THE DEVELOPMENT OF ANDROID-BASED LEARNING MEDIA USING KODULAR IN BIOLOGY FOR GRADE VII STUDENTS AT PUBLIC JUNIOR HIGH SCHOOL 5 TAEBENU SATAP

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ABSTRACT

The purpose of this study is to create an android-based learning media using Kodular for junior high school grade VII biology in Public Junior 5 Taebenu SATAP. The research took a quasi-experimental form, which then compared the efficacy of the media developed for traditional teaching methods in regard to enhancing student understanding of complex biological concepts. Significant improvements were shown in the post-test scores, engagement, and motivation for the first half of this experimental group by using Android-based learning media as compared to control group. The outcome surfaced that more interactive and multimedia-intensive user interface of mobile application provided significant influence on the level of understanding students had about abstract biological concepts, which consequently contribute to better learning results. While rural schools may lack the resources that such challenges demand, this study demonstrates the potentially revolutionary way that mobile learning tools can address science education. The results indicate that utilizing Android-supported applications in the classroom is a practical way to create individualized, engaging learning opportunities for learners of the 21st century.

Keywords : *Android-based learning media, Kodular, mobile learning, science education, biology education, student engagement, rural schools.*

I. INTRODUCTION

Technology is reformulating every sector, including education in the age of the Fourth Industrial Revolution. Integrating digital tools into educational activities is now viewed as a vital cog in ensuring that students of the 21st century are engaged and live in dynamic learning worlds (Girdzijauskienė et al., 2022). This digitalization trend is in line with the Indonesian National Education System Law (UU No. 20 Tahun 2003) which highlights that education is an intentional and planned kind of effort to create learning opportunities enabling students to actively form a profound capability in several domains, especially in terms of their critical thinking or problem-solving abilities.

Digital technology has become a vital part of many areas, including education as an instrument to promote teaching and learning. Studies have proven that mobile-based learning tools offer flexibility, accessibility, and a personalized learning environment which is absent from traditional methodologies (Bidarra & Sousa, 2020). According to Bukharaev and Wisam Altaher (2017) by use of mobile learning platforms, the given specific type development in education that allows student to learn at any time and any place makes offering such services more practical and scalable. Within a scientific educational context, and for biology specifically, these platforms are able to aide in the presentation of concepts that are not only quite abstract, but very complex as well by providing interactive assessments or simulations/visualizations.

Biology in general is a subject that lends itself to learning about complex processes and systems including cellular biology, ecosystems and human anatomy while traditional lecture always fall short of our expectations. Nearly all the studies have shown that these subjects are best understood by students when reinforced through digital media and interactive learning content (Watrianthos et al., 2022). However, in many schools, particularly in rural areas such as Public Junior High School 5 Taebenu SATAP, access to innovative teaching tools is limited, leading to suboptimal learning outcomes. Recent research further supports the potential that digital media in science education has for achieving significant improvement of student engagement and understanding complex scientific phenomena, provided they are integrated well into curriculum (Alnajjar, 2022; Mat Nor & Halim, 2023; Wahyuni & Fitria, 2023).

To address this problem. this research proposed the development of Android-based learning media with Kodular (visual programming platform that allows educators to create mobile applications without knowledge developing a program is fairly fussy, which aimed at solving just such problems). Recent research highlights Kodular's potential in creating interactive learning tools for students. Studies have shown that Kodular enables students to develop interactive multimedia for mathematics education, fostering creative thinking skills in dimensions of fluency, flexibility, and originality (Djuredje et al., 2022; Witriyono et al., 2022). This research aims to develop a digital learning tool that aligns with the biology curriculum for Grade VII students and enhances their learning outcomes by offering engaging, accessible, and interactive content.

The specific research objectives are as follows:

1. To develop an Android-based learning media for teaching biology using the Kodular platform.
2. To evaluate the effectiveness of the developed media in improving student understanding of biological concepts, specifically in Grade VII.
3. To assess student engagement, motivation, and satisfaction with the Android-based learning media in the context of biology education.

