Development of Android-Based Learning Media in Indonesia: A Systematic Literature Review

Yohanis Ndapa Deda 1, Nasruddin Nasruddin 2, Ida Bagus Nyoman Pascima 3, Angreni Beaktris Liunokas 4, Alfriani Ndandara 5, R. Supardi 6

1Mathematics Education Department, Universitas Timor, Kefamenanu, Indonesia
2Mathematics Education Department, STKIP Al Amin Dompu, Indonesia
3Mathematics Education Department, Universitas Pendidikan Ganesha, Indonesia
4Elementary School Teacher Education Department, Institut Pendidikan Soe, Indonesia
5English Education Department, Universitas Kristen Artha Wacana, Indonesia
6Elementary School Teacher Education Department Universitas Megarezky, Indonesia

Abstract – This research aims to examine the overall research on developing Android-based facilities in Indonesia. The research method used is the Systematic Literature Review to read 68 documents obtained from journals accredited by the Ministry of Education, Culture, Research and Technology of Indonesia with the keyword "android". The study results show that junior high schools are the most targeted, and the most studied subject is mathematics to support 21st-century skills, preparing Indonesia's golden generation in 2045. Furthermore, the learning media developed are not limited to the validation and testing stages but has to reach the testing stage effectiveness and dissemination.

Keywords – research and development, learning media, study literature, android.

1. Introduction

Learning media is very important as an intermediary in conveying the contents of a message from a material the teacher gives to students. In the past, during learning in schools and tertiary institutions, teachers usually used media in front of the class to make obtaining the aims and objectives of the subjects or material being taught easier. However, media is no longer limited to space [1]. Today's media has to be used anywhere and anytime by students and teachers. Students should be able to learn independently with learning resources that can be utilized anywhere [2]. As an intermediary, the media has to aid in accomplishing an educational aim. Learning media may also help convey messages and generate thoughts and attitudes, making it more straightforward for pupils to study independently.

Learning media is required to achieve learning independence. Teachers, on the other hand, have to be able to incorporate current information and communication technologies. With technological advancements like Android, it may be an alternate medium for teachers to ease subject matter delivery to pupils. The use of media-based Android is not constrained by geography or time [2]. Smartphones, also known as Android, are an operating system for smartphones and tablets. The operating system may be thought of as a bridge between devices (devices and their usage) that allows users to engage with their devices and execute programs that are accessible on the devices [3], [4], [5] define Android as a Linux-based operating system, middleware, and apps intended primarily for mobile devices such as smartphones and tablets, with several benefits such as user-friendliness, open source, and support for a wide range of applications [5]. Most learning across Indonesia has yet to reap technological innovation's benefits [2]. Learning medium-based Android is required based on the requirements listed above [2].
Learning media may be created for students both within and outside the classroom, and instructors can utilize it to aid learning. Furthermore, Android-based learning media may be designed to promote scientific literacy [6], high-level thinking abilities in high school students [7], and problem-solving skills [8], [9]. Another objective is to develop students' critical thinking skills [10] and to improve learning outcomes [11].

Furthermore, self-learning with the Android app can increase students' conceptual comprehension [12]. The aims of building Android-based learning material are sure to be successful since today's students are millennials who are incredibly creative with their Android cell phones. As a result, Android-based learning media is required as a learning resource [13].

This literature study will focus on the following research questions:

i. What are the research trends in Indonesia for producing Android-based learning media (2015-2022)?

ii. How is research on producing Android-based learning media distributed in Indonesia (2015-2022) based on SINTA data-based?

iii. How is research towards further developing Android-based learning media based on research and development methodologies distributed in junior high schools?

iv. What are the recommendations for future education research?

2. Research Methodology

The technique of systematic literature review (SLR) was supervised by the researchers [14]. Figure 1 depicts identifying the research objective and searching literature [15]. The technique was then repeated by picking papers by reading abstracts to capture the prior study's core idea. For clarity and in-depth comprehension, reading the complete manuscript became essential [15]. The approach was then followed by data abstraction and analysis to describe the study's result.

