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Development of Android-Based SPU Learning Media in General Chemistry Course 1 for University Students

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ABSTRACT

This study aims to develop an Android-based SPU learning media using APP Inventor in the general chemistry course 1 of the Universitas Bengkulu Science Education study program. The method used in this study is Research and Development (R&D) with a 4D (four-D) research and development model, namely definition, formulation of learning objectives, design, carried out by designing media In learning, developing (developing) the validation of learning media content by media experts and material experts, and dissemination (dissemination) through YouTube. The results obtained include developing Android-based SPU learning media with six main contents: the intro, home, CPL, and CPMK pages, materials, evaluations, and about me. The validation results by material experts, media experts, and assessments by students are all in the "appropriate" category, so this application is perfect to use. Student responses after using this application are also good and are in the "agree" category, meaning that students agree and are interested in the SPU application used. Student learning outcomes have increased after using SPU learning media. The gain score is 0,60 and is in the "medium" category, indicating that SPU learning media effectively improves student learning outcomes in the general chemistry 1 course, especially in SPU material.

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1. INTRODUCTION

One of the efforts of educators or teachers in teaching students who learn is through education (Ruhimat, 2011). The purpose of national education, in general, is to improve the quality of Human Resources (HR). In order to improve the quality of human resources, it needs to be balanced with improving the quality of education. The achievement of educational goals is closely related to the effectiveness of learning. One of the supports for learning effectiveness is the use of learning media. Lecturers or teachers in the classroom generate numerous learning media, but improving the quality of

learning requires practical learning media that students may use as a means of independent learning. One of the learning media students favor is learning practical media and following the times.

One of the things that cannot be avoided in the 4.0 era is the progress of information and communication technology which is developing very rapidly (Budiman, 2017). Technological advancements have sparked movements in various fields, one of which is education, which is characterized by digital communication. According to Istiyanto (2013), wireless digital communication is needed in various fields ranging from education, business, health, and security. Therefore, the availability of mobile devices is needed to support activities in various fields because they are flexible and practical to use.

At this time, gadgets have become an inseparable part of the community. According to data recorded at the Ministry of Communication and Information, gadget users in Indonesia have touched 240 million units. This is quite large compared to Indonesia's total population, currently 230 million people. Opera, a company that acts as a web browser, stated that users of gadgets with OS 3 android aged 13 to 24 reached 44% (Bambang, 2013). The rapid development of gadget technology among students certainly provides opportunities for the world of education to utilize gadget technology as a learning medium. Learning media is a tool that teachers and lecturers use to facilitate learning activities (Alhafidz et al., 2018). Learning media is also one of the factors that can affect student learning outcomes. By using suitable learning media, learning materials can be delivered interestingly so that learning objectives will be more easily achieved (Indaryati & Jailani, 2015). Learning media during learning activities can increase students' learning motivation and affect students' psychological conditions (Sakti et al., 2012). The use of appropriate learning media can also improve student learning outcomes. According to constructivist understanding, learning is the result of its construction (learners) due to its interaction with the learning environment (Daryanto, 2013).

One of the developments of learning media that utilizes gadget technology is android-based learning media using APP Inventor. According to Munadi (2013), android-based learning media is quite significant in improving student learning outcomes so that it is very effectively used as a learning medium. Android-based learning media is also efficient in supporting the student learning process anywhere and anytime. According to Chuang (2014), Android and tablet-based learning media can positively impact cognitive, metacognitive, affective, and socio-cultural aspects.

Android is a middleware operating system and applications presented in mobile software. One of the advantages of Android is that it is open-source, so many application developers (developers) seek to develop applications that are useful and can be run on the Android system, one of which is the APP inventor application (Bagus & Krisnawan, 2016). According to Mulyadi (2013), App Inventor is a tool used to create android applications based on visual block programming so that users can create applications without coding. Visual block programming, referred to here, is that in its use, the user can view, use, arrange, and drag-drop "blocks," which are command symbols and certain event handler functions in creating applications and can be called without writing a program code. One of the advantages of using the APP inventor is that the system is relatively easy to use and suitable for all cellphones, so it can be recommended to create android-based learning media. The development of android-based learning media allows children to learn autonomously, allowing the character education ideal of independence to be implemented in everyday life.