At a time when there is increasing evidence in favor of integrating mobile applications into education, this study is particularly significant. Mobile devices and applications, identified here as mobile learning tools, these may provide the opportunity to reshape educational opportunities for students; offering more active, personal based learning experiences that in

some contexts are more successful than traditional methods (García-Martínez et al., 2019; Karabatzaki et al., 2018). This study also works to remedy a gap in availability of high-quality educational resources for rural areas by creating an affordable and user-friendly model that can be adopted by schools with limited equipment.

This study aims to contribute to the current research literature on digital learning technologies by exploring how effective the Android learning media in improving students'achievement in science education. The results could support educators and policy makers in guiding integrating mobile learning tools for their teaching practices.

II. LITERATURE REVIEW

1. Mobile Learning in Education

Mobile technology is no doubt a game changer in education as it has transformed the way through which information is accessed by students, but time and again it brings us to the attention of certain issues. M-learning or mobile learning has become one of the most popular methods as it provides flexibility, personalization, and instant access to educational materials. (Bidarra & Sousa, 2020). According to García-Martínez et al. (2019), mobile devices and mobile apps have taken learning out of the classroom, providing students with self-directed learning opportunities and instantaneous access to resources. This change is particularly significant in science education, as students must learn to work with intricate concepts that cannot be completely learned through traditional lecture-based teaching alone.

The usage of mobile devices in education has proved to improve student engagement, motivation and hence efficiency (Karabatzaki et al., 2018). Studies show that the learners are likely to be more involved in learning, when supported by mobile applications as they offer opportunities to add multimedia elements that can only serve to enrich their learning experience (Watrianthos et al., 2022). In science education, for example, mobile apps can deliver simulations, quizzes and videos that help bring scientific abstract into a more real-world and engaging context. However, it is important to make sure the content that is given on the platform should be according to curriculum align standards and education goals.

2. Science Education and Digital Tools

At the junior high school level, for instance, many science education curricula ask students to learn about complex biological systems and processes (e.g., cellular biology, human anatomy & physiology, ecosystems). Classrooms have schools of science in books and take to the speeches without any concern to make sure that we can understand these tougho areas. According to Bybee (2010), science education should foster inquiry-based learning, where students are encouraged to ask questions, explore solutions, and apply scientific principles to real-world problems. These experiences can be supported using digital tools which enable students to engage with scientific phenomena interactively and in an immersive manner, similarly as if they were physically performing the experiment.

Research shows digital instruments assist us be taught extra interactively by making learning more engaging and intriguing (Wahyuni & Fitria, 2023). Students can interact with multiple representations of chemical kinetics, manipulate the simulations, and perform virtual experiments with instant feedback on common misconceptions. For instance, in Biology, students can investigate cellular structure and function using digital simulations and model ecological interactions or human body systems. Interactive learning experiences enable digital tools to allow for students to learn more deeply scientific concepts and produce better results in science subjects (Watrianthos et al., 2022).

3. Kodular and Android-Based Learning Media

Kodular is a visual programming platform that allows educators to create Android-based applications without requiring advanced coding skills. This is a popular platform in recent years because it can be used easily by creating educational endpoints exactly for individual learning needs. Users can use Kodular to build multimedia applications such as quizzes, animations and videos that provide an alternative whiteboard for knowledge delivery (Djuredje et al., 2022).

For scientific education with Kodular, applications can be created to visualize complicated copies of biological processes or environmental issues or to conduct virtual experiments and test basic knowledge. Research by Witriyono et al. (2022), applications developed for Kodular were verified to be capable of enhancing the mathematics knowledge among students since they require creative thinking and a problem-solving approach. In the

current research, Kodular was employed to create an Android-based biology learning media which sought to enhance student engagement and master of biological systems.

It creates a good lesson where teacher use the Kodular to give a unique and engaging learning experience that assimilates perfectly with the global data, which goes in favour of learning through Mobile Apps. Kodular-based applications can bridge the gap between traditional forms of teaching and the needs of 21st-century learners by providing personalized, interactive learning experiences (Alnajjar, 2022). This study becomes so important because the use of Kodular is expected to produce a cost-effective and user friendly solution can be applied at schools that have limited resources such as Public Junior High School 5 Taebenu SATAP.

