

## DEVELOPMENT OF ANDROID-BASED LEARNING MEDIA APPLICATIONS ON ELEMENTS PERIODIC SYSTEM TOPICS

Anisa Pradila and Fajriah Azra\*

Chemistry Education Program, Faculty of Mathematics and Natural Science, Universitas Negeri Padang, Indonesia

\*Email: [bunda\\_syasfa@yahoo.com](mailto:bunda_syasfa@yahoo.com)

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**Abstract:** This study aims to develop android-based learning media applications and determine the level of validity. This research was designed using the Plomp development model, which consists of 3 stages: the preliminary research stage, the development stage or prototyping, and the assessment stage. In this study, the authors limit the research carried out to the development stage or prototype, which produces prototype III. The development of this android-based application is expected to assist teachers in overcoming obstacles in making learning media and can be used as one of the learning media that can help students in learning, especially on the material of the periodic system of elements. Nine validators carried out the validation test of the learning media application: six content experts (Padang State University lecturers and teachers of SMAN 12 Padang) and three media experts (Lecturer of Engineering Padang State University). The data obtained from the validator was then analyzed using Aiken's V. The product validation test results had an index of 0.877 from content experts and 0.955 from media experts in the valid category. Thus, based on the validation test results, the Android-based learning media application on the developed periodic system material is valid.

**Keywords:** *Application, Android, Instructional Media, Element Periodic*

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### INTRODUCTION

The era of revolution 4.0 is marked by the progress of science and technology, which is growing rapidly. These developments provide innovations in various aspects of human life, one of which is education. The era of revolution 4.0 has impacted education, namely with the emergence of learning media, one of which is learning media based on or combined with technology [1].

Learning media is a tool that can be used to send or convey messages in the learning process [2]. Learning media has a role in the effectiveness of the learning process as it can make it easier for educators to convey material to students and help increase student motivation in learning [3]. Based on the questionnaires distributed to chemistry teachers at SMAN 8 Padang, SMAN 12 Padang, and SMA Adabiah Padang, teachers have used learning media and teaching materials such as worksheets, books, learning videos, and power points. However, in the process of making, the teacher still experiences several obstacles such as taking a long time, lack of ability to make media, lack of availability of adequate facilities, and the need for careful planning in making and presenting the media, especially on the material of the element periodic system.

Element periodic elements are one example of material in chemistry subjects taught in class X SMA in odd semesters. The periodic element system is an abstract and fundamental material that studies the arrangement of the elements based on similar properties and the increasing atomic number of these elements [4]. Element periodic system material consists of concepts, facts, and principles. The concepts of the periodic system of elements lie in the

relationship between the periodic system and the electron configuration, understanding the nature, and the periodic nature of showing a tendency to change periodically based on groups and periods. In addition, this material also requires students' understanding of the principles of the periodic system of elements located in the modern periodic system, which is arranged based on the increasing atomic number of an element, and based on the electron configuration of an atom. It will be known what group and period an element is. The facts on the matter of the periodic system are in the form of the period number stating the number of shells, the group number stating the number of valence electrons, and the periodicity of the elements [5].

Based on questionnaires distributed to students in three schools (SMAN 8 Padang, SMAN 12 Padang, and SMA Adabiah Padang), students experience problems in the learning process on the material of the element periodic systems. Some of those problems are teaching materials given by teachers are difficult for to understand by students, and media learning is less interesting. It has yet to be able to engage students actively, and the material for the periodic element systems is abstract. It is supported by the opinion of Qonitah [6] students have difficulty understanding the material of the periodic element systems, namely due to the lack of variation in the selection of learning media by teachers and students becoming passive agents in the learning process often dominated by teachers. So by looking at the conditions of these problems, it is necessary to have learning media

that can help students and teachers, especially on the material of the periodic element systems. Android-based learning media is expected to be an alternative. Android-based learning media is a learning media operated on a smartphone device with an android operating system. Android-based learning media can be an option for students to use at an unspecified time and place [7]. In addition, the use of android-based learning media can be used by students freely, meaning that students can use android-based learning media during and outside the learning process [8].

This learning media has the advantage that it can display learning materials in a simple form, is easy to carry everywhere, practical, interesting, and equipped with pictures, videos, audio, and colors, and students can learn the material provided anywhere and anytime via an android smartphone. In addition, using android-based learning media in the learning process can make students more enthusiastic about participating in learning [9]. The use of android-based learning media can improve the academic performance of high school students through learning outcomes and motivation [10].

The current study focuses on developing Android-Based Learning Media Applications on Periodic System Elements for Class X high school.

