

ARTICLE

Development Of Android Application For Green Chemicals In The 2030 Sustainable Development For Grade X at The Activator School In Senior High Schools

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ABSTRACT

The study aims to create an android application-based learning media for activator schools on green chemistry in the 2030 sustainable development that is valid and practical. This research is development research conducted with the Plomp development model. The Plomp development model consists of three stages including the preliminary research, development or prototyping phase, and the assessment phase. The research was conducted at SMAN 15 Padang. Product validation is carried out by media experts and material experts. The product practicality assessment was carried out by 2 chemistry teachers, 18 students in grade X.7 for small group trial. The results showed that the android-based learning media developed were categorized as valid (0,92 for the material and 0,90 for the media) and the results of the practicality test were very practical, respectively 88% for the teacher practicality test, 91% for the small group test. In conclusion, android-based media products on green chemistry in the 2030 sustainable development are Valid and practical to implement in chemistry learning in activator schools.

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1. Introduction

Since 2020, education in Indonesia has been experiencing extraordinary changes from the impact of the COVID-19 pandemic. To adapt to existing conditions, policymakers have developed several concepts of curriculum change. Such as the adjustment of the 2013 emergency curriculum which was simplified to the adjustment of the prototype curriculum which is now called the Merdeka Curriculum. The Merdeka Curriculum is a curriculum that can be chosen as an option to be implemented by the education unit for the 2022/2023 academic year (Margaretha P.N & Konten, 2021). The Merdeka Curriculum is expected to accelerate the recovery of learning after the Covid-19 pandemic and develop the character of students according to the profile of Pancasila students. To implement the Merdeka Curriculum, the Minister of Education and Culture and Research and Technology, Nadiem Makarim, is very serious about launching the Activator School Program.

An activator school is a school that focuses on student learning outcomes holistically with the realization of a Pancasila student profile consisting of competencies (literacy & numeracy) and character starting with superior

human resources (principals and teachers). In the academic year (FY) 2021/2022, the Activator School Program includes approximately 2,500 educational units in 34 provinces and 110 districts/cities. And in the academic year (TA) 2022/2023, it is targeted that as many as 10,000 educational units in 34 provinces and 250 districts/cities are involved to participate in the Activator School Program (Faiz et al., 2022). That way, it can be seen clearly the plans of policymakers to realize the goals of an Merdeka Curriculum.

Not only adjusting the Merdeka Curriculum in activator schools, Kemendikbud-Ristek is also thinking about a new educational paradigm that leads to the concept of 21st-century learning where Indonesian education needs to make improvements to exist in the current globalized education era (Faiz & Faridah, 2022).. In the 21st century, it is suggested to have several skills, namely the skills to think, act and live in the world. First, thinking skills consist of creative thinking, critical thinking, and problem-solving. Second, Action skills consist of collaboration, communication, and literacy (digital and technology). And lastly, worldwide life skills include initiative, self-development, global knowledge, and social responsibility. These skills should be implemented in 21st-learning because this era will require humans who can innovate and have creativity in order to adapt quickly. So that the government of the Republic of Indonesia must pay attention and as soon as possible complete appropriate facilities and infrastructure to face global developments, the most important thing is in the era of society 5.0 (society 5.0) (Putriani & Hudaidah, 2021)

The era of society 5.0 (Society 5.0), also called super smart society, is a society that can innovate anything in the era of the industrial revolution 4.0. For example, the internet of things, artificial intelligence, big data, and robots to advance the quality of human life that aims to deal with various kinds of social challenges and problems (Indarta et al., 2022). Students in the 21st century are generation z or millennial generation, namely the generation that is native to technology (Pujiriyanto, 2019).. Now technology has a very important role in the world of education, such as the existence of electronic media that is used as a source for learning other than teachers (Effendi & Wahidy, 2019) and the learning process that can be carried out online by using the internet (Indarta et al., 2021).