4. Challenges and Opportunities in Using Mobile Learning for Science Education

While mobile learning offers numerous benefits, at the same time, there are challenges that come with this approach in a classroom. One of the biggest challenges is how to make sure that the content provided through mobile applications and curriculum objectives are aligned with everything that mobile applications deliver. Especially in our field, teachers need to make wise choices how they use or develop mobile applications that lead the students to meet learning goals with correct and trustworthy information (Wahyuni & Fitria, 2023).

An additional hurdle is the view that mobile devices are primarily for entertainment purposes and not educational ones. Despite all these benefits, the biggest problem most hesitant educators have with mobile applications in education is that they are distractions. Nonetheless, evidence suggests that, if implemented well, then m-learning tools can have a great positive impact on student engagement, motivation and learning (Girdzijauskienė et al., 2022).

Mobile learning opportunities are numerous in science education. The use of mobile applications, provide any extent deliver an absolutely personalized learning solution for students and all method based on their requirement, style of learning (Bidarra & Sousa, 2020). Mobile learning tools, moreover, make it easier for students in underserved rural to access the resources available online and thus can provide for better content than what is otherwise easy to get (Bukharaev & Wisam Altaher, 2017). Through this research it is hoped to know the actual opportunities by creating learning media for biology special education on android based, which are designed for students at Public Junior High School 5 Taebenu SATAP.

III. METHODOLOGY

1. Research Design

This study employed a Research and Development (R&D) approach following the ADDIE model (Analysis, Design, Development, Implementation, and Evaluation) to create and implement an Android-based learning media using Kodular for biology lessons in Grade VII at Public Junior High School 5 Taebenu SATAP. This R&D model was chosen as it is prevalent in educational product development and permits a systemic and iterative design, development, implementation, and effectiveness evaluation of learning media (Molenda, 2003). The study was designed to examine both the development of the learning tool and its impact on student outcomes.

2. Participants

The research subjects of this study were 30 Grade VII students in Public Junior High School 5 Taebenu SATAP, which consisted of two groups: the experimental group (15 students) by using a Kodular-based Android application media for biology learning; and the control group (15 students) received traditional classroom teachings without utilize a mobile-learning device. Convenience and interest based selection of students; No previous experience with the Kodular platform was mandatory for being selected.

3. Instruments

The primary instruments for data collection in this study were:

a) Pre-test and Post-test.
   These assessments were created to evaluate the biology background of the students and their comprehension on the concepts discussed during the lectures. The pre-test was conducted before the use of Android-based learning media, and post test after given to students to see whether improved student learning result.
b) Questionnaires.
   The questionnaire was developed in order to measure the student engagement, motivation and satisfaction from the Kodular-based learning media. A 5-Point Likert Scale was applied to the questionnaire with scores of strongly disagree, and strongly agree.
c) Observation Sheets.
   Researchers monitored students' interactions, engagement demonstration behaviors and skill with the digital tool through observation sheets during the intervention.

4. Development of the Android-Based Learning Media

The development process of the Android-based learning media using Kodular followed the ADDIE model:

a) Analysis.

In this phase, researchers investigate Grade VII students' needs in terms of learning biology subject and problem associated to confronting by them when learning biological concepts through traditional methods.

b) Design.
During the design, we sketched a blueprint that would stimulate curiosity for basic biological processes at an early stage, using interactive media to engage students and help them understand more about how life works.

c) Development.
For the learning media based on Android, it was developed using the Kodular platform. The application consisted of videos, animations, quizzes and interactive simulations relating to the systems in human body and ecosystems which was mapped to the Grade VII biology syllabus.

d) Implementation.
The Kodular-based learning media was implemented in the experimental group over the course of four weeks. The lessons were delivered through the Android application, with students encouraged to actively participate in the interactive elements.

e) Evaluation.
The evaluation phase consisted of collecting data from pretest, post-test questionnaires, and observations to determine the effectiveness of the learning media on enabling students to succeed while being engaged.

5. Data Collection Procedures

Data were collected through a combination of pre-tests and post-tests, questionnaires, and classroom observations. The pre-test was administered to both the experimental and control groups prior to the intervention to establish a baseline for student knowledge. Following the intervention, a post-test was administered to both groups to measure the improvement in student learning outcomes.

After the intervention questionnaire it was disseminated to the students of experimental group about their interest, motivation, and satisfaction using Kodular for learning media. Additionally, the researchers recorded student activity during the lessons and observed how students used an Android application.

