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Development of Android-Based Learning Media Applications on Atomic Structure Materials for Class X SMA/MA

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Abstract : Development of Android-Based Learning Media Applications on Atomic Structure Material for Class X SMA/MA. Android-based learning media application is one of the innovations in the world of education. This product was developed to meet the needs of teachers and students in learning. This study aims to develop an android-based learning media application on Atomic Structure material for class X SMA/MA that is valid and practical. This research is a development research which is carried out by using the Plomp development model which is limited to the *prototyping phase* for practicality testing in *small group evaluations*. The research was carried out at FMIPA UNP, FT UNP, and SMAN 8 Padang. Product validation is carried out by material experts and media experts. Product practicality assessment was carried out by 2 chemistry teachers and 12 students for small group trials. The validity analysis technique used the Aiken's V index and the practicality analysis technique used the percentage formula. The results showed that the developed Android-based learning media application was classified as valid (obtained an average value of V, namely 0.939 for material experts and 0.959 for media experts) and the practicality test results in small groups were classified as very practical (obtained a practicality percentage value of 94% for teacher practicality test and 93% for student practicality test).

Keywords: Android, Applications, Atomic Model, Atomic Structure, Learning Media.

Abstrak : Pengembangan Aplikasi Media Pembelajaran Berbasis Android Pada Materi Struktur Atom Untuk Kelas X SMA/MA. Aplikasi media pembelajaran berbasis android merupakan salah satu inovasi dalam dunia pendidikan. Produk ini dikembangkan guna memenuhi kebutuhan guru dan peserta didik dalam pembelajaran. Penelitian ini bertujuan untuk mengembangkan aplikasi media pembelajaran berbasis android pada materi Struktur Atom untuk kelas X SMA/MA yang valid dan praktis. Penelitian ini adalah penelitian pengembangan yang dilakukan dengan model pengembangan Plomp yang dibatasi sampai tahap *prototyping phase* untuk uji praktikalitas pada *small group evaluation*. Penelitian dilaksanakan di FMIPA UNP, FT UNP, dan SMAN 8 Padang. Validasi produk dilakukan oleh ahli materi dan ahli media. Penilaian praktikalitas produk dilakukan oleh 2 guru kimia serta 12 peserta didik untuk uji coba kelompok kecil. Teknik analisis validitas menggunakan indeks Aiken's V serta teknik analisis praktikalitas menggunakan formula persentase. Hasil penelitian menunjukkan aplikasi media pembelajaran berbasis android yang dikembangkan tergolong dalam kategori valid (diperoleh rata-rata nilai V yaitu 0,939 untuk ahli materi serta 0,959 untuk ahli media) dan hasil uji praktikalitas pada kelompok kecil tergolong sangat praktis (diperoleh nilai persentase praktikalitas yaitu 94% untuk uji praktikalitas guru serta 93% untuk uji praktikalitas peserta didik).

Kata Kunci : Android, Aplikasi, Media Pembelajaran, Model Atom, Struktur Atom.

• INTRODUCTION

The development of science and technology in the world of education today requires the learning process to be more applicable and interesting in order to improve the quality of education. To encourage the realization of this can be done by using learning aids or media. Learning media is an intermediary or tool to facilitate the learning process, which can streamline communication between teachers and students (Setyantoko, 2016). One of the innovations in learning is by implementing the use of gadgets, especially Android-based which are designed to assist the learning process (Samsinar, 2020).

Learning by using an Android-based gadget intermediary can be done on chemical material, one of which is Atomic Structure. The concepts in Atomic Structure material need to be understood correctly and well. Because the discussion of Atomic Structure can be considered as a door to the next understanding of chemistry (Mampate, 2020). So that the help that can be done is by selecting the right learning media.

After distributing questionnaires to teachers and class X students at SMAN 8 Padang, SMAN 12 Padang, and SMA Pembangunan Laboratorium UNP, it was found that teachers from the three schools in learning Atomic Structure material used media and teaching materials at the stage of discovery and consolidation of concepts. Where the media is able to present information to students in large numbers, but has not been able to make students independent during online learning. Besides, teachers in online learning use sites/applications such as Google Classroom, Zoom Meeting and WhatsApp. However, the use of these sites/applications has not made 66.67% of students participate actively in online learning. This is inseparable from the obstacles experienced by students during online learning. On the other hand, 66.67% of teachers also have problems in correcting assignments, exercises or students' evaluation on atomic structure material during online learning.

