International Journal of Computer Applications Technology and Research
Volume 12–Issue 06, 01-07, 2023, ISSN:-2319–8656
DOI:10.7753/IJCATR1206.1001

Preparing Atomic Structure and Periodical System Android Based-Teaching Media using Funchem Smart Apps Creator Program

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Abstract: Learning media is one of the developments in information technology that has an impact on the world of education. As a result, the education sector must be able to use technology to create multimedia-based learning media that are more appealing, interactive, and comprehensive. The purpose of this research and development is to describe the preparation step, feasibility (validity), effectiveness, and improvement of student learning interest through learning media using an Android-based teaching model developed in general chemistry learning of atomic structure and periodic system elements material using the 4D development model. Thisresearch and development resulted Android based learning applications with a capacity of 28.3 MB "Funchem" that has been declared valid (appropriate) with the goal of creating learning applications that are accurate and concise for usage by students. Validity is met based on the assessment of the validators of material experts and media experts with the feasibility level for media eligibility is 87.5% and for material eligibility is 85.6%, putting it in the highly feasible category for both media and material.

Keywords: Learning Media, General Chemistry, Atomic Structure, Periodic System Elements, Android based Learning, Smart Apps Creator.

1. INTRODUCTION

Education is an attempt to prepare the next generation to welcome and face the global era. Technological advancements have an impact on education. The media, methods, motivation, and interest in learning are all inextricably linked to the learning process. Media can be used to deliver educational materials to students delivered by teachers. While the learning method governs how teaching materials and delivery strategies are organized. [1]

Today, it is impossible to avoid the impact of science and technology on the world of education, so the world of education must constantly adapt technological developments to efforts to improve educational quality. [2]

The shape of the module is developing in tandem with technological advancement, which has a favorable impact.The module's development begins with a printed module and progresses to an E-module. E-modules, as instructional resources, can include interactive experiments and simulations, as well as images, videos, and animations. [3]

Learning media is one of the developments in information technology that has an impact on the world of education. As a result, the education sector must be able to use technology to create multimedia-based learning media that are more appealing, interactive, and comprehensive. Visual media such as pictures, floor plans, maps, and diagrams, as well as audio visuals such as videos and sound slides, are excellent choices for improving educational quality. Learning media can also be very useful and beneficial for students if they are directly involved in its use. learning media is critical because it has a significant impact on classroom teaching activities. Relevance, convenience, attractiveness, and usefulness are four important factors in good learning media. [4]

The use of appropriate media in the classroom can improve the learning process. Because the use of media in learning canhelp educators' limitations in conveying information and the limitations of class hours, the more relevant a media is, the more interesting and useful the use of media will be. [5]

One type of ICT-assisted learning media that can be used is learning media that is operated on a smartphone device running the Android operating system. Currently, the Androidoperating system is the most popular and widely used by the public, particularly among high school students. In Indonesia, Android users accounted for 65.9% of all smartphone users as of June 2015. [6]

The creation of Android-based learning media meets the requirements of the 2013 Curriculum. The incorporation of Information Technology (IT) into all subjects is one of the changes in the 2013 Curriculum. IT is no longer a subject in and of itself, but rather a vehicle for all other subjects. This means that teachers in various subject areas, including chemistry, must initiate widespread and effective use of IT. With the advancement of mobile learning media, students will be able to access and learn from anywhere and at any time. This means that students will take a more active role in their learning, in line with the learning mandate in the 2013 Curriculum, which emphasizes students as the center of learning. [7]

Chemistry is one of the sciences that evolves in parallel with technological advancement. Chemistry is abstract, interconnected, and demands excellent thinking skills in its application. [8] Chemistry is difficult for students to understand because it is a subject that has facts, procedures, and concepts, and Chemistry is more than just solving problems; students must also learn descriptions such as chemical facts, chemical rules, and the material studied in chemistry is extensive. [9]

A periodic table of elements is well-known in chemistry education. The periodic table of elements is a table that lists the names of chemical elements and categorizes them based on how similar their properties are. The elements in the periodic table are divided into eight major groups, namely groups I A to VIII A, and transition groups, namely groups I B to VIII B. These elements are also classified into three types: solid, liquid, and gaseous.