The S1 Science Education study program is one of the newly established study programs at the Faculty of KIP, Bengkulu University. Therefore, the learning media used in the teaching and learning process are considered less than optimal to support the learning process, especially in the general chemistry 1-course Elements (SPU). Appropriate learning media is expected to make it easier for students to understand SPU material, especially about the periodic properties of elements in one group or one period.

Both at school and in universities, there has been much research into the development of android-based learning media. Several studies on the development of android-based learning media have been conducted, including one by (Andi Rustandi, 2020) titled "Development of Android-Based Learning

Media in Simulation and Digital Communication Subjects for Class X Vocational High School Information Technology, Airlangga, Academic Year 2020/2021," which found that the learning media developed is highly feasible to use, with a feasibility percentage of 94.52%. Another study, titled "Development of Android-Based Learning Media for Physics Subjects in Energy Subjects in Class X IPA 1 SMA Negeri 2 Muara Badak for the Academic Year 2019/2020," was carried out by (Saputra et al., 2020). Based on the overall validation results from material experts and media specialists, the medium generated is very viable to use, with an average validation rating of 96.5. Asti Amalina Puspitaningrum (2019) researched learning media production under "Development of Android-Based Learning Media on Static Routing Materials." The findings of this study suggest that the learning media created are effective and can assist students in comprehending learning materials. The findings of expert validation of learning media have also been quite promising. Another study, "Development of Android-Based Learning Media on Solubility Materials to Improve Academic Performance of High School Students," was undertaken by (Yektyastuti & Ikhsan, 2016). Material and media elements and the chemical learning media employed all impact high school pupils' academic achievement. In addition to the four studies mentioned above, a study titled "Development of Android-Based PCT (Paper Chromatography Techniques) Practicum Media with QR Code Technology on Mixed Separation Materials" was undertaken by (Uliyandari et al., 2022). Based on an evaluation by media and material specialists, the PCT suitable medium generated is suitable for usage. With a conversion value of 3.98, student responses to this study fall into agreement with the group.

Based on the five studies mentioned above, the researcher attempted to construct an Android-based SPU learning medium in the general chemistry course 1 of the Science education study program, Faculty of Teacher Training and Education, Bengkulu University. The learning media that will be created will develop earlier researchers' learning media. Its development lies in the content or content of the learning media and software used. This SPU learning media has many features, ranging from material, images, animations, and videos, that allow students to understand the material presented efficiently. This is a development of other learning media that only displays learning media features in images and materials. The software used also determines the quality of the learning media used. In this study, the researcher tried to make SPU learning media by using the APP inventor application as the software maker. The advantages of this application are that it is easy to use and does not need to use coding. In addition, this software is also easy to install and compatible with all types of laptops, which allows the software to be used on a wide scale. The SPU learning media developed in this study also has several advantages, starting from its many features and enriched with exciting materials, images, animations, and videos. Also, the distribution of the SPU application is effortless, click on the link, and the application can be directly installed on the cellphone. SPU users and learning media are compatible with all Android phones.

The development of Android-based learning media using the APP Inventor is considered very important to be developed because it is one of the learning media that can support optimizing the learning process in the general chemistry course 1 in the Science Education Study Program of Bengkulu University, especially during the endemic period of covid 19 which requires students to do hybrid learning between face-to-face learning and online learning from home. The use of this android-based learning media can be done efficiently only by installing the SPU application on the student's Android, and then students can immediately use it as a learning medium by utilizing its features in it. This learning media is also not glued to the classroom because it can be installed on each student's Android, making it possible to be used as a learning medium independently in their respective homes.

2. METHODS

Research and development (R&D) was the research approach used in this study. Research and development is a research method used to create products and test their efficacy development research, according to Sugiyono (2010), is research that tries to produce specific products. This study is based on the 4D (four-dimensional) research and development paradigm, which has four stages: defining,

designing, developing, and distributing. The learning objectives are created at the definition stage, learning media are designed at the design stage, learning media content is validated by media and material specialists at the development stage, and learning media content is disseminated via YouTube at the dissemination stage. In general chemistry course 1, this research was undertaken to construct an android-based learning medium using APP inventor. This study was conducted over one semester (six months), from July to December 2020. Students from the Science Education Study Program FKIP Bengkulu University made up the study's population, while the sample consisted of 57 first-semester students attending general chemistry course 1.