## RESEARCH METHOD

The research was conducted at Universitas Negeri Padang and SMAN 12 Padang. The subjects of this study were Chemistry Lecturers, FMIPA UNP, Engineering Lecturers UNP, teachers, and students of SMAN 12 Padang who have studied the material of periodic element systems. The type of research used is Educational Design Research (EDR), which is a research method that aims to design and develop something as a solution to complex educational problems and validates theory [11]. The research conducted was designed based on the Plomp development model. Plomp has three stages: the preliminary research stage, the development or prototyping stage, and the assessment stage [11].

First, several analyses were carried out at the preliminary research stage, such as needs analysis, context analysis, literature review, and conceptual framework development. This preliminary research is intended to identify what problems occur in the field and find solutions.

Second, at the stage of development or prototype. This stage consists of designing a product based on the problems analyzed in the previous preliminary research stage. That design has to be produced called prototype I. Furthermore, the results of prototype one were evaluated by self-evaluation using a checklist system to see what components still need to be available to produce prototype II. Furthermore, prototype II's results are assessed from experts' perspectives in their fields, called expert reviews, and based on the point of view of students,

called one-to-one evaluation. Based on this assessment, if there are improvements and suggestions, it is necessary to revise the product. The result of the improvement is called prototype III. Furthermore, prototype III produced was carried out in a small group test or formative evaluation aimed at testing practicality and effectiveness to produce prototype IV. This research it is only limited to the development or prototype stage to produce prototype III.

Third, at the assessment stage, an evaluation is carried out to see whether the resulting product can be used in practice in the field.

The data analysis technique used in the study to calculate the level of validity of the resulting product is using the Aiken's V index with the following formula:

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

Keterangan:

V = validity index

s = r-l<sub>0</sub>

r = the value provided by the validator

l<sub>0</sub> = lowest score in the scoring category

n = number of validator

c = number of the rating category

This study used six validators. So based on the number of validators, the minimum V value is 0,79 [12]. The category of validity levels can be seen in table 1 below.

Table 1. Validity Category

No.	Aiken V Score	Validity
1	V < 0.79	Invalid
2	V > 0.79	Valid

## RESULT AND DISCUSSION

### Preliminary research stage

This preliminary research stage aims to identify problems that exist in the field and get an overview of the characteristics that will be developed to solve the problems that have been obtained [13].

### Need Analysis

Needs analysis aims to understand the description of the learning process in the field, seen from the views of students and teachers. Needs analysis was conducted by distributing questionnaires to class X students and teachers at SMAN 8 Padang, SMAN Padang, and SMA Adabiah Padang. Based on the distribution of the questionnaires that have been carried out, it can be concluded that: 1) teachers experience obstacles in making learning media and teaching materials. The manufacturing process takes a

long time, lack of ability to create media, the need for more availability of adequate facilities, and the need for careful planning in the making and the presentation of the media primarily on the material of the element's periodic system. 2) students are constrained in understanding the material for the element periodic systems because the material is abstract. Furthermore, the teaching materials provided by the teacher are difficult to understand, and the media used by the teacher needs to be able to make students active.

Based on this needs analysis, a solution is given by developing an Android-based learning media application on the material element periodic systems for class X high school. Android-based learning media developed following the wishes and needs of students and teachers based on questionnaires that have been distributed, including audio and video, can be used to practice questions and measure students' mastery of the material and can be used anytime and anywhere.

### **Context Analysis**

Context analysis contains an analysis carried out on students' abilities that must be achieved or mastered based on KEPBALITBANGBUT No.018/KR/2020 concerning changes to Permendikbud no.37 of 2018. Context analysis carried out at this stage is by analyzing core competencies. Basic competencies, which follow the syllabus in the 2013 revised 2018 curriculum, will be used in android-based learning media applications on the elemental periodic system material, namely basic competencies 3.3 and 4.3, then lowering these basic competencies into indicators of competency achievement and learning objectives.

### **Literature Review and Development of Conceptual Framework**

Some literature reported valid android-based learning media using Kodular software on each material, namely electrolyte & non-electrolyte solutions, thermochemistry, basic laws of chemistry, and chemical equilibrium [7, 14, 15, 16]. Information was obtained that the existence of Android-based learning media can make students more enthusiastic about learning and support student learning activities anywhere and anytime [9]. The development of android-based learning media carried out by Putri [17] got a good response in the feasibility test students and can increase students' learning motivation after using the media. Android-based learning media can also increase the growth of students' scientific literacy [18]. In addition, the learning media developed by Lubis and Ikhsan [19]. It can be used to increase students' learning motivation and cognitive achievement. The development of the conceptual framework is carried out by compiling research process design activities

based on needs analysis, context analysis, and literature review that have been carried out.

### **Development or Prototype Stage**

At the development or prototype stage, this is done based on the identification results carried out at the preliminary research stage aimed at making relevant products. Furthermore, the product that has been obtained is revised based on formative evaluation and continues to the validation stage. This stage is only limited to the third prototype stage, namely the validation stage.