Students are expected to memorize and understand many elements during the teaching and learning process, as this will be useful when they learn the next material. Even though the periodic table introduced to students by the teacher is still in the form of a manual that only contains the names of chemical compounds and their groups with no additional information. This is certainly inconvenient for students and even makes them lazy when studying chemical elements. If students are lazy and lack interest to learn chemical elements, they will become tired of studying further material related to the periodic table of elements, because the periodic table of elements is the foundation for studying chemical elements in the following lesson. Media assistance will be very beneficial for students' thinking processes in order for them to correctly understand the material. [10]

Based on observations made at SMAN 5 Medan, it was discovered that the majority of chemistry teachers have yet to use, let alone develop, interactive multimedia-based learning media in the process of teaching and learning activities. Most teachers continue to use traditional methods of instruction in the classroom. If a teacher continues to deliver subject matter using traditional methods, students' absorption of the subject matter is not optimal. If this is done repeatedly without any variation in learning methods, students will quickly become bored in subsequent lessons, resulting in low student interest in learning, so that students often prefer to play android, such as opening social media, rather than using android to help the learning process. Furthermore, students at these schools are permitted to bring androids or other communication devices to school. As a result, it is not surprising that many students fail assignments or daily tests.

In a study on chemical bonding materials conducted by Sary and Iis Siti Jahro, it was concluded that the feasibility of developing interactive multimedia based on the Lectora Inspire based on BSNP criteria assessment categorized as "Very Feasible" with the results of media validation from 3 validators categorized as "Very Feasible" because the average percentage of validation results from 3 validators was above 90%, namely 95.33%; 91.7% and 100%. For the results of material validation from 3 validators categorized as "Very Feasible" too, because the average percentage of validation results from 3 validators was above 95%, namely 97%; 97%
and 95.7%. [11]

While Mastur's research obtained validation results from material experts, media experts, and chemistry teachers, the percentages were 74%, 87.6%, and 79%, respectively. The implementation of students through a questionnaire resulted in a 96% presentation in the very good category. Overall, it is possible to conclude that interactive media on reaction rate learning is appropriate for use as a learning media in high school. [12]

Based on the problems and previous studies described, the development of learning media is required to be able to overcome problems in the learning process and increase student interest in learning, with one form of media development that is comfortable and interesting for students, such as learning media based on Android. Learning media will be created in this study using the Android-based Smart Apps Creator software. The researcher chose Smart Apps Creator because it can be used offline, which means students do not need a data package to use it. Furthermore, if there is an error in the preparation of the media, this application canbe repaired and is simple to use.

Based on the aforementioned facts and descriptions, it is important to develop learning media based on android, assisted by smart app creator, on atomic structure and periodicsystem elements material, which is expected to support the implementation of an effective and efficient learning process. The use of learning media-based android, assisted by smart app creators, is also projected to increase student interest in learning chemistry, particularly atomic structure and periodic system elements material.

2. METHOD

The 4-D (Four D) research model was used in this study. Sivasailam Thiagarajan, Dorothy S. Semmel, and Melyn I. Semmel created this model. This research is based on Sivasailam Thiagarajan's procedure and development of instructional materials. This model is ideal for conducting product research and development. In this case, the researcher wishes to create learning media to aid students in their study of atomic structure and the periodic system of elements. The developed learning media will be tested for feasibility using product validity and media trial use. The 4D model-based development process is divided into four stages, as shown in the figure below:

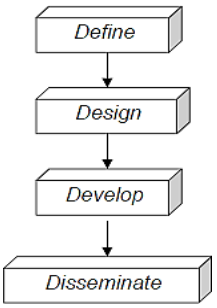


Figure 1. 4D development model flow

(a) Define stage, were the stage of needs analysis. Researchers in product development must refer to the development requirements, analyze, and collect information on the extent to which development must be carried out. Defining or analyzing needs can be accomplished through an examination of previous research and literature studies, a syllabus, or interviews with teachers/ informant.