The data collection strategies used in this investigation were quantitative. Data was collected in the form of validation data on learning media by material and media specialists and student responses to learning media questionnaires. After using the android-based SPU learning medium, students' pretest and post-test results yielded additional quantitative data. A verified pretest and post-test question, a questionnaire validation of learning media by media experts and material experts, and a questionnaire on student responses to the usage of learning media all contributed to constructing the instrument used in this study. The study used a Likert scale for data analysis, which was then transformed into a 5-scale table. Meanwhile, the pretest and post-test results were assessed using a gain score and a minimal completeness score comparison (KKM).

3. FINDINGS AND DISCUSSION

1. Development of Learning Media

The development of learning media aims to assist students in understanding the material presented by lecturers, especially on SPU material (Priodic Element system) in general chemistry courses 1. Media development is carried out in 4 stages, namely:

Define

The fundamental problem is determined at this stage, and the learning objectives are defined. The problem obtained based on the results of observations is that there are still differences in students' abilities to accept the material being taught, so learning media are needed that can guide students to study independently. At this stage, the collection of materials used in the manufacture of learning media such as syllabus, lesson plans, materials on SPU, and a grid of evaluation questions. Researchers also conducted discussions with cognate lecturers to obtain quality learning media. Based on the discussion results on making Android-based SPU learning media, it is considered necessary to make it to support the student learning process in the general chemistry course 1 science education study program at Bengkulu University.

Design

The researchers started planning the media that would be created at this point, which included creating scenarios, building storyboards, creating learning media layouts, and compiling assessment questions. The end product is a comprehensive design or storyboard ready to be developed in the next stage.

Develop

A. Media Development

At this stage, the researcher develops learning media based on the learning materials that have been collected and the storyboards that have been made. The result of this development is an android-based SPU (Elementary Systemic System) application with App inventor. This application can be accessed from gadgets with Android OS. The material focused on in this learning media is the periodic system of elements, starting from the development of periodic systems of elements, periodic tables of elements,

and periodic characteristics. The results of the design and systematics of the learning media developed to include the following components:

1. **The intro page** contains the "menu" button, which is used to enter the main menu page. This page also added the University of Bengkulu symbol as the researcher's university of origin. This page is used to attract students' attention to be interested in learning the material contained in the learning media.
2. **On this menu, the home or main** menu, the user can access all the menus in the learning media. The menus contained in this main menu are CPL and learning objectives, materials, evaluations (questions), and about me.
3. **CPL and CPMK,** this page contains CPL, CPMK, sub CPMK, and learning objectives so that students know the achievements and learning objectives that must be achieved after carrying out learning using the SPU application.
4. **Material,** this page contains the material presented in the learning media. There are 3 materials displayed in this SPU learning media, namely material on the development of periodic elements systems, periodic tables of elements, and periodic characteristics of elements.
5. **Evaluation,** this page consists of evaluation questions totaling 5 essay questions. These questions test students' understanding before and after participating in learning using SPU learning media.
6. **About me,** this page contains the profile of the researcher as well as the maker of android-based SPU learning media

Here are some views of the Android-based SPU learning media that have been designed :