6. Data Analysis

The data collected from the pre-test and post-test scores were analyzed using descriptive and inferential statistics. The analysis included:

a) Descriptive Statistics.
The mean, median, and standard deviation were calculated for both the pre-test and post-test scores to summarize student performance.

b) Inferential Statistics.
A paired T-test was conducted to determine whether there was a statistically significant difference between the pre-test and post-test scores of the experimental and control groups. A significance level of $p < 0.05$ was used to test the hypothesis that the Android-based learning media would improve student learning outcomes.

Data from the questionnaires were analyzed using frequency distributions and percentages to measure the level of student engagement, motivation, and satisfaction. Qualitative data from classroom observations were analyzed to provide additional insights into how students interacted with the learning media.

IV. RESULTS

1. Development of Android-Based Learning Media Using Kodular

In the first phase, an Android-based learning application for students Grade VII in Public Junior High School 5 Taebenu SATAP was developed. The app was coded using Kodular, a visual programming interface for making mobile apps with no or low coding experience. There were some components in the application:

a) Interactive Biology Lessons.
   The app had modules where students were taught biology concepts such as cellular structure, human anatomy and ecosystems. Every bulletin was adorned with animations and diagrams to simplify difficult biological ideas.
b) Quizzes and Self-Assessment Tools.
   After every module, there could be quizzes for students to quiz themselves and assess their learning.
c) Simulations and Virtual Experiments.
   As a tool, the app realistic simulators that allowed it to function as if students were performing experiments on living processes (cell life or ecosystem operation) in order to provide a hands-on experience in computer programs.
d) User-Friendly Interface.
   The app had an intuitive interface that allowed students to easily navigate the content without encountering technical problems. This bit was critical for students with scarce digital experience.

Feedback has been gained from teachers and students at every step, in line with a user-centered process of development to make sure the app was helpful for them. The app was tested on various Android devices to verify compatibility and usability across multiple distributions.

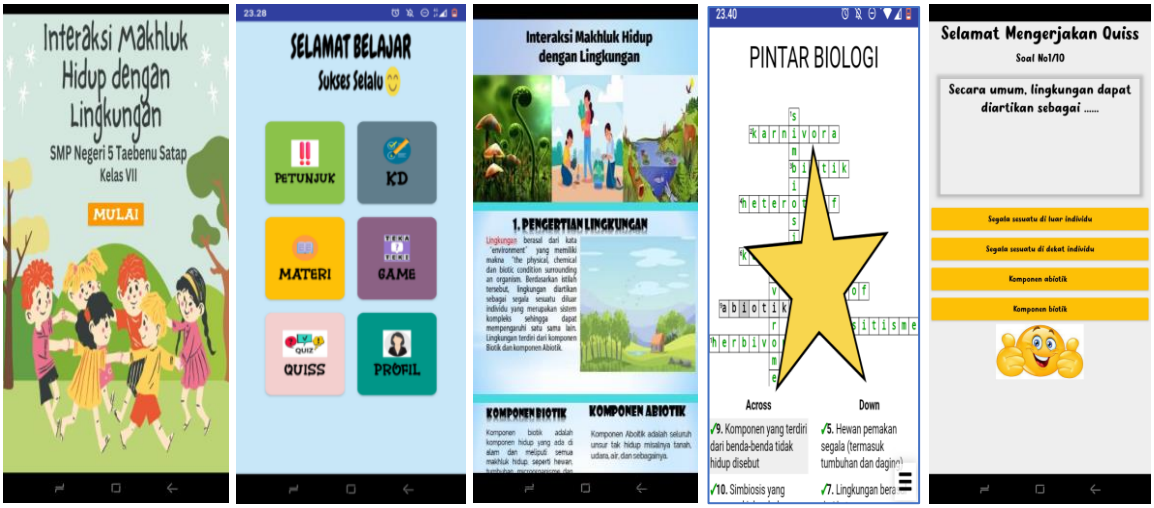

Figure1. Android-based learning media using Kodular for biology lessons

2. Pre-Test and Post-Test Results

Once the learning media based on Android had been developed, the study moved on to evaluation of its effectiveness using pre-test and post-test given to control and experimental classes.

a. Pre-Test Scores

As shown in Table 1, the pre-test scores of experimental group and control group. The results demonstrate that before the intervention, there was not much difference in terms of prior knowledge among both sets as the marks for pretest were not significant.