(b) Design stage, The goal of this stage is to create android-based learning media with the Smart Apps Creator application. The following are the procedures that will befollowed: (1) Media Selection, this stage is carried out toidentify learning media based on student needs so that basic competencies are expected to be achieved by students. (2)

Format Selection, this stage is carried out to design learning content, learning resources such as the use of images and writing. (3) Initial design, the initial design was a version of the learning media before it was validated. This design is based on the results of the analysis that has been done.

(c) Develop stage, this stage of development aims to create android-based learning media on the material of atomic structure and the periodic system of elements using the Smart Apps Creator application. Experts performed media validation and material validation at this stage. The validator will provide input that will assist in the creation of learning media.

(d) Disseminate stage. At this point, the developed media is ready for distribution. Students and teacher will receive media in the form of apps delivered via social media platforms such as WhatsApp.

Non-test instruments were used to collect data in this study. The non-test instrument was used to analyze the android-based media used, its validity, and to determine students' interest in learning. The non-test instruments used in this study include (a) Questionnaire, It will be used in this study tocollect data on the feasibility of the developed android-based media, and a student response questionnaire was used to collect student response data. (b) Android-based Media Validation Questionnaire, the questionnaire used in this study was based on the Badan Standar Nasional Pendidikan (BSNP) of Indonesia's assessment of teaching materials for media. In this study, a Likert scale with four alternative answers in the form of a checklist was used. Feasibility studies, language feasibility, graphic feasibility, and presentation feasibility are examples of alternative answers that are scored using aspects from the media standardization questionnaire. (c) Interview, this interview aims to observe learning conducted in the classroom with a chemistry teacher including the applicable curriculum, the learning media used, the characteristics ofstudents' grades, facilities in the school, methods and syllabus as well as the learning design used.

This study employs qualitative data analysis techniques, with descriptive analysis performed on qualitative data, which includes a media feasibility assessment sheet completed by a validator, a student response questionnaire sheet for learning media, and a student learning interest questionnaire sheet.This data was analyzed to determine the impact of the developed learning media. Product quality assessment data were obtained from the results of questionnaires by media experts, material experts, student's interest and response. According to the 4-D research model were used, only the define and design stage will be reporting in this article.

3. RESEARCH RESULT

This research and development resulted in a product in the form of Android-based learning media on the topic of atomic structure and periodic system elements with the application name FunChem. The Research and Development (R&D) method and the 4D development model are used in this study. The 4D development model used in this study is divided into four parts: (1) Define stage, (2) Design stage, (3) Develop stage, and (4) Disseminate stage. However, in writing this journal, the researcher only included the results of the research which were published only up to the design stage so that it could be clearly stated how the process of making Android-based Funchem learning media was carried out with the help of the Smart Apps Creator.

3.1 Define Stage

At this stage analysis is carried out in the form of needs analysis, learning material analysis, and environmental analysis.

(1) Needs Analysis, it aims to identify the resulting product to suit the needs. Mrs. Duma Roida Tampubolon, S.Pd., M.Pd., one of the Chemistry teachers at SMA Negeri 5 Medan, was interviewed face to face and the researcher asked 11 questions related to needs analysis. Table 1 shows an analysis of the development of learning media conducted by interviewing Chemistry teachers.

Table 1. Learning Media Development Need Analysis by Interview with one of Chemistry Teacher at SMA Negeri 5 Medan.