Then, from the results of the questionnaire were obtained information that teachers and students like media with certain characteristics. So that learning media are developed whose characteristics are appropriate and liked by students, and are expected to attract students' interest while studying. Where learning media that are made are interesting, can increase students' motivation in learning. Increasing students' motivation in learning will affect student learning outcomes so that they are able to achieve educational goals (Kurniawan & Hidayah, 2020). So learning media that is combined with this technology is made with an attractive appearance (Fuady et al., 2017).

Furthermore, from the questionnaire given in three schools, it was stated that 100% of teachers had problems in making android-based learning media applications on atomic structure material. So, based on the results of the questionnaire it was stated that an android-based learning media was needed for online/offline learning on Atomic Structure material, so that 100% of teachers and students were interested in and agreed to develop an android-based learning media application on Atomic Structure material. This is supported by the results of the questionnaire which state that all students have smartphones, and the majority of teachers allow students to use smartphones in the learning process.

• METHOD

This research belongs to the category of R&D (Research and Design). The research was carried out in order to produce an android-based learning media application on Atomic Structure material for class X SMA/MA that is valid and practical. The development model in this study is the Plomp development model. The research was carried out until the prototyping phase, namely the practicality test on the small group evaluation. The research was carried out in the 2021/2022 academic year, in which the preliminary research stage was carried out at SMAN 8 Padang, SMAN 12 Padang, and SMA Pembangunan Laboratorium UNP. While the development or prototyping phase was carried out at FMIPA UNP, FT UNP and SMAN 8 Padang. The subjects of this study were two chemistry lecturers at FMIPA UNP, two FT UNP lecturers, three chemistry teachers at SMAN 8 Padang, three students at SMAN 8 Padang for one-to-one evaluation and twelve students at SMAN 8 Padang for small group evaluation. The research instrument was a validity instrument in the form of a validation questionnaire for material experts and media experts. Then the interview sheet for students at the one-to-one evaluation stage. Next, the practicality instrument is in the form of a practicality questionnaire for teachers and students. Then the validity test data obtained were analyzed using the Aiken's V formula,

and the level of practicality using the percentage formula. Data analysis techniques for each test are as follows:

a. Validity Analysis Techniques

The validity analysis technique uses the Aiken's V index:

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

Information:

V = validity index
s = $r - l_0$
r = score given by the rater
l_0 = the lowest score in the scoring category
n = many raters (validators)
c = number of categories in the assessment

The results obtained are then processed and then interpreted on the Aiken's V index.

Right-Tail Probabilities (p) for Selected Values of the Validity Coefficient (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
5	1.00	.031	.90	.025	.87	.021	.80	.040	.80	.032	.77	.047
6			.92	.010	.89	.007	.88	.005	.83	.010	.83	.008
6	1.00	.016	.83	.038	.78	.050	.79	.029	.77	.036	.75	.041
7			.93	.004	.86	.007	.82	.010	.83	.006	.81	.008
7	1.00	.008	.86	.016	.76	.045	.75	.041	.74	.038	.74	.036
8	1.00	.004	.88	.007	.83	.007	.81	.008	.80	.007	.79	.007

Figure 1. Table Aiken's V
(Lewis. R. Aiken, 1985)

b. Practical Analysis Techniques

Practicality Analysis uses a percentage formula with the formula:

$$NP = \frac{R}{SM} \times 100$$

Information :

NP : expected or sought percent value
R : raw score obtained by students
SM : the ideal maximum score of the test in question
100 : fixed number

Table 1. Practicality Category

Score	Criteria
86% - 100 %	Very Practical
76% - 85%	Practical
60% - 75%	Quite Practical
55% - 59%	Less Practical
≤ 54%	Not Practical

(Purwanto, 2010)

- **RESULT AND DISCUSSION**

1. Preliminary Research

a. Needs Analysis

The results of the needs analysis are the media and teaching materials used have not been able to make students study actively and independently, especially in online learning on Atomic Structure material. Then, students need media that has audio/sound, learning videos, interesting visuals, practice questions for strengthening concepts, can be used anywhere and anytime both online and offline, easy to obtain and owned by students and perform the system submicroscopically, macroscopic, and

symbolic. Furthermore, many students have obstacles during online learning. Next, the teachers have problems in making Android-based learning media on Atomic Structure material and difficulties in correcting students' assignments during online learning. Based on this information, an Android-based learning media application was developed on Atomic Structure material.

