students must be able to understand the material without direct guidance from the teacher and must provide extra funds for internet data.

Based on the results of questionnaires distributed in four schools, such as : SMAN 1 Padang, SMAN 7 Padang, SMAN 16 Padang, and SMA Adabiah 2 Padang state that in the online learning students have not been able to learn independently and actively. Students have several problems such as difficulties in having internet data, unsupported signals, so students cannot carry out online learning at the specified time. In addition, teachers also have difficulties in the online learning system such as difficulty of correcting students' assignments and exercises. The use of android as one of the main devices in online learning is also not

optimal for learning. Safitri et al [3] state that the dependence of Indonesian students on smartphones/androids was very high. However, using Android for a long duration for less useful things can have a negative impact on students, such as decreasing the quality of students in learning. In fact, if Android contains applications and learning content, this can be a fun and interesting learning media so that it can improve the quality of students learning [4]. Based on this, the innovation are needed to make the use of android is maximally for online learning so students can learn independently and actively. One of the innovation to use android in learning is the use of android-based applications.

Android-based instructional media application is a learning application that developed on android device with Kodular web as the app inventor. This application can be used as a instructional media for mobile learning. Android-based application is instructional media using mobile devices and without a cable connection [5]. This application is developed in such a way as to be attractive and liked by teachers and students so make student can learn independently and actively. Android-based applications have characteristics are practical and can be carried anywhere. In addition, the android-based application presents text, images, audio and video so that it is more interesting and easy to understand. According to Fatma et al [6] android applications can be used as student learning sources. The android-based application can be used as a instructional media in providing learning in the classroom. By using this application as a instructional media, it will make the learning process centered on students.

Chemistry is one of the subject that can use android-based applications as instructional media.The material that must be studied in chemistry subject by students of 2nd grade senior high school student in odd semesters is the rate of reaction. The material has the characteristics of a complex material. Musya'idah et al [7] state that based on the results of the analysis of the reaction rate material, it was found that the reaction rate contains abstract concepts, mathematical calculations, and graphs, this makes it difficult for students to learn the material of reaction rates. Therefore, it is necessary to have a good understanding of the concept in studying the material.

Studies on the development of learning media based on Android applications have been tried by several previous researchers. Lubis et al [8] report that there was an increase in students' learning motivation and cognitive achievement after using chemistry android-based instructional media compared to conventional learning. Prasetyo et al [9] report that android-based chemistry learning media can have a significant effect on increasing the learning motivation of high school students. Furthermore, Yektyastuti, et al [10] also develop an android-based instructional media on the solubility module. It was found that the use of the developed chemistry instructional media had an effect on increasing the academic performance of senior high school students.

Based on the problems that have been explained, this research develop and design an Android-based application as instructional media on reaction rate chapter for 2nd grade senior high school student. The android-based application will be examined by several expert until the android-based application is valid.

II. METHODS

The type of this research is EDR (Educational Design Research). This research was conducted to produce an Android-based application instructional media on the reaction rate chapter for 2nd grade senior high school students. The development model in this research is Plomp model which consists of three stages, are : preliminary research, development and prototyping phase, and assessment phase. However, this research is limited only to the development and prototyping phase at the validity stage.

In the Preliminary Research will be carried out several analyzes, namely : needs analysis, context analysis, review of literature, and conceptual framework. Needs analysis was carried out by giving questionnaires to chemistry teachers and 2nd grade senior high school student at SMAN 1 Padang, SMAN 7 Padang, SMAN 16 Padang, and SMA Adabiah 2 Padang. Needs analysis aims to determine the characteristics of the needs and problems faced by student teachers. After getting the problems obtained through the distribution of questionnaires, the researchers conducted a context analysis of basic competence related to the reaction rate which would produce indicators and learning objectives that would be presented in an android-based application. Then a review of literature was carried out in several journals that had similar problems and tried to find solutions to problems in the field. The journals read are a source of research ideas.

At the stage of development and prototyping phase will be produced 3 prototypes, are: prototype 1, prototype 2, and prototype 3. Each prototype is the result of formative evaluation carried out on each prototype produced. The formative evaluations that will be carried out are: self evaluation which aims to check the completeness of the components in the application; evaluation based on

expert review (expert review) and one-to-one evaluation which aims to see the validity of the developed android-based application.

The analysis technique of instructional media validity is carried out to see the developed instructional media expediency can be continued to the next stage, that are practicality and effectiveness. The formula used for validity is Aiken with Aiken's V index. This formula is based on the results of an expert assessment with the number of n people on an item regarding the review of the item representing the construct. The formula for calculating the validity coefficient of Aiken's V is as follows :

$$V = \frac{\sum s}{[n(c-1)]} \quad (1)$$

$$s = r - Io \quad (2)$$

V is the validity index, r is the scale given by the validator, Io is the lowest validity scale, c is the highest validity scale, and n is the number of raters [11].