Nu	Question	Answer
1.	What is the curriculum used in SMAN 5 Medan?	Merdeka Mandiri
2.	What is the KKM score for chemistry at SMAN 5 Medan?	78
3.	What are the learning outcomesof class X students regarding atomic structure and periodic system elements?	Good
4.	How is the student's interest in chemistry lessons, especially material on atomic structure and periodic system elements?	Not Good
5.	Is the atomic structure and periodic system elements included in the category of difficult materials?	Not really (Intermediate)
6.	What difficulties are encountered in teaching the atomic structure and periodic system elements?	Students still have difficulty memorizing existing material. There are also elements that have exception atomic numbers so that misconceptions often occur.
7.	How is the chemistry learning process at SMAN 5 Medan?	Good
8.	What media have been used for chemistry learning process at SMAN 5 Medan?	Power Point
9.	What are the advantages and disadvantages of the media that has been used?	Advantages: more interesting. Disadvantages: Students are less likely to seek information because almost all of the material is summarized in PowerPoint.
10.	Have you ever used android-based media in learning the atomic structure and periodic system elements?	No
11.	What do you think about the use of Android-based learning media to study chemistry, especially material on atomic structure and the periodic system of elements?	Really good

As shown in table 1, students' interest in learning Chemistry, particularly atomic structure and periodic system elements, remains low. The teacher notices that there is a lot of material that is summarized in one chapter, making it difficult for students to remember the topics being taught and giving students saturation. The use of the provided PowerPoint media has both advantages and disadvantages for the learning process. The advantage is that PowerPoint media can be designed to be as appealing as possible in order to piquechildren's interest. Meanwhile, because the media can provide many material summaries, students are less interested in finding learning resources from other media sources such as books and journals.

According to the findings of an interview with one of the teachers at SMA Negeri 5 Medan, the learning process for atomic structure and periodic system elements is still not optimal. This occurs because the teacher summarizes that students are still uninterested in independent learning and only use one medium provided by the teacher. Furthermore, there are many topics in the atomic structure and periodic system elements material that students do not always understand and quickly become bored with.

On the other hand, every student has a mobile phone, and X-MIPA 4 students are more likely to have an Android-based phone and be able to use it. Even though the learning process is said to be smooth, Android is still not being used effectively. Teachers continue to rely on a few applications that serve as a repository for students' assignments. WhatsApp and Zoom meetings are two applications that teachers use (theuse of these applications is rarely used). In addition, the school does not provide any applications to aid in the learning process.

The researcher also distributed a questionnaire to students in class X-MIPA 4 to measure their interest in studying Chemistry, particularly the topics of atomic structure and periodic system elements. To gauge students' interest, 20 questions were asked. The questionnaire distributed consisted of 10 statements. The research instrument uses a Likert scale, namely by giving a score of 1 (strongly disagree), 2 (disagree), 3 (agree), and 4 (strongly agree). Table 2 shows the results of the questionnaire in terms of measuring student interest. The table obtains an overall percentage of 67.5%, indicating that many students disagree with the positive statements provided. This can lead to the conclusion that students are uninterested in comprehending and learning about Chemistry.

Table 2. Result of student interest questionnaire in measuring the need for learning media based on Android by Google Form for 33 students.

Nu	Statement	Result	
		Average Value	Percentage (%)
1.	I do my chemistry assignment seriously	2,64	65,9
2.	I finished my chemistry assignment on time	2,52	62,9
3.	I care about the results I get	2,52	62,9
4.	If my chemistry score is bad, I will continue to study hard so that my grades will get better	2,52	62,9
5.	If I got a bad grade in chemistry, I would review the exam questions and look for the right answers	2,64	65,9
6.	I will be satisfied if I can work on chemistry problems by getting good grades	2,18	54,5
7.	I listened carefully to teacher's explanation	2,76	68,9
8.	I asked the teacher about material that I did not understand	2,64	65,9
9.	I did the chemistry assignments given by the teacher myself	2,85	71,2
10.	In doing assignments and chemistry questions, I try to do them with the help of learning media independently.	2,64	65,9
11.	I never copy a friend's answer because I believe in my answer	3,03	75,8
12.	I like studying chemistry because teacher uses media in learning (learning videos, quizzes, etc.)	2,67	66,7
13.	I like studying chemistry because the teacher uses games in learning	2,52	62,9
14.	I never feel bored in studying chemistry	2,88	72,0
15.	I give my opinion during the discussion	2,64	65,9
16.	If there is a different opinion, I will give my respond	2,67	66,7
17.	I'm sure I can get the best grades because I do my chemistry assignments well	2,58	64,4
18.	If my answer is different from my friend's, I still won't change my answer to have the same answer	2,88	72,0
19.	I am challenged to work on chemistry problems that are considered difficult by friends	2,85	71,2
20.	I prefer to do difficult questions than easy questions	2,79	69,7
Overall Percentage (%)			67,5
Category			**DISAGREE**