Figure 1. Main Screen Display

Figure 2. Menu Page Display

Figure 3. Display of CPL and CPMK

Figure 4. Display of Learning Materials

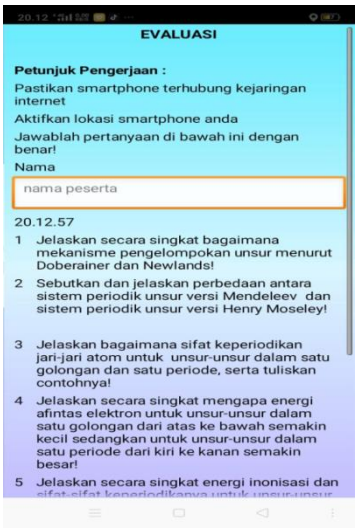

Figure 5. Display of Evaluation Questions

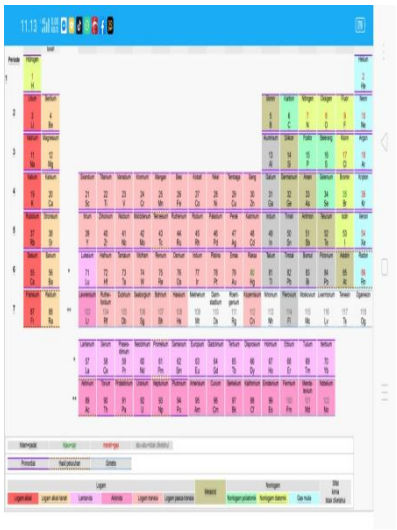

Figure 6. Display of the Periodic System Table of Elements

The developed learning media is subsequently evaluated to confirm that the information is genuinely suitable for use by students. Two specialists, namely material and media experts, carried out the validation. Validators are professionals who are experts in their disciplines.

Validation by material expert lecturers focuses on two main aspects, namely learning aspects (learning objectives, material delivery, and evaluation) and material aspects (material relevance and material selection). At the same time, the validation of learning media with media experts focuses on aspects of the display of learning media (text display, color combinations, images, and navigation buttons) and aspects of use (user instructions and interaction with media). The validation results by material experts and media experts obtained first were converted into quantitative data by scoring. The scoring results in each aspect were converted to a five-scale adapted from Sukardjo (2010), as presented in table 1.

Table 1. Conversion of scores on a scale of five in the validation step

Validator	Value Interval	Category	Information
Material Expert	X > 71,34	Very Worthy	Number of Items : 17 Lowest Ideal Score = 17 Highest ideal score : 85 Xi = 51 Sbi = 11,3
	57,78 < X ≤ 71,34	Worthy	
	44,22 < X ≤ 57,78	Decent enough	
	30,66 < X ≤ 44,22	Less Worthy	
	X ≤ 30,66	Not Feasible	
Media Expert	X > 54,48	Very Worthy	Number of Items: 13 Lowest Ideal Score = 13 Highest ideal score : 65 Xi = 39 Sbi = 8,6
	44,16 < X ≤ 54,48	Worthy	
	33,84 < X ≤ 44,16	Decent enough	
	23,52 < X ≤ 33,84	Less Worthy	
	X ≤ 23,52	Not Feasible	

The data collected from the validation of the Android-based SPU (Priodic Elementary System) learning media by material experts and media experts, as shown in tables 2 and 3 below, were scored following table 1.

Table 2. Validation Results by Material Experts

Assessment Aspect	Number of Items	Score obtained	Category
Learning	10	40	**Worthy**
Theory	7	29	
Amount	17	69	

Table 3. Validation Results by Media Experts

Assessment Aspect	Number of Items	Score obtained	Category
Learning Media Display	8	32	**Worthy**
Use	5	21	
Amount	13	53	

The validation results from media experts and material experts based on tables 1 and 2 are in the "appropriate" category. This "feasible" category states that the Android-based SPU learning media is feasible to be used and applied to general chemistry learning 1 in the Science education study program FKIP UNIB.

A. The results of the media feasibility assessment and student responses

The media feasibility assessment in this study was carried out by students of the science education study program who took the general chemistry 1 course. This assessment focused on aspects of learning, material, display, and use of learning media.

The same questionnaire was also used to obtain data on student responses to each statement item. The data obtained will describe student agreement with each aspect contained in the learning media used. The data obtained will describe whether the learning media developed is following student expectations or not.

The results of student's assessment of the feasibility of learning media are converted into quantitative data by scoring. The scoring results are then converted to a scale of five according to table 4.

Table 4. Conversion of five-scale scores on student assessment questionnaires

Value Interval	Category	Information
X > 33,6	Very Worthy	Number of Items : 8
27,2 < X ≤ 33,6	Worthy	Lowest Ideal Score= 8
20,8 < X ≤ 27,2	Decent enough	Highest ideal score : 40
14,4 < X ≤ 20,8	Less Worthy	Xi = 24
X ≤ 14,4	Not Feasible	Sbi = 5,33

After scoring the following table 4. The data obtained from the results of the media feasibility assessment by students as shown in table 5 below:

Table 5. Results of media assessment by students

Rated aspect	Amount
Learning	475
Theory	461
Appearance	477
Use	463
Total	1876
Conversion rate	**32,912**
Category	**Worthy**

Based on the data in table 5, the media feasibility assessment by students is in the "Eligible" category so that the media can be used and applied to students.