III. RESULT AND DISCUSSION

A. Preliminary Research

Preliminary research aims to determine the condition of teachers and students during online learning, especially on the topic of reaction rate. In the preliminary research stage carried out several activities, namely 1) Needs analysis 2) Context analysis 3) Review of Literature, and 3) Conceptual framework.

In the needs analysis, researchers distributed questionnaires in 4 schools, namely SMAN 1 Padang, SMAN 7 Padang, SMAN 16 Padang and SMA Adabiah 2 Padang. Respondents to this research questionnaire were 6 high school chemistry teachers and 120 high school class XI students, 30 students from class XI high school were taken from each observation school. Based on the results of the questionnaires that have been distributed, it is found that: 1) Teachers have used instructional media in the discovery and consolidation of concepts in online learning. Media and teaching materials used by teachers are printed books, LKPD, E-Modules, PPT, and learning videos 2) All teachers and 95% of students use android in online learning 3) Teachers and students like media with characteristics are: has audio and video , can be used for practice questions, can be used to measure students' mastery of the material, can be used anytime and anywhere, and can be used in a state connected to the internet or not 4) Teachers still need other alternative media for teaching on reaction rate chapter 5) almost all of teachers and students have never used an Android-based instructional media application on the reaction rate chapter, so teachers and students are interested in developing an Android-based instructional media application on the reaction rate chapter.

In addition, researchers also found several problems faced by teachers and students during online learning, namely: 1) The media and teaching materials used have not made students learn independently 2) Media and teaching materials, electronic devices, and applications/sites used have not made students participate actively in online learning 3) Students have problems in online learning such as difficulty in having internet data, unsupported signals, students carry out online learning at the specified time, and students have difficulty understanding the material being studied 4) Teachers have difficulty in correcting assignments and exercise/evaluation of students in online learning on reaction rate chapter 5) 55.83% of students use android 5-10 hours a day but 58.33% of students in that duration less than 25% are used for chemistry learning. Based on the needs and context analysis that the researchers got from the observations made, the researchers developed an android-based application as a instructional media for the reaction rate chapter for 2nd grade senior high school student. Context analysis is done by analyzing Core Competencies and Basic Competencies which will be used in android-based applications on this reaction rate material. At this stage a competency and instructional analysis is carried out which includes an analysis of basic competencies of the reaction rate in 2nd grade senior high school. Instructional analysis is a decrease in Basic Competencies that have been selected at the competency analysis stage to become learning indicators and learning objectives that will be presented in android-based applications.

The results of a literature study related to the development of Android-based applications that have been carried out and tried by several previous researchers. Lubis et al [8] report that there was an increase in students' learning motivation and cognitive achievement after using Android-based chemistry learning media compared to conventional learning. Prasetyo et al [9] report that

android-based chemistry learning media can have a significant effect on increasing the learning motivation of high school students. Yektyastuti, et al [10] also developed an android-based learning media on the solubility module. It was found that the use of the developed chemistry learning media had an effect on increasing the academic performance of high school students.

The conceptual framework is designed based on the results of needs analysis, context analysis, and literature study by outlining the design of the research process, a series of research that will be carried out based on the results of the analysis that has been carried out so that it can connect the appropriate concepts so that a systematic concept is obtained [12]

B. Development and Prototyping Phase

At the prototyping phase, it is limited only to the validity stage. Android-based application as a instructional media carried out content and construct validity and media validity. Content and construct validity were carried out by 5 UNP chemistry lecturers and 3 teachers at SMAN 7 Padang. Media validity was carried out by 3 UNP Engineering lecturers.

1. Prototype I

The first activity carried out at this stage is making prototype I. Prototype I is a prototype made based on the results of the research design obtained in the preliminary research. After obtaining prototype I, a self-evaluation was carried out. It aims to see and see the completeness of the components in android-based applications. This evaluation is carried out using a check list for completeness of the application. In prototype I, it is complete so no revision is needed and the result is Prototype II.