b. Context Analysis

This stage performs an analysis of the abilities that must be achieved by students is carried out based on Permen no. 37 of 2018 regarding the 2013 revision of the 2018 curriculum. This analysis begins by reviewing the syllabus so that basic competencies are obtained which are reduced to become competency achievement indicators. Based on these indicators, it is hoped that students will be able to achieve learning objectives in Atomic Structure material.

c. Literature Review

The results obtained from the literature review refer to Khairiyyah & Azra (2021), Utari & Azra (2022), Kahesa & Azra (2022), Adawiyah & Azra (2022) and Misel & Azra (2022), each of them has developed media applications Android-based learning on SMA/MA Chemistry material. In which these researchers have tested the validity of Android-based learning media applications and the results are valid as learning media. Next, Islami (2018) has developed Android-based learning media on Atomic Structure material for class X SMA/MA, the results are valid and practical to use as learning media. Furthermore, Cahyana et al (2018) has developed an android-based learning media on the subject matter of Atomic Structure and the Periodic Table. Then Putri et al (2021) have developed android-based learning media to increase student learning motivation. Pamungkas (2020) has developed learning media using codular in branching and repetition material to increase students' understanding. Next, Yektyastuti & Ikhsan (2016) have developed Android-based learning media on solubility material to improve the academic performance of high school students.

d. Development of the Conceptual

The conceptual framework can be seen in Figure 2.

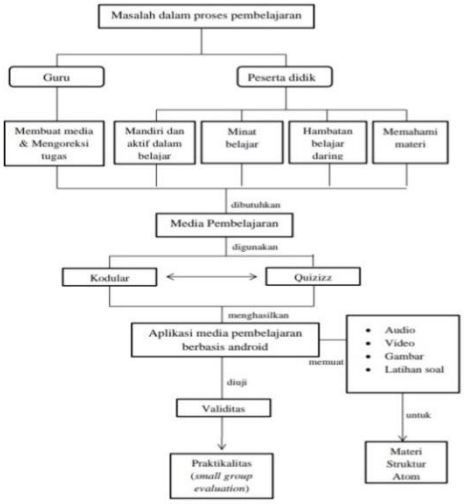


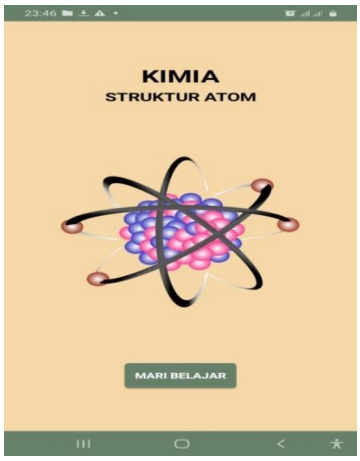
Figure 2. Conceptual Framework

2. Development or Prototyping Phase

a. Prototype I

Prototype I produces an android-based learning media application on Atomic Structure material which contains several components, the first of which is the Main Appearance of the Application. Which contains the application identity consisting of the application title, supporting images, and a

button containing the words "MARI BELAJAR". This main view also has audio that will turn on automatically when the application's main display page is opened. The main display can be seen in Figure 3.



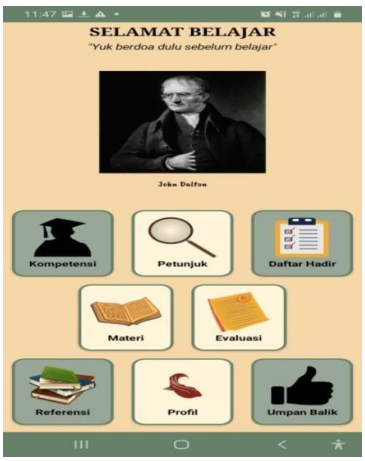


Figure 3. Main View Application **Figure 4.** Display Application Home (*Home*)

Next is the Application Home (*Home*) which can be seen in Figure 4. This is the main menu page of the application. The homepage of this application consists of several icons that can be accessed by users including the Kompetensi, Petunjuk, Daftar Hadir, Materi, Evaluasi, Referensi, Profil, and Umpan Balik. The homepage of this application also presents pictures or photos of chemists who have discovered various developments in atomic theory, where the photos can be changed automatically. Furthermore, this android-based learning media application has a Kompetensi feature, which presents KI, KD, IPK, Learning Objectives and Concept Maps related to Atomic Structure material. This feature aims to make teachers and students know the competencies that must be achieved in the learning process in this material. The next feature is Petunjuk, which contains directions for teachers and students in using this application. Then the Daftar Hadir feature aims to enable students to report their presence to the teacher in participating in the learning process through online applications. In this feature, the teacher can find out information from students in the form of name, class, school and location of students. The attendance list display can be seen in Figure 5.