The use of technology and information in education can be used by educators to create learning media. Learning media are everything that can deliver messages to recipients in teaching and learning activities. Teachers must be able to develop their creativity in making learning media such as Android-base learning media by utilizing the use of technology. Students are also expected to be able to use technology in their learning activities

Android-based learning media in the learning process can be used by teachers to present material. The advantage of an Android-based application is that it provides convenience anywhere and anytime. Based on research from (Tjandi, 2022) entitled "Development of Mobile Applications Loaded with Problem Based Learning as Interactive Learning Media Using Android Studio for Basic Networking Computer Subjects" with the results of research that mobile applications containing problem-based learning as interactive learning media using Android studio are very feasible and practical and quite effective in its application.

One of the learning models that can be used for 21st century learning skills is the problem-based learning model (Barus, 2019). The learning model is one of the important components to support the success of learning activities. The selection of the learning model must be appropriate because it can have an impact on the success and achievement of learning objectives which are marked by certain positive behavioral changes (Samala et al., 2022).. PBL is based on various problems that require authentic investigation, namely the real solution of real problems (Trianto, 2010). The direct impact of learning using PBL (Problem based Learning) can be seen in the understanding, transfer of knowledge, critical thinking skills, problem-solving abilities, and communication skills of students

One of the chemistry materials for grade X semester 1 in the Merdeka Curriculum is green chemistry in 2030 sustainable development. Characteristics of green chemistry material introducing the chemical concepts in environmental management in real life can use the Problem-based learning model. This issue is still new so the learning resources in the form of learning media are still few, and teachers only use student books as learning resources. Teachers are still in the stage of developing teaching materials or learning media about green chemistry in the 2030 sustainable development.

Based on the results of interviews and questionnaires that have been distributed to grade X students who have studied green chemistry material as many as 50 people at SMA 15 Padang, the results are: (1) learning media related to Green Chemistry material in Sustainable Development 2030 in activator schools is still lacking, teachers only using teaching modules from the Ministry of Education and Culture, videos, and textbooks. (2) the concept and understanding of students regarding Green Chemistry material in sustainable development in 2030 is still lacking, it can be seen from the results of the questionnaire that 54% of students stated that they had difficulty to learn this material. (3) 86% of students stated that IT-based learning was interesting, at the Activator School, students were required to use IT in learning activities, and 100% of students had androids. (4) teachers need other alternative

learning media in accordance with the activator school program in learning about Green Chemistry in Sustainable Development 2030 and (5) Teachers and students have never used an android application in the form of learning media on green chemistry material in the 2030 sustainable development so that teacher and students are interested in developing an android application for Green Chemistry in the 2030 Sustainable Development.

The Android-based application was developed to create learning media in schools that apply an Merdeka Curriculum for grade X chemistry learning on green chemistry in the 2030 sustainable development.

2. Method

The research method is Research and Development (R&D), according to (Batubara, 2020) development research aims to produce a certain product through a research process. The subjects of this study were chemistry lecturers, FMIPA UNP, electronics engineering lecturers, FT UNP, high school chemistry teachers, and grade X.7 students at SMA 15 Padang. The research object is an android application in the form of learning media on green chemistry in the 2030 sustainable development for grade X in the activator school. The development model used is the Plomp model. The Plomp development model consists of 3 stages, namely preliminary research phase, the development or prototyping phase and assessment phase (Plomp & Nieveen, 2013). This research is limited to the development or prototyping phase until the practical test. In accordance with the development model used, the product development procedure is focused on two stages. These stages can be illustrated in table 1.

Table 1. Product Development Stage

Stage	Criteria	Activity Description
<i>Preliminary research</i>	Observation and interview activities, focus on the requirements and applications needed.	Problem analysis and literature study. The result of this stage is a conceptual framework based on the problems and constraints experienced by teachers and students.
<i>Development or prototyping phase</i>	Focus on product development and practical stage in small group trials (<i>small group</i>)	Development of a prototype that will be piloted and revised based on formative evaluation and Conduct practical stage to assess whether the product is practical

The instrument used in this research is a validation instrument in the form of a media expert validation questionnaire sheet and material expert validation for the assessment of learning media based on a ready-made Android application. And a practical instrument in the form of a student and teacher response questionnaire which aims to assess the android application created in terms of learning aspects, interface components and programming. Then the data obtained is used to see the level of validity of the application to be analyzed by using the Aiken's V formula and the level of practicality using the percentage formula. Data analysis techniques for each test are as follows:

1) Validity analysis technique

In the Validation questionnaire, the validator provides an assessment of the question items. Then the given value the validator for the question items will be analyzed using the Aiken's V formula. At the end of the assessment a V value is obtained which is called the validator agreement index.