Based on the findings of an interview with one of the chemistry teachers at SMAN 5 Medan and the results of a questionnaire administered to class X MIPA 4 students, it is possible to conclude that the development of researchproducts in the form of Android-based learning media assisted by Smart Apps Creator is feasible to implement because it has many advantages, including the ability to package the materialbeing taught as attractively as possible to attract students'interest in learning. There are practice questions accompanied by discussion in chemistry, particularly in atomic structure and periodic system elements material, as well as ease ingetting the material being taught because it has been summarized as accurately as possible. Furthermore, because itdoes not require an internet connection to use, Android-based learning media can be accessed at any time and from any location.

(2) Analysis of Learning Materials, is a step in determining learning materials that are aligned with the curriculum in SMA and also meet the needs of the students. The researcher continues to determine the sub-materials that will be summarized in the development of Android-based learning media applications after the formulation of core competencies and achievement indicators of competence. The particles that comprise the atom, atomic number and mass number,isotopes, isobars, isotones, development of atomic models, electron configurations, orbitals, quantum numbers, anddevelopment of the Periodic System of Elements are interpretations of sub-materials.

(3) Environmental analysis, is performed in order to determine the environment, which includes how the teacher delivers the material to students and how to boost student interest. Based on the findings of the environmental analysis observations, it is clear that no student worksheets are used during learning and that the teacher solely concentrates on one source of learning, namely textbooks, resulting in students' lack of enthusiasm in learning about Chemistry. Instructors also do not create visually appealing Power Pointpresentations and merely utilize Power Point to save timewhen instructing (There is no attractive color combination andthe screen is filled with letters without any animation and few pictures and tables are used.) This influences the learningprocess. Several children use cellphones behind their backs and do not pay attention to the learning process. Based on the observations made by the researcher while the teacher and students were carrying out the learning process, the researcher concludes that a student-centered learning process using Android-based learning media is required so that students can increase their interest in learning, particularly in atomic structure and periodic system elements material.

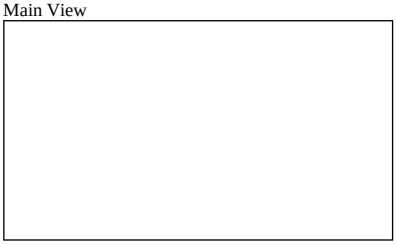
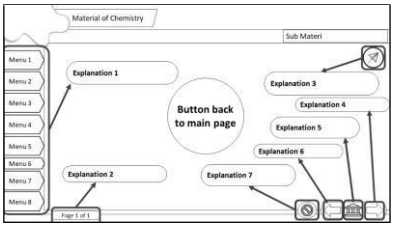
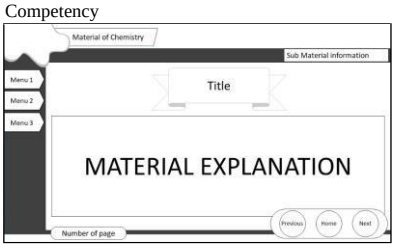
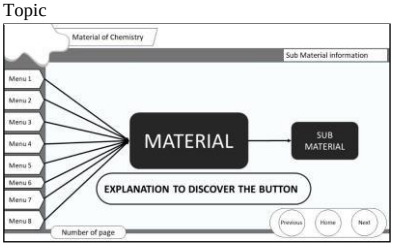
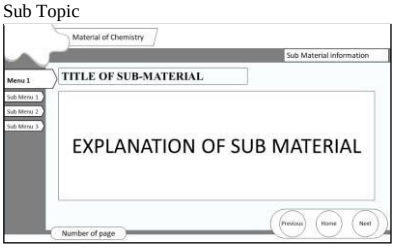
3.2 Design Stage