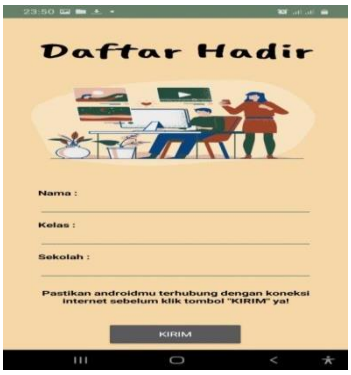


Figure 5. Attendance List Features

Next is the Materi feature. This feature contains learning material for Atomic Structure. Learning materials are arranged based on a scientific approach, starting from observing activities carried out by students on the images, videos or illustrations provided. Then students are guided through questions related to the results of observations. The next follow-up is to ask, namely to collect information, one of which is through the activity of answering a series of objective questions so that they find concepts independently. After that is the activity of associating or reasoning, namely the process of thinking logically and systematically through the activities of working on exercises with objective questions in order to solidify the concepts they have obtained, accompanied by their

discussion. Furthermore, communicating activities, namely students express conclusions independently regarding the concepts they have obtained. At the end of the learning material, a learning video is presented as a video to reinforce understanding of the concept, which contains an explanation regarding the material they have learned.

Then this application loads the Evaluasi feature. This feature contains questions and discussions related to Atomic Structure material. The questions are created on a website called Quizizz, which is then connected to this application. In this Quizizz, students will get a score based on the accuracy and speed in answering questions. This goals to create enthusiasm and motivation of students in learning. Furthermore, this feature also loads a page containing assignments related to the studied material. Next is the Referensi feature. This feature contains a list of sources or references used in developing this application. It is intended in order that students can browse learning material if they want to learn more. Then the Profil feature which contains the identity of the application maker and supervisor. Next is the Umpan Balik feature. In this feature students can provide an assessment of the learning process using this application. This feature is connected to Google Form, so teachers can access students' answers on the Google Form spreadsheet page.

b. Prototype II

The results of prototype I were then carried out (self-evaluation) to produce prototype II which was presented in the form of a questionnaire sheet, namely a check list system. The results obtained from the self-evaluation are the application components are complete.

c. Prototype III

1) Expert Review

a) Material Expert Validation Results

Based on the results obtained on the validity of the material expert, the average value of Aiken's V is 0.939. Thus the android-based learning media application on the Atomic Structure material developed is classified as valid. The results of the material expert validity data analysis can be seen in Table 2.

Table 2. Results of Material Expert Validity Data Analysis

No	Aspects assessed	V	Validity
1.	Content Component	0,903	Valid
2.	Construct Component	0,913	Valid
3.	Linguistic Component	0,968	Valid
4.	Graphical Component	0,975	Valid
***V* Material Expert Validity**		**0,939**	**Valid**

Based on these results, it can be seen that the media developed from the content components is in accordance with the demands of Core Competency, Basic Competency, Competency Achievement Indicators, and learning objectives. This is in accordance with what was stated by (Purwanto, 2010). Then, in the construct or presentation component, the system of material composing in this Android-based learning media application is appropriate based on a scientific approach, and is arranged systematically. In addition, the learning objectives and indicators to be achieved are clear, as well as the ease of using this Android-based learning media application. This is appropriate based on (National, 2008). Next is the language component, in terms of writing in content, videos and images contained in this Android-based learning media application can be read. Then the use of language is effective and efficient (brief and clear), and the language used is easy to understand. Furthermore, the rules in writing are in accordance with good and correct Indonesian language rules, and the information in this Android-based learning media application is contained clearly. This is in accordance with what was stated by (Ulumudin et al., 2017). Furthermore, in the graphical component, this Android-based learning media application is good, namely in terms of design and color of the initial display and display of content, layout (lay out) of the composition of content in the application, use of type (font) and font size (size). This is in accordance with what was stated by (Ulumudin et al., 2017).

b) Media Expert Validation Results

Based on the results obtained on the validity of media experts, the average value of Aiken's V is 0.959. Thus the android-based learning media application on the Atomic Structure material developed is classified as valid.