Response data or student responses to learning media are known through questionnaires distributed to students after using SPU learning media. These student responses cover four aspects: learning aspects, material aspects, display aspects, and usage aspects. The student responses are converted into quantitative data using the scoring method, according to table 6.

Table 6. Conversion of scores on a five scale

Formula	Value Interval	Category
X>Xi + 1,8 SBi	X > 4,206	Strongly agree
Xi + 0,6SBi < X ≤ Xi + 1,8SBi	3,402 <X≤ 4,206	Agree
Xi - 0,6SBi < X ≤ Xi + 0,6SBi	2,598 < X ≤ 3,402	Just Agree
Xi – 1,8SBi < X ≤ Xi - 0,6SBi	1,794 < X ≤ 2,598	Disagree
X≤Xi - 1,8 SBi	X ≤ 1,794	Do not agree

Keterangan : Xi : ½ x (5+1) = 3
Sbi : 1/6 x (5-1) = 0,67

Source : (Suartama, 2010)

After the data is converted according to table 6, the response data or student responses to SPU learning media can be presented in table 7 below:

Table 7. Data on student responses to learning media

Rated aspect	Statement	Accumulated score responses	Conversion Rate	Conclusion of student responses
Learning	1	249	4,36	Strongly agree
	2	226	3,96	Agree
Average student response scores for learning aspects		**237,5**	**4,16**	Agree
Theory	3	235	4,12	Agree
	4	226	3,96	Agree
Average student response scores for material aspects		**230,5**	**4,04**	**Agree**

Learning Media Display	5	240	4,21	Strongly agree
	6	237	4,16	Agree
The average student response score for the display aspect of learning media		**238,5**	**4,18**	**Agree**
Use	7	224	3,93	Agree
	8	239	4,19	Agree
Average student response scores for aspects of the use		**231,5**	**4,06**	**Agree**
Average response scores on all aspects		**234,5**	**4,11**	**Agree**

The average score for student replies to the Android-based SPU learning media is 234.5, which, when converted to a scale of 5, equals an average conversion value of 4.11 for the category "agree." This can be viewed as a widespread agreement among students on the Android-based SPU instructional medium elements.

This SPU Learning Media is a new learning medium for S1 Science Education students, so the enthusiasm and curiosity of students towards this application are also relatively high. With enthusiasm and high curiosity, the students' responses to this application as a practical and easily accessible learning medium are also quite good, so it falls in the "agree" category.

Disseminate

At this stage, the application was distributed to students through Bengkulu University e-learning. The software from this application is also distributed via YouTube to make it easier for students who want to use this application as a learning medium, especially during the COVID-19 pandemic as it is today. The youtube link for the tutorial video for using this application is https://www.youtube.com/channel/UCzgkxCuBTkbe6Wb6KXIHZ5w, while the google drive link to download this application on the youtube page is https://drive.google.com/file/d/1Hrow529N1d_ro255vBVDkJFUuMgk1ehP /view?usp=sharing.

Following the media distribution, the study looked at student learning results following the use of Android-based SPU learning media. By comparing students' pretest and post-test results, the influence of employing SPU learning media on student learning outcomes can be determined. The pretest was administered prior to the students' usage of the SPU learning media, and the post-test was administered after they had used the SPU learning media. Figures 1 and 2 depict the data from the students' pretest and post-test results:

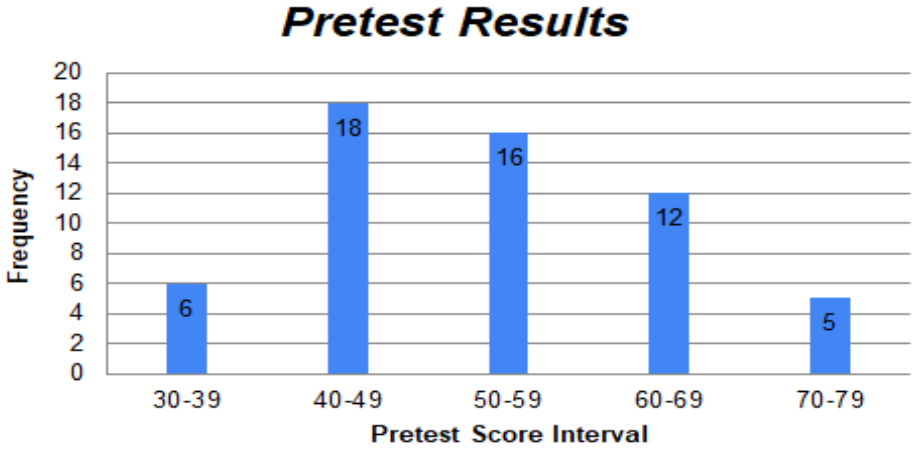

Figure 4. Histogram of student pretest results

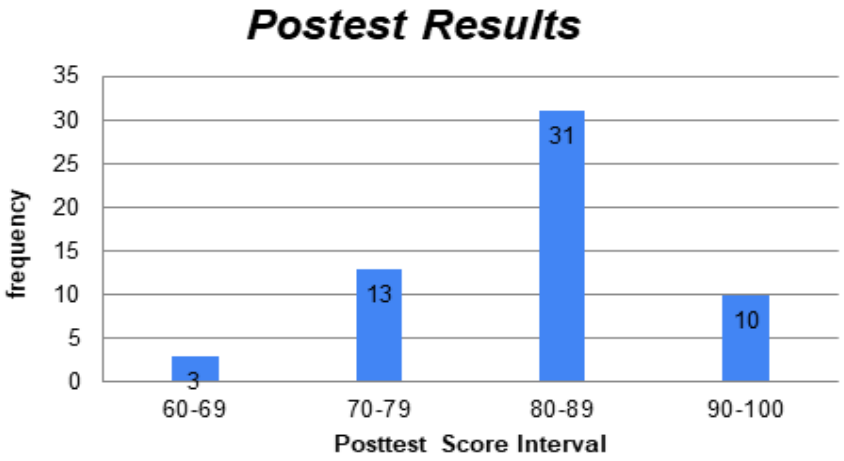

Figure 5. Histogram of student post-test results

The students' average pretest score was 51.05, and the students' post-test average was 80.78. The students' pretest and post-test results were tested for gain or gain scores by comparing the students' average pretest and post-test scores. The gain score obtained is 0.6 in the "medium" category. This shows that the use of SPU learning media effectively improves student learning outcomes on the Elemental Periodic System material.

This increase in student learning outcomes is thought to be due to the very high curiosity of students towards the new learning media they use, thereby spurring interest in these media. This interest then spurred students' motivation to take part in learning activities. Another factor that is suspected to be the cause of the increase in student learning outcomes is the nature of the learning media which is very practical and can be read and studied repeatedly at home so that they can learn whenever they want and can repeat the study if there are things that have not been understood. This is in line with the opinion of (Muyaroah & Fajartia, 2017) in his research, which states that android-based learning media can motivate students to learn the material given quickly. Learning with android-based learning media makes students happier because it is packaged with a unique presentation, and students can learn anytime and anywhere. This android-based learning media has several advantages; namely, this media has an attractive appearance in terms of color, writing, images, and animation. This media is also easy to operate and distribute to students.

4. CONCLUSION

The development of android-based SPU learning media in the general chemistry course 1 FKIP UNIB refers to 4 stages: defining, designing, developing, and causing. There is six main content of SPU learning media: intro, home, CPL and CPMK pages, materials, evaluations, and about me. The deployment or distribution of the application to users is carried out through the youtube site. The validation results by material experts, media experts, and assessments by students are all in the "appropriate" category, so this application is perfect to use. Student responses after using this application are also good and are in the "agree" category, meaning that students agree and are interested in the SPU application used. Student learning outcomes also increased after using the SPU learning media. This was indicated by the gain score of 0.60 and was in the "moderate" category, which indicated that the use of SPU learning media effectively improved student learning outcomes on the periodic element system material. This research was limited to SPU (Elemental Personality System) material in general chemistry course 1. Therefore, it is still necessary to develop learning media on other materials in the general chemistry 1 course or other subjects in the science education program. FKIP Bengkulu University.

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