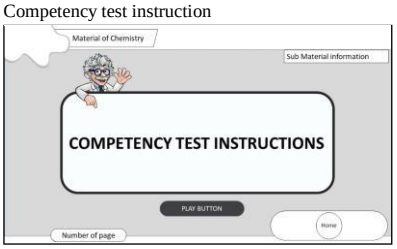
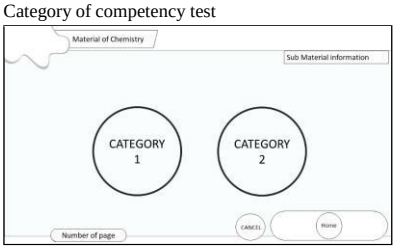
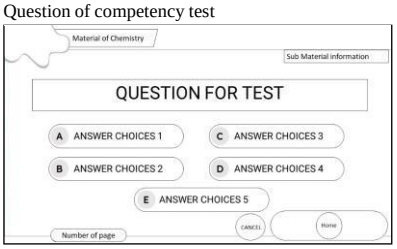
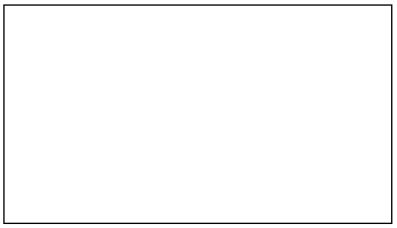
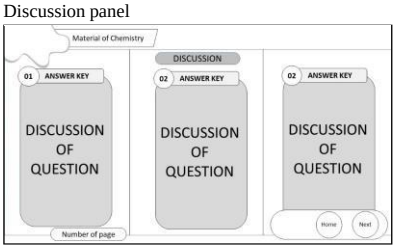
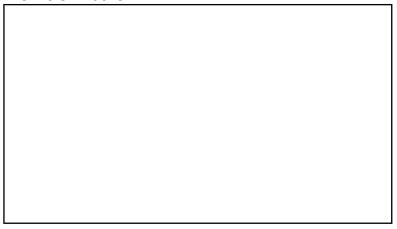
During the design stage, instructional media is created through a careful and planned process. In the context of creating an Android-based learning media application for Chemistry, researchers collaborated with the subject teacher and supervisor in advance to determine the necessary resources, menus, and perspectives that should be included. The focus of this stage is to collect data and develop various elements such as models, objectives, and display color combinations, which are all crucial in creating an effective learning media application that caters to the needs of both teachers and students.

Based on the research, relevant data on atomic structure and periodic system elements is gathered to assist in creating an Android-based learning media. The application is designed to

incorporate five functional features, namely media introduction, competency, material, competency exam, and Author profile. These features are specifically included to facilitate students in comprehending the topic effectively. In short, the Android-based learning media is developed by integrating important data related to atomic structure and periodic system elements, while also ensuring that students have access to multiple features for a better experience. Following the design step, the content preparation stage is carried out in order for it to be included in the application. The main design is created initially in Power Point. Table 3 shows the storyboard and content of the "FunChem" application feature.

Table 3. "Funchem" app design

Nu	Story Board	Information
1.	Main View 	In the main view, there are 5 features in particular, namely atomic structure and periodic system elements also the UNIMED logo.
2.	Media Introduction 	The media introduction menu is intended for students to understand how to run using the media that has been developed.
3.	Competency 	Basic competencies, indicators and learning objectives are arranged based on the lesson plan and syllabus.
4.	Topic  Sub Topic 	The material is separated into 8 sections which can make it easier for students to explore the material in depth per each topic and Sub-topics will appear if students choose topics to study.