Table 3. Results of Media Expert Validity

No	Aspects assessed	V	Validity
1.	Media Efficiency	0,983	Valid
2.	Key Function	0,979	Valid
3.	Physical Quality	0,916	Valid
	***V* Media Expert Validity**	**0,959**	**Valid**

Based on these results, it can be seen that in terms of media efficiency, this Android-based learning media application in terms of installing applications, using applications, selecting application menus, interacting with applications, entering and exiting applications is relatively easy. This is in accordance with what was stated by (Yamin & Harmanto, 2020). Next from the aspect of button function. Where the accuracy of the button reaction (button) of this application is quite good. Then the use of application navigation is easy to use, the instructions for using this application are easy to understand, and the menu facilities in this application are quite complete. According to Yamin & Harmanto (2020), the use of menu buttons make it easier for students to access and run learning media based on Android applications. Next on the aspect of physical quality. Where in terms of application duplication, file capacity and storage as well as the strength or durability of the program are classified as good. This is in accordance with what was stated by (Latief et al., 2022).

2) One-to-one Evaluation

At this stage the information obtained that starting from the application homepage (home) it has a nice and attractive appearance, equipped with photographs of chemists or inventors of atomic theory, and the home section already represents the contents of the entire application. Students are very capable and easy to understand the instructions for using this Android-based learning media application. Furthermore, the images and videos contained in the Android-based learning media application can be observed clearly and help students find and understand the concepts. The presentation of the material is very complete and very interesting because it is accompanied by sound or audio and video, making learning fun. Furthermore, students easily understand the language used in this application. In terms of the use of type (font) and font size (size) in this Android-based learning media application, students can read it clearly.

d. Prototype IV

At this stage the average value of the practicality test was obtained from the chemistry teacher by 94% in the very practical practicality category, and for students it was obtained by 93% in the very practical practicality category. The results of practicality data analysis on teachers and students can be seen in Table 4 and Table 5.

Table 4. Results of Practical Data Analysis on Teachers

No	Aspects assessed	Percentage of Practicality	Category
1.	Ease of Use	93%	Very Practical
2.	Learning Time Efficiency	95%	Very Practical
3.	Benefits	93%	Very Practical
	Overall Percentage	**94%**	**Very Practical**

Table 5. Results of Practicality Data Analysis for Students (*small group evaluation*)

No.	Aspects assessed	Percentage of Practicality	Category
1.	Ease of Use	94%	Very Practical
2.	Learning Time Efficiency	93%	Very Practical
3.	Benefits	94%	Very Practical
Overall Percentage		**93%**	**Very Practical**

Based on the research results, it is known that in terms of ease of use, this Android-based learning media application is easy to use. This is in accordance with what is stated by (Kurniasih et al, 2020). Furthermore, on the efficiency aspect of learning time, this application is efficient in terms of time to be used in the learning process. This is in accordance with what was stated by (Putri, 2019). Then on the aspect of benefits, this application supports the teacher's role as a facilitator and reduces the teacher's workload to explain the material repeatedly. This is in accordance with what was stated by (Yamin & Harmanto, 2020). Besides, the benefits that are also felt by students including this application helps students understanding the concepts independently through pictures, animations, illustrations, learning videos. Then the practice questions provided can help students in strengthening the concepts they have acquired.

• CONCLUSION

Based on the results of the study, it is concluded that the android-based learning media application on Atomic Structure material for class X SMA/MA that was developed was valid (obtained an average V score of 0.939 for material experts and 0.959 for media experts), as well as very practical the practicality percentage is 94% for the teacher's practicality test and 93% for the student's practicality test). This application can meet the needs of students in learning, increase the activity and independence of students in learning, and help students in discovering and strengthening concepts. Furthermore, for teachers, this application can be used as an alternative variety of learning media, especially in Atomic Structure material. For future researchers, it is hoped that they will be able to test the effectiveness of the small group evaluation as well as the Assessment Phase for this developed Android-based learning media application.

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