### **Prototype I**

This prototype stage is the result of the design and realization of the preliminary research stage. The prototype I produced in this study is an Android-based learning media application on the elemental periodic system material, consisting of several components: application starts page, application menu page, competencies (KI, KD, IPK, and Learning Objectives), and application usage instructions (Instructions). Use for teachers and instructions for use for students), attendance, materials, evaluation, profiles, references, and feedback.

The android-based learning media application on the elemental periodic system material developed has an attendance feature connected directly using the google form. With this feature, it is expected that during the learning process, the teacher's time will be more efficient in taking student attendance data. In addition, the evaluation feature is directly linked to a quiz. A quiz is an educational web tool that can be used as a learning evaluation medium which is presented in the form of an interactive quiz game equipped with sound and animation that is presented with a more attractive appearance [20]. The advantage of this quiz is that the questions presented have a time limit, and there are ratings of students who have worked on the questions [21]. Student ratings are determined by the accuracy of the answers given and the speed of students in answering. So, with the quiz, the evaluation of the questions can be done actively and interestingly for students.

Android-based learning media application developed using Kodular software. Kodular is a website that its users can use to create applications based on the Android operating system. The advantage of this coded software is that in making applications based on the Android system, there is no need to do coding (writing programming code) but only by using Block Programming. Kodular was created on an open-source project MIT App Inventor [22].

Android-based learning media developed using a guided inquiry learning model. The

guided inquiry learning model, according to Katauhi et al. [23], is a learning model that requires students to conduct investigations that can improve the ability of students skills. In addition, the guided inquiry learning model is centered on students, which requires students to be actively involved in the learning process and trains students in developing thinking and critical thinking skills [24]. This guided inquiry consists of several syntaxes, including orientation, exploration, concept formation, application, and closure [25].

### Prototype II

After prototype I was produced, a self-evaluation of the prototype I was carried out to produce prototype II. This self-evaluation is carried out using a Checklist system of important components that must be in the application. If there are revisions, it is necessary to make revisions/improvements to produce prototype II.

### Prototype III

At this stage of prototype III, the results obtained from prototype II are then carried out by expert review and one-to-one evaluation to produce prototype III.

### Expert Review

Expert reviews are carried out by experts consisting of content and media experts. The content experts consisted of 4 UNP chemistry lecturers and two chemistry teachers at SMAN 12 Padang. Meanwhile, media experts consist of 3 UNP engineering lecturers.

The assessment components carried out by content experts include content, construct, linguistic, and graphic components. The results of the validity assessment carried out by the content expert validator were then analyzed using Aiken's V formula, and the overall Aiken's V value from the content expert's assessment was 0.875 with a valid category. The results of the assessment of each component can be seen in table 2.

Table 2 The Result of Data Analysis By Content Expert

Assessment Component	V	Validity
Content Component	0.86	Valid
Contact Component	0.86	Valid
Linguistic Component	0.89	Valid
Graphic Component	0.93	Valid
Average	0.88	Valid

Furthermore, the validity assessment carried out by media experts was then analyzed using Aiken's V formula, and the average value of Aiken's V was 0.97 with a valid category. The media expert

validity assessment component consists of three components, namely the display component, the programming component, and the utilization component. The results of the assessment of each component can be seen in table 3.

Table 3 The Result of Data Analysis By Media Expert

Assessment Component	V	Validity
Display Component	0.97	Valid
Programming Component	0.95	Valid
Utilization Component	0.98	Valid
Average	0.97	Valid

Based on the validity assessment that has been carried out on content experts with an Aiken V value of 0.87 and media experts with an Aikens' V value of 0.97. The android-based learning media application on the material element periodic system for class X SMA/MA has been developed with the valid category. Prototype II, which has been valid based on content and media aspects, then revised based on suggestions and input that has been given by the material and media validator to produce an Android-based learning media application for better material on the element periodic system.

### One-to-one Evaluation

This one-to-one evaluation stage was carried out on three students of SMAN 12 Padang. They have studied the material of element periodic systems with different abilities (high-medium-low) based on recommendations by the teacher. This stage is intended to assess media applications developed from students' points of view. In the content component, the display on the application already represents the contents of the application. Students can understand and be helped in studying the material for the periodic system of elements. The available pictures and videos can attract students to learn the content of the learning media application. In the construct component, the guided inquiry stages in the application are easily understood by students, and the presentation of the presented media can hone students' thinking skills. Furthermore, on the linguistic component, it was found that the writing on the content, videos, and images in the application was easy to read, and the language used was easy to understand. In the graphic component, the use of type and size of letters, images, videos, designs, and colors in the application can be read and observed clearly and is interesting for students.

## CONCLUSION

The android-based learning media application on element periodic system for class X high school which was developed using the Plomp development model, can be categorized as valid with the Aiken's V value from the content expert of 0.87 and the Aiken's V value from the media expert by 0.97.

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