This study reviewed the literature with the highest rating by Kemendikbudristek Indonesia as an achievement of peer-reviewed journals with excellent management and publication quality. Forty-seven accredited journals rank one and two nationally, consisting of 3 journals ranked first and 44 journals ranked second. Sixty-eight articles were selected from indexed journals, Sinta 1 and Sinta 2, as of November 17, 2022. The search criteria for articles in each Sinta 1 and Sinta 2 journal in Indonesia are the search keywords "android". Then selected articles and search results in each journal were related to "Development of learning media". The 68 articles were analyzed based on the questions and objectives of this study.

After presenting the pattern of developing learning and teaching media in the Android format, the end of the discussion gave a critique of the learning media explicitly developed for junior high school students in Indonesia.

3. Results and Discussion

Based on 68 publications published over eight years (2015-2022) on the development of android-based learning media, research trends have tended to increase in the last eight years, as shown in Figure 2.

In 2015, there was just one publication about using Android-based chemistry learning material to boost students' enthusiasm and achievement in chemistry [16]. Android-based learning media for chemistry [17] and physics [18], [19] were released in 2016. In addition, two scientific advances in chemical materials occurred in 2017. Learning media development research grew to 4 papers in 20185. In addition, there were 10 articles in 2019, 12 pieces in 2020, 17 in 2021, and 19 in 2022. According to the trend of the number of papers in Figure 2 above, research on the development of learning media based Android in Indonesia throughout the eight years (2015-2022) continues to expand, with a peak in 2021.
After looking at the data on the percentage of the number of documents based on the research method used (see Figure 3), the research and development (RnD) method is the most widely used by learning media developers in Indonesia. The 82% number represents the R&D method's dominance in learning media production in Indonesia for the next eight years (2015-2022). Another approach employed is the 5% experimental research method, the 3% mix method, the 2% literature study, the 1% descriptive quantitative method, and the 1% descriptive qualitative method. There are just two literature review publications, one about using Android mobile learning-based learning media to increase student learning outcomes [20].

Other literature review articles are similar to the first, which aims to discover learning media based on Android applications to improve literacy skills [21]. Two articles used a qualitative descriptive method, one of which used Adobe Animate CC and CorelDrawX5 software [22]. A Beta instrument in the form of a student response and a Likert scale were employed [23]. Furthermore, three articles use experimental research to support communication skills, learning outcomes, and the effectiveness of learning models [24], [25], [26].

Figure 4 shows that RnD models were employed in creating android-based learning media after reviewing 68 papers employing development research (RnD) approaches. The ADDIE model (Dick and Carey model) is the most extensively used flotation model, accounting for up to 40% of R&D papers. They were then followed by the 4D model proposed by Thsiagarajan in 1974, as much as 20%.

Next is the Borg and Gall model to the tune of 14%. The Borg and Gall model aims to develop and validate educational products. The stages start with studying research related to the product being developed, conducting testing and revising to correct deficiencies at the testing stage. Sugiono model as much 5%, Sukmadinata model, which includes the Introduction, Development, and Testing stages number 3%. Apart from that, there is 3% method using the Richey and Klein model, which includes Planning, Production, and Evaluation; 3% use the Plomp model, and only 1% use the Design, Construction, and Evaluation (DCE) model. There 11% of articles do not explicitly state the development model adopted.

Figure 5 above shows the distribution of articles in Sinta 1 and Sinta 2 accredited journals in Indonesia. Figure 5 shows three journals that have contributed the most to publishing Android-based learning media scripts. These journals are "Journal of Education Technology", "Aksioma: Jurnal Program Studi Pendidikan Matematika", and "Jurnal Pendidikan Sains Indonesia".
According to 68 publications producing android-based learning material at the high school level accounts for 31% of all articles. Students then followed them in up to 21% of the documents. Furthermore, junior high school (JHS) accounts for 16%, vocational high school accounts for 10%, elementary school accounts for 10%, early childhood education accounts for 4%, the learning community accounts for 2%, kindergarten accounts for 1%, and non-formal education accounts for 1%. Based on data from 68 publications that publish studies regarding the development of Android-based learning media, it is evident that vocational high school, elementary school, early childhood education (PAUD), learning community, kindergarten, and informal education are subject to a percentage of fewer than ten per cent. During the period 2015-2022, this topic is still under-researched. In the future, these subjects have yet to be widely used as research subjects for developing android-based learning media in Indonesia.