Nu	Story Board	Information
5.	Competency test instruction  Category of competency test  Question of competency test  Score Board  Discussion panel 	The practice questions are divided into 2 categories, namely atomic structure and the Periodic System of elements. The questions in the application are structured in such a way as to summarize the learning objectives that must be achieved by students. There is also a discussion that can help students to study the questions asked and a scoreboard to be able to assess student achievement, whether the student understands and achieves the learning objectives properly.
6.	Profile of Author 	This section contains a profile of the researcher

3.3 Product Feasibility

The researchers' application idea is implemented by experts who use the Smart Apps Creator to create learning applications with a capacity of 28.3 MB that can be installed on Android. "FunChem" is the name given to the developed application. Because there is no requirement for the internet to run this application, it can be accessed offline.

Applications that are developed in accordance with the design are then validated by two material experts and two media experts. Mr. Dr. Marudut Sinaga, M.Sc as a UNIMED chemistry professor, Dr. Bajoka Nainggolan, M.S as a UNIMED chemistry lecturer, and Ms. Duma Tampubolon, S.Pd., M.Pd as a chemistry teacher at SMA Negeri 5 Medan were the validators. The validation results show that the application developed fits the eligibility criteria.

1. Material Expert Validation

This instrument was given to one UNIMED chemistry lecturer (D1) and one chemistry teacher at SMAN 5 Medan (G1). The results of material validation of learning media in the form of Android applications developed on atomic structure and periodic system elements can be seen in table 4

Table 4. The results of the material feasibility test by the material expert validator

Nu	Assessment Component	Assessment Percentation		Average of percentation (%)
		D1 (%)	G1 (%)	
1.	Material feasibility	85	80	82,5
2.	Evaluation feasibility	91,7	91,7	91,7
3.	Language feasibility	90	75	82,5
Total Average				**85,6**
Research analysis validation criteria				**VERY WORTH IT**

Based on table 4, the assessment by the material expert validator includes the feasibility of the material, evaluation, and language. The material validation assessment by one UNIMED lecturer and one chemistry teacher at SMAN 5Medan for the developed media obtained an average of 85.6%so that it was categorized as very worth it / feasible.

2. Media Expert Validation

This instrument was handed to one UNIMED chemistry lecturer (D1) and one SMAN 5 Medan chemistry teacher (G1). Table 5 shows the results of media validation of learning media in the form of Android applications created on atomic structure and periodic system elements.

Table 5. The results of the media feasibility test by the media expert validator

Nu	Assessment Component	Assessment Percentation		Average of percentation (%)
		D1 (%)	G1 (%)	
1.	Influence on learning	85	85	85
2.	Software engineering	90	95	92,5
3.	Visualization	80	90	85
Total Average				**87,5**
Research analysis validation criteria				**VERY WORTH IT**

Based on Table 5, the assessment by the media expert validator includes aspects of the quality of learning, software engineering, and visualization. The media validation assessment by one UNIMED lecturer and one chemistry teacher at SMAN 5 Medan for the media developed obtained an average of 87.5% so it is categorized as very worth it / feasible.

4. CONCLUSION

The following conclusions were reached based on data and questionnaire calculations gathered from research for the creation of android-based learning media on atomic structure and periodic system elements. (1) The results of the media needs analysis at SMA Negeri 5 Medan are high because the results of a questionnaire that measures student interest are 67.5% with the "disagree" category of the 20 positive statements given by researchers, as well as the results of teacher interviews and environmental analysis. (2) The Smart Apps Creator assists in the developed Android-based learning media, which comprises five components, including media introduction, competencies, resources, competency tests, and Author profiles, with the goal of creating applications that are accurate and concise for usage by students. (3) Based on validator validation results, the feasibility level for media eligibility is 87.5% and for material eligibility is 85.6%, putting it in the highly feasible category for both media and material.

5. ACKNOWLEDGMENTS

Thank to the Rector Unimed and Head of LPPM who has funded this research through Unimed PNBP fund by Applied Research Scheme for the 2023 Fiscal Year. We also thanks to the Dean of FMIPA Unimed, Head of Chemistry Deparment Unimed, Head of SMA Negeri 5 Medan and their Teacher of Chemistry, validators for providing our research, and indeed all respondents who had been supporting this research.

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