2. Prototype II

Prototype II will be evaluated formatively. The formative evaluation that will be carried out are expert review and one-to-one evaluation. The expert review of the Android-based learning media application is carried out by several experts related to their fields. Validity consists of two aspects, namely content and construct validity and media validity. The assessment components on content and construct validity are 1) content component 2) construct component 3) linguistic component, and 4) graphic component. The results of the content and construct validity obtained are 0.85. This information can be seen in table 1 and in Figure 1

TABLE 1. CONSTRUCT VALIDITY

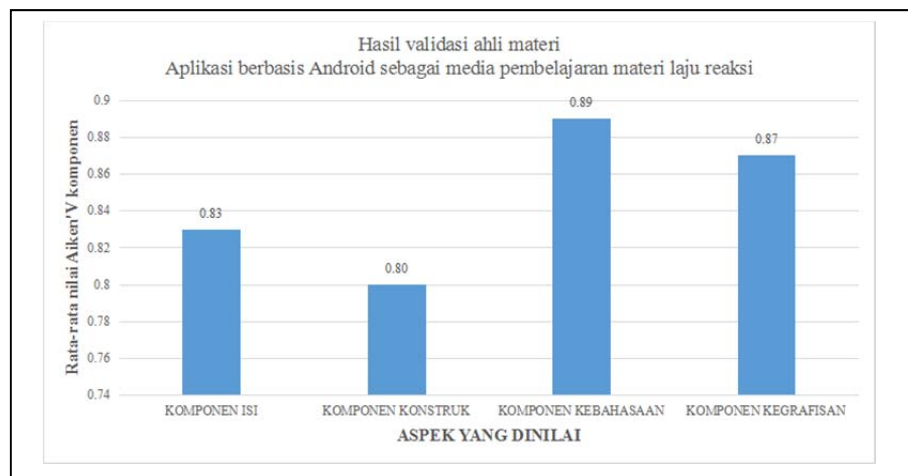| Num.	Assessment components	V	Validity
11	content	0.83	Valid
22	construct	0.80	Valid
33	linguistic	0.89	Valid
44	graphic	0.87	Valid
Average		**0.85**	**Valid**

Fig 1. Content and Construct Validity Result Graph

Media validity has three assessment components, namely 1) Media efficiency 2) Button function, and 3) Physical quality. The results obtained from the validity of the media are 0.988. This information can be seen in table 2 and figure 2

TABEL 2. MEDIA VALIDITY

Num.	Assessment components	V	Validity
11	Media efficiency	**0,983**	Valid
22	Button function	**0,979**	Valid
33	Physical quality	**1,00**	Valid
Average		**0,988**	**Valid**

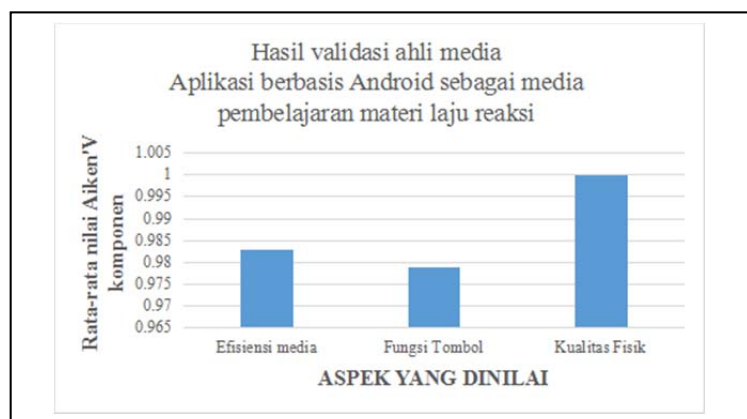Fig 2. Media Validity Result Graph

One-to-one evaluation was conducted with three students of SMAN 7 Padang.One-to-one evaluation aims to see the attractiveness, clarity, and errors contained in the application. Based on the results of interviews, students state that the Android-based instructional media application had an attractive appearance, easy to use, the font type and size were good, and the language was easy to understand. The results obtained from this formative evaluation in the form of suggestions from the validity experts will be used for making prototype III.

3. Prototype III

Prototype III is a prototype resulting from the improvement of prototype II based on the suggestions given by the validity experts in formative evaluation. This prototype III is an Android-based learning media application that is already valid. The display of the parts of the Android-based learning media application can be seen as follows:

Fig 3. Application Log In screen

Log in screen will be seen when firstly we open the application. This screen contain application logo and start button. User need to click the start button before use this application.

Fig 4. Homepage Screen

After log in screen is clicked, homepage screen will be appeared. This screen contains all of menus in the android-based application. This application made using Indonesian Language. The first menu is guideline. The guideline made for teacher and student, these are make the users easier to use the android based application. Competence menu contain the basic competence, competence indicator, and learning objectives. The purpose is to make student and teacher know the competence that will be achieved after learn using this android based application. The concept map menu contain concept map that appropriate with rate of reaction chapter. Material menu contain the main of this application. There are 3 sub-chapter that are collision theory, rate of reaction concept, and factors that impacted the rate of reaction. Material in each part of chapter are arranged using guided inquiry learning model furthermore will be shown on fig. 5. Attendance list aims to make teacher can get student attendance easily using this application. The list will be gotten in teacher's google drive. The attendance list screen shown on fig.6. Evaluation menu contain evaluation questions and discussion. Evaluation question is linked to quizziz, then student able to answer the question. The advantage of quizziz able to make students work correctly and fastly. There are rank of student that have been finished the quiz, the rank make students are motivated. Student able access discussion or answer key after finished the quiz. Teacher gives student the password to access the discussion. The evaluation screen shown on fig.8. Profile menu contain the developer profiles. Profile menu shown on fig.9. References menu or the bibliography contain list of books and references have been used while develop the application content. Feedback menu aims to make developer able to adjust and improve for the next step. Feedback menu shown on fig. 7.