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

$$s = r - lo$$

Description :

- Lo = lowest validity score (lo= 1)
- c = highest validity score (c= 5)
- r = validator choice category score
- n = number of validators

Table 2. Validity category base on Aiken's V

No. of Items (m) or Raters (n)	Number of Rating Categories (c)											
	2		3		4		5		6		7	
	V	p	V	p	V	p	V	p	V	p	V	p
2							1.00	.040	1.00	.028	1.00	.020
3							1.00	.008	1.00	.005	1.00	.003
3			1.00	.037	1.00	.016	.92	.032	.87	.046	.89	.029
4					1.00	.004	.94	.008	.95	.004	.92	.006
4			1.00	.012	.92	.020	.88	.024	.85	.027	.83	.029
5			1.00	.004	.93	.006	.90	.007	.88	.007	.87	.007

Source : Aiken 1985

2) Practical analysis techniques

The data analysis technique for the practicality assessment of the android application is determined by using the percentage formula with the formula:

$$\text{Practicality percentage} = \frac{\text{Total Value}}{\text{Maximum Value}} \times 100\%$$

Table 3. Practicality assessment category

Achievement Level	Category
81 % - 100%	Very practical
61% - 80%	Practical
41% - 60%	Quite practical
21% - 40%	Less practical
0 – 20%	Impractical

source : (Yanto, 2019)

3. Results and discussion

3.1 Preliminary Research

The initial investigation stage was carried out in several stages. These stages are needs analysis, context analysis, literature review and conceptual framework development.

a. Needs analysis

In the needs analysis stage, the researcher conducted several activities such as interviews with chemistry teachers at SMA 9 Padang and SMA 15 Padang and distributing questionnaires to students at SMA 15 Padang.

At this stage it can be concluded that overall, there is still a lack of variety of learning media in the activator school that is in accordance with the activator school program as well as the needs and characteristics of students who state that IT-based learning is interesting, then an android application is developed in the form of learning media for concept discovery and material stabilization. on Green Chemistry in Sustainable Development 2030.

b. Context analysis

At this stage an analysis of the curriculum is carried out. It is necessary to review the curriculum applied at SMA 15 Padang, namely the Merdeka curriculum. This curriculum is a new curriculum that has been implemented in the activator schools. The analysis of a curriculum has the aim of understanding the subject matter that will be explained during ongoing learning activities based on the desired learning outcomes. This analysis is used to see the suitability of the material with the android application and is used to Indicators of achievement of learning objectives (IKTP), which is used as a guide when developing android applications on green chemistry materials in the 2030 sustainable development for grade X at the activator school.

c. Literature review and conceptual framework development

The literature review aims to obtain references related to research activities related to the results of need analysis and context analysis. And the conceptual framework aims to obtain guidelines as a framework research based on the results of need analysis, context analysis, and literature review. Development of a conceptual framework based on the problems and constraints experienced by teachers and students is that learning media is needed in accordance with the activator school program.

3.2 Prototype Development Phase

a. Prototype I

In the design of prototype I, the source collection and determination of the components that will be loaded on the application are carried out. The design of the presentation of the material in the application is in accordance with the steps of problem-based learning. The design of the application is designed using the Canva website and the application is generated using the android studio site.

b. Prototype II

Prototype II was produced after the Self Evaluation stage was carried out on prototype I. In the self-evaluation, error checking was carried out on the determination of typing letters, button sizes, and completeness of components in the application.

c. Prototype III

Prototype III was produced after a formative evaluation was carried out in the form of a one-to-one evaluation and expert review which aims to obtain the validity value of the developed application in order to obtain a valid prototype III.