Table 1: Pre-Test Scores of Experimental and Control Groups

Group	N	Mean Pre-Test Score	Standard Deviation
Experimental Group	15	60.5	4.21
Control Group	15	59.8	4.35

b. Post-Test Scores

In order to evaluate the impact of Android-based learning media on student understanding of biology concepts, post-test scores were recorded after the intervention. The mean post-test scores for the Experimental and Control groups are given in Table 2. The results showed that the learning media which they used in experimental group based on Android were significantly better than those of control group with conventional formal.

Table 2: Post-Test Scores of Experimental and Control Groups

Group	N	Mean Post-Test Score	Standard Deviation
Experimental Group	15	85.7	3.89
Control Group	15	65.2	4.57

3. Improvement in Learning Outcomes

This difference between pre-test and post-test scores of both groups were analyzed to measure the effect of two intervention strategies on better learning. Table 3 reveals that there was a significant difference of learning outcomes between expermienatal group compared to control group.

Table 3: Improvement in Pre-Test and Post-Test Scores

Group	N	Mean Score Improvement	Standard Deviation
Experimental Group	15	25.2	3.57
Control Group	15	5.4	2.89

A paired T-test analysis confirmed that the improvement in the experimental group's scores was statistically significant ($p < 0.05$), reinforcing the conclusion that the Android-based learning media contributed to better learning outcomes.

4. Student Engagement, Motivation, and Satisfaction

A set of questions is given to the experimental group participants about the use, motivation, and satisfaction of the Android-based learning media. The results which are indicated in Table 4 reveal that the students perceived that learning media is very interesting and motivating.

Table 4: Student Engagement, Motivation, and Satisfaction Ratings

Aspect	Mean Score (out of 5)	Standard Deviation
Engagement	4.6	0.45
Motivation	4.5	0.52
Satisfaction with the Learning Media	4.7	0.43

These results suggest that the Android-based learning media had a positive impact on students' engagement and motivation in learning biology.

5. Qualitative Observations

To that end, classroom observations gave us additional information about whether or not the learning media was working. These lessons were much easier to implement, and there was far less resistance from the students in the experimental group than those in my classes. They were more actively engaged in the discussion, asked questions and showed a generally better performance concerning biology contents compared to controls. The more interactive nature of the Kodular-based learning media would have led students to further explore topics, which in turn caused their control based group counterparts to be far less engaging

V. DISCUSSION

In the case of this study, it turned out that Android-based learning media developed with Kodular could improve biology learning outcomes in Grade VII in understanding complex

biological concepts. The outcomes are in line with the preceding literature, underlining on how digital learning tools can foster active participation of students, motivational basis for teaching and performance in science education (Karabatzaki et al., 2018; Watrianthos et al., 2022). In this section, we will reflect on the implications of these results with respect to our research questions and contribute to the broader knowledge community surrounding mlearning in education.

1. The Impact of Android-Based Learning Media on Student Learning Outcomes

The pre-test and post-test data also showed a significant improvement in the learning outcomes of students using Android-based learning media. The experimental group, who interacted with the multimedia developed by Kodular, had significantly higher post-test scores than the control group and therefore suggests that BL is an efficacious way to aid understanding of biology concepts in conjunction with mobile learning tools. Their app was interactive, multimedia-rich and helped students in visualising abstract biological processes as cellular functions or complex human body anatomy which is challenging to conduct through conventional teaching methods. This is consistent with the findings of Bybee (2010) and Wahyuni & Fitria (2023), who emphasize that digital tools facilitate deeper understanding of scientific phenomena by making complex concepts more accessible and engaging.

In addition, the higher learning gain of the experimental group was as a result of active learning environment that was provided by Koduar-based application. It encouraged students to discover, interact with and then apply their knowledge to simulated environments, not merely communicating information passively. This aligns with the principles of inquiry-based learning, where students take an active role in their own learning (Bybee, 2010).