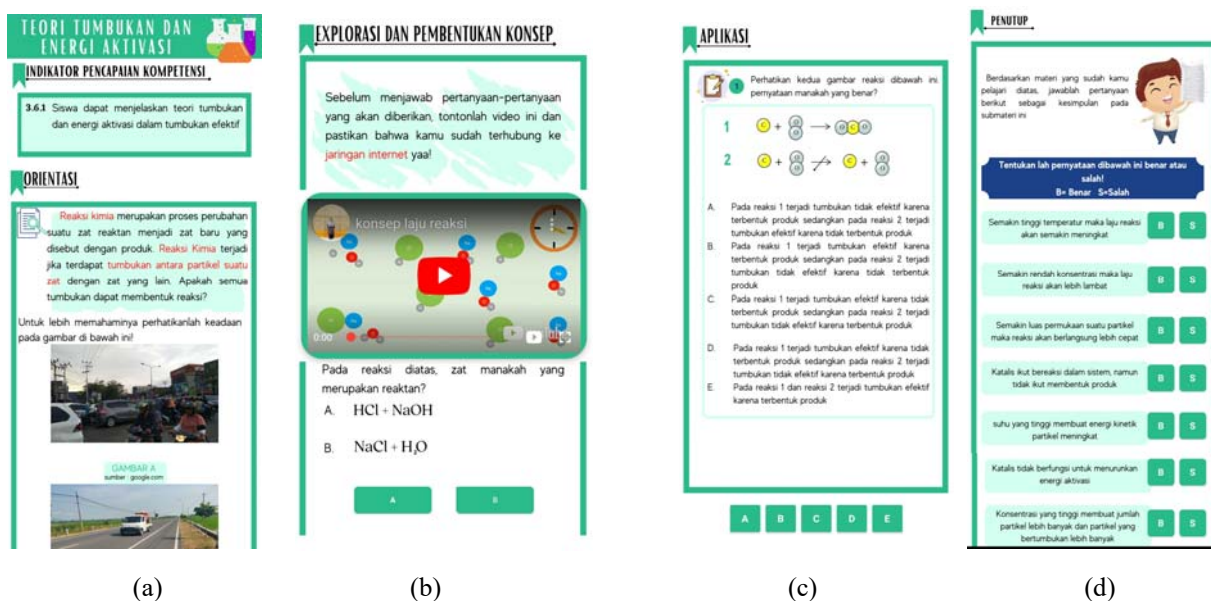(a)   (b)   (c)   (d)

Fig. 5 guided inquiry learning model in android-based application (a) Orientation stage (b) Exploration and concept invention stage (c) Application stage (d) Closing stage

There are many advantages from the utilization of guided inquiry learning model in the android-based application that has been developed. On the orientation stage, there are model in the form of picture then there are some of question that make student curious. We can called as question of the day. Continue to Exploration and concept invention stage, there are models in the form of video, picture, and graph then there are a number of key questions that must be answer consecutively. Each of question must be answered correctly before continue to the next question. This sequence make student able to learn independently because this make student explore and invent the concept by themself. On the application stage, there are a number of question that given to student. The questions are the implementation of the concept that has been explored. The answer explanation will be given after student able to answer the question correctly. The answer explanation make student understand deeply about the concept. The last is closing stage, students are expected able to conclude the main concept that have been explored and have been invented by themself before. In the android-based application, there are some type of questions that given, such as multiple choices, true or false, fill the blank, etc. Various kind of question make student motivated.

Fig. 6. Attandance List

Fig. 7. Feedback

Fig. 8. Evaluation

Fig. 9. Developer Profiles

IV. CONCLUSION

Based on the development of android based application as an instructional media on reaction rate chapter for 2nd grade senior high school student and a number of evaluation that have been done, we able to conclude that android based application as an instructional media on reaction rate chapter has been developed using Plomp model. Android based application as an instructional media on reaction rate chapter is valid based on Aiken'V index. Construct aspect validity level with value 0.85 and media aspect validity level with value 0.988.

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