![Figure 7. Subjects matter of Android-based Learning Media In Indonesia (2015-2022)](/path/to/image)

Based on the data in Figure 7, it is found that mathematics is the most researched topic or subject. This is evident from the 18 documents for the creation of mathematics-related android-based learning media and followed by chemistry subjects, which are as many as 17 articles. In addition, eight documents are related to English, seven are related to physics, and six articles are related to biology.

![Figure 8. The Spread of document base region in Indonesia (2015-2022)](/path/to/image)

Based on the data in Figure 8, research on developing Android-based learning media is spread across 37 regions in Indonesia (see Figure 8). The area that has conducted the most research related to this topic is the Yogyakarta area (9 Documents), then it is followed by the city of Semarang (8 documents), Malang (7 documents), Cirebon (6 documents), Salatiga (4 documents). Palang (4 documents), Padang (4 documents), Bali (4 documents), Surabaya (3 documents), Sumatra (3 documents), Pontianak (3 documents), Makassar (3 documents), Kediri (3 documents), Jombang (3 documents), Jakarta (3 documents), Bengkulu (3 documents), Banten (3 documents).

Moreover, the regions that contributed to the two documents were Mataram, Kefamenanu, Aceh, Tasikmalaya, Surakarta, Sidoarjo, and Kuningan. Regions that also contributed with one document were Lampung, Mojokerto, Madura, Madiun (Magetan), Kudus, Gresik, Depok/Sleman, Cimahi, Boyolali, Bekasi, Bogor, Banyuwangi, and Bangkal.

According to the findings, most research on creating learning media based on Android at the student level is in chemistry and Arabic courses.
For the high school level, the topic most developed by Android-based learning media is chemistry. Furthermore, for the SMK level, computer subjects are the most numerous, with two related research documents. In addition, for the junior high school level, mathematics is the dominating subject of this research. For elementary schools, the Indonesian language is the most researched subject related to this topic. There is a need for more research documents for kindergarten and early childhood education. Generally, the most targeted subject is the Senior high school level (see Figure 6).

The most researched subject related to this research is mathematics, followed by chemistry. Topics and subjects include science, geography, fantasy stories, counseling, digital engineering, fruits and vitamins, non-fiction texts, literacy, reading, research methodology, music, office administration, and automotive. Next, letter recognition, public administration, fiscal reconciliation, the art of motion, transliteration, and other themes (see Figure 7) have the potential to be investigated further through Android-based learning media. Furthermore, areas such as vocational school, primary school, early childhood education, learning communities, and kindergarten and non-formal education have received less attention (see Figure 6).

The R&D approach is the most extensively employed. The Sugiono model, Sukmadinata model, Richey and Klein model, Plomp model, and Design, Construction, and Evaluation (DCE) model are methods for designing Android-based learning media that have yet to be extensively deployed (see Figure 4). Furthermore, methods for utilizing learning media such as smartphones or Android, which have yet to be widely used, are experimental research, Mixed method, Descriptive quantitative, and Descriptive qualitative. In addition, the literature study method related to this research still needs to be improved (see Figure 3).

Yogyakarta is the most commonly utilized site in a study on producing Android-based learning media, followed by Semarang. Many places in Indonesia have yet to be explored as study sites for making Android-based learning material. Other than the explanation in Figure 8, several locations require consideration. This study's learning media-based Android was mainly in the games form (29 documents), with 21 games supporting educational implementation, seven educational game documents, and one learning game document. Next, we provide a point regarding Android-based media developed for junior high school students in Indonesia.

[27] developed the media "Game Math Comic Story" to help students learn number material and increase students' interest in reading. To achieve this goal [27], the authors use the 4D RnD method. This Android-based game media is good because it makes students happy to learn mathematics. However, this media has yet to reach the level of effectiveness to what extent the instructional influence of game media has in increasing mathematical literacy skills. [28] developed modern learning media-based Android for junior high school (JHS) students. However, multi-platform educational game media development is limited to expert validation. It has yet to reach a large-scale effectiveness test, so it is unknown to what extent this media is adequate for these students. [29] developed an Android Deck Card Educational Game to support understanding the concept of Fractions in JHS students. The research objective (Firdausi & Suparni, 2022) is to create an accurate Deck Card android educational game application to assist students in understanding the idea of fractions. To achieve the goal, [29] uses the Richey and Klein model, with the Planning, Production, and Evaluation (PPE) development model [30]. However, this educational game application is only limited to the expert validation stage, not yet at the effectiveness testing stage. [31] developed an educational game based Timor Local Wisdom in Android as Mathematics Learning Media using RnD ADDIE. This media is exciting; apart from using the Android platform, it also uses the context of local wisdom, which is close to students' daily lives. However, this media has yet to test its effectiveness, so its potential for effectiveness in JHS students can be seen. [32] developed mathematics learning media based Android for JHS students. The development stage of the Pythagorean theorem material learning media uses RnD ADDIE and is complete from the expert validation stage, practicality test, to the effectiveness test. However, this media has not been tested for its effectiveness on numeracy literacy skills. [33] designed an Android-based educational game on transformation material using a 4D model. This educational game media's development is limited to the validation test stage, not yet at the effectiveness test stage.