2. Engagement, Motivation, and Satisfaction with Mobile Learning Tools

The subsequently much higher levels of student engagement, motivation and satisfaction reported by the experimental group make mobile learning tools key components for improving the learning experience. Both students and teacher felt that animations, simulations and interactive quizzes provided more effective learning experiences than typical textbook-style instruction. The use of multimedia elements, such as videos and animations, not only helped to maintain student interest but also reinforced key biological concepts, resulting in better retention and comprehension (Bidarra & Sousa, 2020).

The questionnaire results, which showed high ratings for engagement (mean score of 4.6), motivation (mean score of 4.5), and satisfaction (mean score of 4.7), confirm that students responded positively to the integration of digital tools into their learning process. These findings echo those of García-Martínez et al. (2019), who noted that mobile devices offer personalized and flexible learning opportunities that cater to individual learning preferences. This is particularly important in science education, where students must engage with complex and abstract concepts.

3. Comparison with Traditional Teaching Methods

A comparison of the experimental group and control group is enlightening with regard to limiting features of teaching done in traditional ways in science education. Scores and

engagement after post-testing were much lower in the control group (having been taught via traditional lectures and texts). This underlines the argument that traditional methods, although efficient in certain situations, are not effective for meeting the requirements of current digital native learners who have been used to interactive and multimedia-based learning environments (Walker, 2021).

Meanwhile, the android-based experimental group has more enthusiastic to be participated in the learning activities than the control group. Interactive exercises in the learning media (quizzes, simulations) provided frequent opportunities for students to use new knowledge by asking questions and generating multiple solutions to problems. The intervention group learned actively, opposing the completely passive learning style of the control group, which was less time-consuming but more memorization based. The findings support the idea that digital tools can bridge the gap between traditional forms of instruction and the learning preferences of 21st-century students (Karabatzaki et al., 2018).

4. Challenges and Opportunities in Implementing Mobile Learning in Rural Schools

The findings of this study was encouraging, however there were some obstacle in regards to the realization of using mobile learning tools in general respect for rural schools especially Public Junior High School 5 Taebenu SATAP. One of the major challenges is availability of resources like proper internet connectivity and mobile devices (Girdzijauskienė et al., 2022). It is important to note how this kind of tools can struggle to scale in rural areas, even when designed through Kodular so that they could be user-friendly and work ok on a variety of cheap android phones. In addition, some of the educators who are resistant to using digital tools or doubt their educational effectiveness need to be brought up. This shows the importance of continuous teacher support and professional development, in order to be able to incorporate mobile learning tools meaningfully into classes.

In this context, the study offers a clear model in which mobile learning can and should play an important role for strengthening scientific education in less developed areas. The use of Android-based learning media might offer such resources, even in rural schools. Mobile learning tools can also deliver a tailored and adaptable experience that meets the unique demands of students, providing widespread access to science education while supporting all learners (Bukharaev & Wisam Altaher, 2017).

VI. CONCLUSION

This is a study on the development and implementing of android-based learning media using kodular specifically in biology subject for grade VII student of public junior high school 5 taebenu SATAP. Findings of the study reveal that embedding digital-tools-including those via mobile applications-into science education can lead to a marked improvement in student learning achievements and motivation, during this downwards phase.

The findings demonstrate that students who used the Android-based learning media showed a marked improvement in their understanding of biological concepts, especially in complex topics such as cellular biology and ecosystems. This enhancement was observed when

the post-test scores has increased for experimental group than the control group showing that mobile learning tools helps in better understanding and repairing of knowledge.

Furthermore, by implementing Kodular for an interactive pedagogy with the intent of enhancing the students' performance so that it helps them to make their learning more lively and personalized. Students in the experimental group scored higher and showed increased satisfaction, suggesting that mobile applications can serve as a supplement to traditional teaching methods for digital-native learners.

The study illustrates the promise of mobile learning to improve science education, while also revealing obstacles like scarce resources and traditional teaching techniques that may hinder rural schools. Responding to these issues will mean significant investment in infrastructure and teacher training to support the successful melding of mobile learning tools. This study adds to the literature on the use of mobile technology in education and shows that Android-based learning media can improve junior high school science teaching and learning. The study also serves as a potential model for other researchers–on how to use Kodular in creating affordable learning tools and can serve as an example to developers of educational tools that might be easily adapted into different subjects and educational contexts. The potential long-term effects of mobile learning on student success and the generalizability of this intervention to other educational contexts should be addressed by future research.

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