1) *One-to-one evaluation* test results

Step one-to-one evaluation was conducted on three students of grade X.7 SMAN 15 Padang who were selected based on their ability levels, namely high, medium, and low. Individual evaluations were carried out by interviewing after using prototype II which aims to find out errors in prototype II for example the appearance of the homepage or main menu that is less attractive, instructions for using applications that are difficult to understand, images and videos that are not clear and have no appeal to study, the material is presented less clear and students have difficulty understanding concepts, the language used is difficult to understand, the stages of learning are difficult to understand, and the type and size of letters are not clearly legible and writing and punctuation errors in the application.

2) *Expert review*

The prototype II that has been produced rated by three material expert validators and four media expert validators. The material expert validation process was carried out by experts in the field of chemistry consisting of two chemistry teachers at SMAN 15 Padang and one chemistry lecturer at the Faculty of Mathematics and Natural Sciences UNP. Validation of media experts was carried out by experts consisting of three lecturers of Electronic Engineering FT UNP and one lecturer in Chemistry, FMIPA UNP. The following are the results of validation by material expert validators and media expert validators for the green chemical android application in the 2030 sustainable development for grade X at the activator school:

a) Material expert validation results

The validity test data was obtained from the research instrument in the form of a validation questionnaire. The components assessed by the material expert validator are content components, construct components, linguistic components, and graphic components. The results of the validation are presented in Table 4.

Table 4. Validity assessment results by material expert validators

No	Category	V Average	Category Validity
1	Content Component	0,93	Valid
2	Construction Component	0,92	Valid
3	Linguistic component	0,93	Valid
4	Graphic component	0,92	Valid
	Average	0,92	Valid

Based on the results of the validation of material experts on the android application in the form of learning media, an analysis with Aiken's V application was valid with a very valid category of validity. Although the validity of the android application is very high, there are still some components that need to be improved.

b) Media expert validation results

Meanwhile, the components assessed by the media expert validator are the display aspect, the programming component, and the utilization aspect. Score of the validity assessment by media expert validators are presented in Table 5.

Table 5. Validation results by media expert validator

No	Category	Validity Average	Validity category
1	Display/User Interface	0,89	Valid
2	Programming Components	0,91	Valid
3	Utilization Aspects	0,91	Valid
	Average	0,91	Valid

Based on the results of the validation of material experts on the android application in the form of learning media, an analysis with Aiken's V application was valid with a very valid category of validity. Although the validity of the android application is very high, there are still some components that need to be improved.

d. Prototype IV

The results of the valid prototype III will be evaluated with a small group trial and teacher response to determine the level of practicality of the prototype III. The small group trial phase was carried out on 18 students of grade X.7 SMAN 15 Padang who have different levels of ability, namely high, medium, and low through a questionnaire as an instrument. Prototype IV was obtained based on improvements from prototype III. evaluation through small group testing (small group evaluation) Small group testing and teacher response has the aim of improving the quality of the prototype to get a prototype IV that is already practical. The practical results of the small group test and teacher response android application on all components are presented in Table 6 below

Table 6. *Practicality test*

N	Practicality Data	Practicality Percentage	Categories of Practicality
1	Teachers	88%	Very Practical
2	Students	91%	Very Practical

The practical assessment or field test of the green chemistry android application in

Based on the analysis of the practical results of the Small group test and teacher response android application of all components to prototype III, it was found that prototype III had a practicality percentage that was categorized as very practical.

The practical assessment of the green chemistry android application in 2030 sustainable development for grade X at the activator school is very practical. So that the android application can be used in learning process at the activator school.

4. Conclusion

From the results of research that has been carried out, conclusion can be drawn that the android application of green chemistry in 2030 sustainable development for grade X at the Activator School in high school has a very valid validity category and a very practical category of practicality so it is suitable to be used in the learning process at the activator school.

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