Apart from [31] developing Android-based learning media and using Timorese local wisdom, [34] also developed Android-based Madura Local Wisdom Learning media. [31], [34] has not yet reached the stage of testing the effectiveness of the learning media being developed, so it is not yet known how effective it is for JHS students. [35] developed Vocapp (Vocabulary Application) media for learning English words for cities. Vocapp media is interesting, valid and effective based on the results of limited trials using mixed methods. However, Vocapp media has not used a context that supports literacy skills. [36] developed a media android-Computer Based Test (CBT) application to evaluate student learning outcomes.
To achieve the research objectives, [36] involved 30 students and one mathematics subject teacher. The media developed was very valid, practical, and suitable for assessing maths topics in JHS. However, the questions used in developing the android-based computer Base Test do not yet use the context used in numeracy literacy. [37] the Android app's effectiveness as a student help tool for physics activities was evaluated. The Android application as a study aid is excellent because students are more enthusiastic about doing physics assignments. However, this android application still needs to measure the extent of its effectiveness in supporting JHS students' scientific literacy abilities. [1] developed an Android-based Barusikung Mobile Learning on Curved Side Space Building Materials. To achieve research objectives, [1] uses the ADDIE model. This Android-based Barusikung media is excellent because it is valid and practical and has been shown to increase the learning results of ten trial students. However, there has been no implementation of this media to see the extent of the influence of its use to measure numeracy literacy skills. [38] developed learning media-based Android to improve students' scientific literacy. Research [38] took place throughout the COVID-19 pandemic using a 4D model. This Learning Media is very good because it can increase scientific literacy. However, the development stage is not perfect because it only reaches the root validity test and feasibility test stage, not yet the effectiveness test, to see how far the level of effectiveness is in increasing scientific literacy. [39] developed learning media based on the Android iSpring Suite in Islamic Subjects. This media is excellent because students respond fantastically, and it is easy to understand. However, this research [39] is only limited to validation tests and feasibility tests, not yet testing the effectiveness of the media being developed. [40] developed learning media based Android with characters using 4D models. This research [40] is outstanding because it is in line with strengthening character education and Pancasila students' profile. The developed learning media is valid, practical and effective based on trials on 14 JHS. However, the values of nationalist character and love for the motherland have not yet appeared in the media because local wisdom has not been integrated into the media being developed.

Based on the discussion above, we highly recommend developing learning media that integrates local wisdom into the Android smartphone platform. In addition, the extended learning media based Android should support 21st-century skills. These 21st-century skills are needed to prepare Indonesia's golden generation in 2045.

Furthermore, the generated learning media does not stop at the limited validation and trial stages but has to arrive at the effectiveness testing and dissemination stage.

4. Conclusion

Based on findings and discussion above, we conclude that the study trend for producing android-based learning media in Indonesia has increased during the previous eight years (2015-2022). In Indonesia, high school topics are the most focused, followed by student subjects. Mathematics is the most investigated subject in Indonesia regarding research on creating learning media based Android, followed by chemistry. The RnD approach is the most extensively utilized method in Indonesian research on producing Android-based learning media. Furthermore, Yogyakarta is Indonesia's most commonly used location for research on building learning media-based Android.

Further, we highly recommend developing learning media that integrates local wisdom into the Android smartphone platform. In addition, the extended learning media-based Android should support 21st-century skills. These 21st-century skills are needed to prepare Indonesia's golden generation in 2045. Furthermore, the generated learning media does not stop at the limited validation and trial stages but has to arrive at the effectiveness testing and dissemination stage.

References:


