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Developing Android-Based Interactive Multimedia with Madurese Culture to Enhance Students' Learning Outcomes in Classroom Action Research

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This study aims to improve Grade VII students' learning outcomes on the topic of the Life Organization System by implementing the culturally responsive "Bebek Songkem" Android-based interactive multimedia. The media was designed to address students' difficulties in understanding abstract biological concepts while providing contextual learning linked to local Madurese culture. The research employed the Classroom Action Research (CAR) model of Kemmis and McTaggart, consisting of the stages of planning, action, observation, and reflection. The participants were 30 students of Class VII-B at UPTD SMPN 5 Bangkalan. Data were collected through pre-tests and post-tests in each cycle and analyzed using gain score. The results showed a consistent improvement in learning outcomes. In Cycle I, the average score increased from 33.33 to 57.00 with a gain score of 0.355 (moderate). In Cycle II, the mean score increased from 43.33 to 86.00 with a gain score of 0.761 (high). These findings demonstrate that integrating local cultural elements into interactive multimedia can enhance students' comprehension, engagement, and overall science learning performance.

Keywords: Interactive Multimedia; Learning Outcomes; Classroom Action Research; Madurese Culture; Culturally Responsive Teaching.

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INTRODUCTION

The rapid development of information and communication technology (ICT) in the digital era has transformed various sectors, including education, by enabling more flexible, interactive, and student-centered learning (Harahap, 2019). Education, according to Ki Hadjar Dewantara, is not merely a transfer of knowledge but a process of guiding children's growth holistically so they may achieve well-being individually and socially (Putri & Akhwani, 2019). This principle is in line with Sustainable Development Goal (SDG) 4, which emphasizes equitable and quality education that nurtures character, competence, and lifelong learning.

According to the Organization for Economic Co-operation and Development (OECD), in the context of 21st-century learning, students are expected to master competencies such as critical thinking, creativity, communication, collaboration, and problem-solving. Thus, science learning in the 21st century not only emphasizes academic achievement, but also learning experiences that are contextually meaningful and encourage the development of 21st century learning skills.

Despite these expectations, initial observations in Grade VII-B at UPTD SMPN 5 Bangkalan revealed that students' learning outcomes for the topic "System of Life Organization" remained below the Minimum Mastery Criteria of 78. These results can be seen in Table 1.

[Table 1 about here.]

Interviews further showed that students perceived the learning process as monotonous, dominated by workbook-based tasks and teacher-centered instruction, which resulted in boredom and low motivation. These findings are consistent with (Solikah, 2020), who reported that limited innovation in learning media contributes to repetitive learning experiences, reduced focus, and declining student motivation. Therefore, more interactive and relevant media innovations are needed to increase engagement and learning outcomes.

One approach that has the potential to be a solution is the use of Android-based interactive multimedia. Previous studies have demonstrated that multimedia can enhance students' understanding of concepts, motivation, and critical thinking skills (Audie, 2019; Harsiwi & Arini, 2020; Haryadi & Kansaa, 2021). Multimedia help students access and understand learning materials, minimize boredom, and increase their focus. Previous studies have demonstrated significant improvements in learning outcomes following the implementation of Android-based interactive multimedia (Agustin et al., 2025; Alifah et al., 2023; Solikah, 2020). Media should also be adaptable to current needs and technological developments (Alifah et al., 2023).

Android-based multimedia, in particular, offers animations, videos, audio, images, text, attractive visual and quizzes that can accommodate diverse learning needs and make abstract scientific concepts more accessible (Agustin et al., 2025; Fatimah et al., 2021).

In science subjects, the topic of Life Organization Systems is one of the most challenging for junior high school students. Students often struggle to visualize and comprehend complex biological structures and organizational levels of life. Conventional, textbook-based learning approaches have not fully supported optimal student understanding. Therefore, alternative learning media are needed that are not only informative but also contextual and capable of enhancing learning motivation.

Beyond technological innovation, the design of learning media must also consider the diversity of students' backgrounds, including culture, language, prior knowledge, interests, and learning styles. These differences shape how students interpret and engage with scientific concepts.

Culturally Responsive Teaching (CRT) offers a pedagogical framework that addresses this need by integrating students' cultural identities into the learning environment (Gay, 2018). CRT posits that learning becomes more meaningful when instructional content reflects students' cultural contexts, enabling them to construct knowledge from their lived experiences.

In science education, culturally integrated designs can strengthen engagement, motivation, and conceptual understanding by presenting examples that are relevant and meaningful to students' everyday lives. Previous studies also highlight that culturally relevant learning content can enhance students' creativity, skills, knowledge, and character, enabling them to contribute to national development while valuing local resources and cultural traditions (Shufa, 2018; Sari et al., 2023).

Students in CRT classrooms tend to report a stronger sense of identity (Lowe et al., 2020), greater engagement in school (Bishop et al., 2019), and more positive behavioural outcomes (Larson et al., 2018). In contrast, teachers who hold discriminatory beliefs tend to have students who demonstrate greater maladaptive outcomes, such as experiences of exclusion and disen gagement (Moodie et al., 2019). This suggests that CRT-based approaches are beneficial not only for improving comprehension of scientific concepts but also for fostering holistic student development grounded in cultural identity.

For students in Bangkalan, the integration of local cultural elements such as Bebek Songkem, a traditional Madurese dish, can provide a contextual bridge between scientific concepts and everyday experiences. Utilizing local culture in learning

media not only supports contextual understanding but also strengthens identity awareness and cultural appreciation. Previous research has shown that integrating CRT into the curriculum helps all students learn locally relevant content and perspectives and enables students, particularly Aboriginal students, to develop a stronger sense of cultural identity and connection to school (Bostwick et al., 2025). Therefore, the use of local contexts, such as Bebek Songkem, can strengthen the sense of belonging and relevance of science learning for Madurese students.

Although numerous studies highlight the effectiveness of interactive multimedia, research that combines interactive multimedia with local cultural contexts—particularly in science learning—is still scarce. Prior research tends to focus on technological features or cognitive outcomes without fully addressing the cultural relevance of the learning materials. This gap underscores the need to develop multimedia that not only supports conceptual understanding but also integrates local cultural identity through a CRT framework.

This gap highlights the need for the development and implementation of culturally responsive multimedia that integrates local context into science learning. Therefore, this study applies Android-based interactive multimedia integrating the cultural identity of Bebek Songkem to improve student learning outcomes in the subject of the Life Organizational System.

METHOD

This study employs a Classroom Action Research (CAR) design following the model developed by Kemmis and McTaggart. CAR was selected as the most appropriate approach because the primary aim of the study was to improve students' learning outcomes through iterative cycles of implementing and refining the "Bebek Songkem" interactive multimedia. CAR allows researchers and teachers to systematically identify classroom problems, test pedagogical interventions, and evaluate their effectiveness in real learning conditions (Kunlasomboon et al., 2015). The Kemmis and McTaggart model consists of four cyclical stages: planning, acting, observing, and reflecting, which enable continuous improvement of the instructional strategy and provide opportunities to adapt the multimedia based on students' responses and learning progress (Agustin et al., 2025). The flow of these stages is illustrated in the following Figure 1:

[Figure 1 about here.]

The research was carried out at UPTD SMPN 5 Bangkalan from February 6 to April 10, 2025, during the second semester of the 2024/2025. The study population comprised all seventh-grade students at the school, totaling 240 students across eight classes.

The sampling was carried out using purposive sampling by selecting class VII B as the research sample. The selection was based on the results of initial observations, including students' learning interest, level of activeness, and the availability of digital learning support devices.

Based on the CAR stages shown in Figure 1, the following are detailed explanations of each phase:

1. The first phase, Planning, involved preparing lesson plans, developing pre-test and post-test instruments, and designing the Android-based interactive multimedia.
2. The second phase, Action, consisted of implementing the planned learning activities and analyzing their strengths and weaknesses at the end of each cycle to guide subsequent improvements.
3. The third phase, Observation, the researcher monitored student engagement, media use, and overall learning effectiveness throughout the instructional process.
4. The fourth phase, Reflection, involved analyzing students' pre-test and post-test scores, which informed revisions to both the instructional strategies and the multimedia used in the next cycle.

The data collection technique in this study involved testing methods. Data were collected from students' cognitive test results, including both pre-test and post-test scores on the topic of the Organizational System of Life. Prior to implementation, the test instruments underwent validity and reliability analyzes using TAP software, as presented in Table 2. The results of the reliability and validity test can be seen in Table 2.

[Table 2 about here.]

The data were analyzed using the gain test and qualitative descriptive analysis. The data processing used the following Equation 1 (Agustin et al., 2025):

[Equation 1 about here.]

The gain score categories are presented in the following Table 3:

[Table 3 about here.]

RESULT AND DISCUSSION

The results of the study show the potential for improving student learning outcomes after implementing the use of interactive multimedia in teaching the topic of the Life Organizational System. This research was conducted in two cycles, each beginning with a pre-test and ending with a post-test.

The success indicator of this study is determined by the improvement in student learning outcomes in each cycle, with the minimum target being the achievement of the Minimum Mastery Criteria (MMC) score of 78. The research process began with interviews with several students and the science teacher of class VII-B. The interviews revealed that the previously used learning media were considered less engaging because they only used textbooks containing material and exercises without sufficient interaction. Additionally, the teacher-centered approach was associated with reduced student engagement and lower levels of enthusiasm during science lessons. This aligns with (Intaniasari et al., 2022), who emphasized that if learning in today's era is presented in a conventional manner, focused on teacher explanation with one-way communication limited to the delivery of information and not supported by evolving media, students tend to feel uninterested and unmotivated.

The science teacher also acknowledged that the integration of technology in the learning process had not been optimal. So far, students were only assigned tasks from the textbook without the support of interactive media that could stimulate their learning interest. Besides the interviews, the researcher also conducted a pre-cycle assessment, both cognitive and non-cognitive, to identify students' initial abilities and learning characteristics.

Initial assessments indicated that most students had not achieved mastery. It was recorded that 23 out of 30 students scored below the MMC. In response to these findings, the researcher designed a learning strategy that integrated technology into the learning process in each cycle. One of the innovations applied was an Android-based interactive multimedia, designed to accommodate various student learning styles, whether auditory, visual, or kinesthetic.

Before implementation, the researcher prepared several learning materials, including teaching modules, student worksheets, and other teaching resources. The developed interactive media contained several features that supported active student engagement throughout the learning process and were applied in the learning activities during the study. This media was methodically designed to include learning resources, quizzes, and learning tasks. The learning content was presented interactively, sequentially, and in a structured manner through an electronic format using text, images, audio, and instructions to assist users in independent learning and in achieving their learning objectives at their own pace. Android-based instructional materials offer students additional opportunities to engage with their learning (Hidayat et al., 2023; Isrokatun et al., 2023). The following are some features of the interactive media application that were developed and implemented during the learning process:

[Figure 2 about here.]

[Figure 3 about here.]

[Figure 4 about here.]

[Figure 5 about here.]

[Figure 6 about here.]

[Figure 7 about here.]

The table below presents the research results from the implementation of the Android-based interactive learning multimedia integrated with local cultural elements:

[Table 4 about here.]

Cycle I

The improvement in student learning outcomes in each cycle is evident from the pre-test and post-test results. The following is a summary of the learning outcomes of class VII B in Cycle I:

[Table 5 about here.]

Table 5 shows that the proportion of students achieving the Minimum Competency Criteria increased from 0% in pre-test to 0.034% in post-test. This increase is also reflected in the N-gain results in Table 4, where the average pre-test and post-test scores increased from 33.333 to 57. The gain score obtained was 0.355, which is categorized as moderate. The results of the first cycle are presented in the Figure 8:

[Figure 8 about here.]

A complete description of the implementation stages in Cycle I can be seen in Table 6.

[Table 6 about here.]

The first cycle was conducted over two meetings. In the first meeting, a discovery learning model was used with the topic of plant tissues. The learning activities applied exploration, group discussions, presentations, question-and-answer sessions, and reflections. During the exploration phase, students were guided to explore the complex parts of plant tissue structures using the interactive learning media “Bebek Songkem.” This media was designed to provide a more imaginative and contextual learning experience, particularly in visually and gradually recognizing plant tissue structures. This

aligns with previous studies, which state that the use of interactive media can enhance students' understanding and engagement in the learning process, as the use of images, audio, and video in such media can help illustrate concepts more clearly, making them easier for students to comprehend (Saprudin et al., 2022; Yurnetti et al., 2025).

The use of the "Bebek Songkem" media not only offered an alternative interactive digital learning approach but also integrated local cultural elements into the learning process. The use of local names and characters aimed to foster a sense of closeness and relevance between the lesson content and students' daily lives. When students see their culture reflected in the learning process, they feel more valued and motivated. Alisoy emphasized that Culturally Responsive Teaching is crucial in creating a learning environment that respects and appreciates diversity, thus fostering a sense of belonging and engagement among all students (Ashrafova, 2024). Incorporating students' cultural knowledge into lessons can make learning more relevant and meaningful (Ashrafova, 2024).

The learning activities did not use direct observation methods involving plant tissue cross-sections with microscopes and plant tissue preparations due to the limited availability of equipment and materials, which were not proportional to the number of students. Therefore, the use of interactive learning multimedia became a solution to help students visualize plant tissue structures. This allowed each student to access the information independently, repeatedly, and according to their individual learning styles. The use of engaging media has been proven to benefit students, particularly by increasing their enthusiasm for learning and broadening their understanding of the subject matter, ultimately leading to improved student comprehension (Purwaningtyas & Mardati, 2020).

The second meeting implemented the cooperative learning model "Numbered Heads Together," combined with the Teaching at the Right Level (TaRL) approach. Students were grouped based on ability levels and completed differentiated mind maps supported by the multimedia resource. Learning was active and enjoyable, as reflected in student participation during the "Numbered Heads" tournament.

The implementation of the first cycle showed that using the "Bebek Songkem" interactive multimedia had a positive impact on improving student learning outcomes. However, some challenges still required attention and improvements for the next cycle. Some students were observed to be less active during the learning process and did not yet contribute optimally to group discussions. Additionally, some students seemed to lack a clear understanding of the learning activities in relation to the subject matter. More in-depth reflections, concept reinforcement, and clarification should be provided at the end of the lessons. These findings became essential reflections for the researcher in designing a more adaptive and inclusive strategy for the next cycle.

Cycle II

The following is a summary of the student learning outcomes in Cycle II:

[Table 7 about here.]

Table 7 shows that the proportion of students achieving the Minimum Competency Criteria increased from 0.034% in pre-test to 76.6% in post-test. This increase is also reflected in the N-gain results in Table 4, where the average pre-test and post-test scores in Cycle II increased from 41.333 to 86. The obtained N-gain score was 0.761, which falls into the high category. The results of the second cycle are presented in the graph:

[Figure 9 about here.]

A complete description of the implementation stages in Cycle II can be seen in Table 8.

[Table 8 about here.]

This significant improvement indicates that the implementation of Android-based interactive multimedia integrating Bebek Songkem as a culturally relevant context effectively supports students' conceptual understanding of the material. Pedagogically, this finding aligns with Vygotsky's sociocultural development theory, which emphasizes social and cultural interactions in relation to cognitive development (Suardipa, 2020). Children's thinking development is influenced by social interactions within the cultural context in which they are raised (Danoebroto, 2015). The observed improvement in mastery in Cycle II thus reflects not only the technical proficiency of multimedia but also the pedagogical effect of connecting science concepts to students' cultural experiences.

Cycle II also consisted of two meetings. In the first meeting, the cooperative learning model was applied, involving group discussions, Q&A sessions, domino games, and reflections. Before the group discussions, students were presented with information about plant and animal organs through the "Bebek Songkem" interactive learning media. Using this media, students were guided to collect information and independently identify the differences between plant and animal organs. Students who face learning difficulties can also benefit from this interactive media, as it allows them to learn at

their own pace and assess their own level of understanding (Laili et al., 2019).

After exploring the information, students continued with the domino game in groups. In this activity, they were asked to match questions and answers on the provided domino cards. As an improvement from the previous cycle, the researcher provided concept reinforcement after the game by discussing each question and answer collectively to ensure comprehensive understanding. Providing reinforcement or feedback helps students assess their learning progress, identify mistakes, deepen their understanding, and develop skills progressively (Magdalena et al., 2023).

The researcher also provided emotional support, especially for students who struggled with emotional regulation. This support included personal attention, individual approaches, and motivational encouragement to help students feel more comfortable and engaged in the learning process. A safe, well-organized, and supportive learning environment can motivate students to learn and achieve better outcomes (Ruwaidah et al., 2025).

In the second meeting of Cycle II, the researcher provided more structured and guided instructions based on the Teaching at the Right Level (TaRL) approach, tailoring the learning to the students' initial ability levels. Students were grouped based on formative assessment results, allowing the learning process to focus on each group's specific needs.

The material on organ systems was presented in stages using Android-based interactive multimedia, which allowed students to access images, animations, and interactive simulations related to the function and structure of living organs. This multimedia supported students in addressing conceptual gaps identified in the previous cycle by providing visual and interactive representations that facilitated deeper understanding. These findings are consistent with previous research showing that Android-based multimedia improves students' understanding of abstract scientific concepts, increases motivation, and supports independent exploration (Agustin et al., 2025; Harsiwi & Arini, 2020). Similarly, this study also demonstrated that interactive features, such as animations, videos, audio, images, text, attractive visual and interactive quizzes, encouraged active learning and allowed students to revisit content as needed, thereby enhancing overall conceptual mastery.

In addition, the group discussions were more structured and productive, guided by questions that promoted critical thinking and collaborative elaboration. At the end of the lesson, both individual and class reflections were conducted, where students shared what they had learned, the difficulties they experienced, and the aspects they found interesting during the learning process. These reflections served to assess students' emotional and cognitive engagement and provided a foundation for the researcher to evaluate the success of the interventions and develop future strategies.

By applying more adaptive strategies and increasingly contextual technology, the second cycle learning process not only strengthened students' conceptual understanding but also created an inclusive learning environment that prioritized students and respected their unique abilities and backgrounds.

The learning process across both cycles demonstrated that the use of Android-based interactive multimedia, which utilized students' local cultural context, positively influenced the improvement of student learning outcomes in each cycle. These findings align with previous studies (Abdurrahman et al., 2020; Agustin et al., 2025; Harsiwi & Arini, 2020; Kartini & Putra, 2020; Putri et al., 2022).

CONCLUSION

The findings indicate that the Android-based interactive multimedia "Bebek Songkem" effectively improved students' learning outcomes on the topic of the Organizational System of Living Beings. This is shown by the consistent increase in pre-test and post-test scores, with the N-gain rising from 0.355 in Cycle I to 0.761 in Cycle II. The improvement can be attributed to the multimedia's ability to visualize abstract biological concepts through animations and culturally relevant content, which enhanced students' engagement and conceptual understanding. These results confirm the research objective and highlight the potential of culturally grounded digital media as an effective tool for supporting science learning. Future work may examine its application across broader topics or grade levels.

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Conflict of Interest Statement: The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

LIST OF TABLES

TABLE 1 / Summative Assessment Results for Science

No.	Description	Result
1.	Average Score	62.9
2.	Students Achieving MMC	7
3.	Students Below MMC	23
4.	Percentage Achieving MMC	23%
5.	Percentage Below MMC	77%

TABLE 2 / Results of Reliability Test and Validity Test

Question Number	Item Difficult	Validity	Reliability	Valid	Reliabel
1	0.50 (medium)	0.586 (medium)	0.882 (high)	√	√
2	0.38 (medium)	0.663 (high)	0.880 (high)	√	√
3	0.25 (difficult)	0.911 (very high)	0.877 (high)	√	√
4	0.25 (difficult)	0.783 (high)	0.879 (high)	√	√
5	0.50 (medium)	0.687 (high)	0.880 (high)	√	√
6	0.38 (medium)	0.877 (very high)	0.876 (high)	√	√
7	0.38 (medium)	0.984 (very high)	0.873 (high)	√	√
8	0.25 (difficult)	1.000 (very high)	0.872 (high)	√	√
9	0.25 (difficult)	0.847 (very high)	0.878 (high)	√	√
10	0.50 (medium)	0.433 (medium)	0.885 (high)	√	√
11	0.25 (difficult)	0.847 (very high)	0.878 (high)	√	√
12	0.63 (medium)	0.569 (medium)	0.882 (high)	√	√
13	0.38 (medium)	0.877 (very high)	0.876 (very high)	√	√
14	0.25 (difficult)	1.000 (very high)	0.872 (high)	√	√
15	0.50 (medium)	0.586 (medium)	0.882 (high)	√	√
16	0.50 (medium)	0.687 (high)	0.880 (high)	√	√
17	0.25 (difficult)	0.847 (very high)	0.878 (high)	√	√
18	0.38 (medium)	0.502 (medium)	0.884 (high)	√	√
19	0.25 (difficult)	0.847 (very high)	0.878 (high)	√	√
20	0.50 (medium)	0.382 (medium)	0.886 (high)	√	√
21	0.50 (medium)	0.687 (high)	0.880 (high)	√	√
22	0.63 (medium)	0.687 (high)	0.880 (high)	√	√

TABLE 3 / N-gain Score Categories

N-gain Value (g)	Category
$g \geq 0.7$	High
$0.3 \leq g \leq 0.7$	Medium
$g \leq 0.3$	Low

TABLE 4 / N-gain Score Analysis Results

Cycle	Average Pre-test	Average Post-test	N-gain Score	Category
I	33.333	57	0.355	Medium
II	43.333	86	0.761	High

TABLE 5 / Student Learning Outcomes in Cycle I

No.	Description	Cycle I	
		Pre-test	**Post-test**
1.	Average score	33.333	57
2.	Students achieving mastery	0	1
3.	Students not achieving mastery	30	29
4.	Percentage of mastery	0%	0.034%
5.	Percentage not achieving mastery	100%	0.966%

TABLE 6 / Summary of Learning Activities in Cycle I Based on CAR Stages

CAR Stage	Learning Activities in Cycle I
Planning	• Preparing lesson plans for plant and animal tissue topics. • Designing learning scenarios using discovery learning and NHT combined with TaRL. • Developing differentiated worksheets (beginner, intermediate, advanced). • Preparing “Bebek Songkem” interactive multimedia as the main instructional resource.
Action	• **Meeting 1:** Discovery learning on plant tissues using multimedia; exploration, group discussion, presentation, Q&A, and reflection. • Students used the interactive multimedia to visualize tissue structures gradually. • **Meeting 2:** NHT cooperative model with TaRL; students created mind maps based on ability groups using multimedia as reference; followed by NHT quiz/tournament.
Observation	• Monitoring student engagement, collaboration, and use of multimedia. • Noting difficulties in group participation, conceptual confusion, and uneven activity levels. • Observing how cultural elements in the media influenced motivation
Reflection	• Identifying the need for stronger concept reinforcement. • Noting inconsistent group participation and need for clearer instructions. • Planning improvements for Cycle II: more structured guidance, additional feedback, clearer scaffolding, and emotional support strategies

TABLE 7 / Student Learning Outcomes in Cycle II

No.	Description	Cycle I	
		Pre-test	**Post-test**
1.	Average score	41.333	86
2.	Students achieving mastery	1	23
3.	Students not achieving mastery	29	7
4.	Percentage of mastery	0.034%	0.766%
5.	Percentage not achieving mastery	0.966%	0.233%

TABLE 8 / Summary of Learning Activities in Cycle II Based on CAR Stages

CAR Stage	Learning Activities in Cycle I
Planning	• Refining lesson plans based on Cycle I reflections. • Designing more structured cooperative learning and reinforcement sessions. • Adjusting TaRL grouping based on updated formative assessments. • Adding guided questions to improve critical thinking during discussions..
Action	• **Meeting 1**: Cooperative learning with multimedia exploration of plant and animal organs; group discussions, Q&A, domino games, and whole-class concept reinforcement. • Providing emotional support and individualized guidance during group work. • **Meeting 2**: More structured instructions based on TaRL; multimedia used for staged exploration of organ systems; guided group discussions, collective reflection, and explanation sessions.
Observation	• Increased student interaction, improved concept mapping, and more productive discussions. • Students used multimedia more independently and revisited animations to clarify concepts. • Emotional engagement improved due to targeted support.
Reflection	• Multimedia and cultural contextualization strengthened conceptual understanding. • Structured guidance and reinforcement improved learning flow. • Cycle II addressed the weaknesses from Cycle I and created a more inclusive, responsive learning environment.

LIST OF EQUATIONS

$$N\ gain = \frac{Posttest\ Score - Pretest\ Score}{Maximum\ Score - Pretest\ Score}$$

EQUATION 1 / N-gain Equation

LIST OF FIGURES

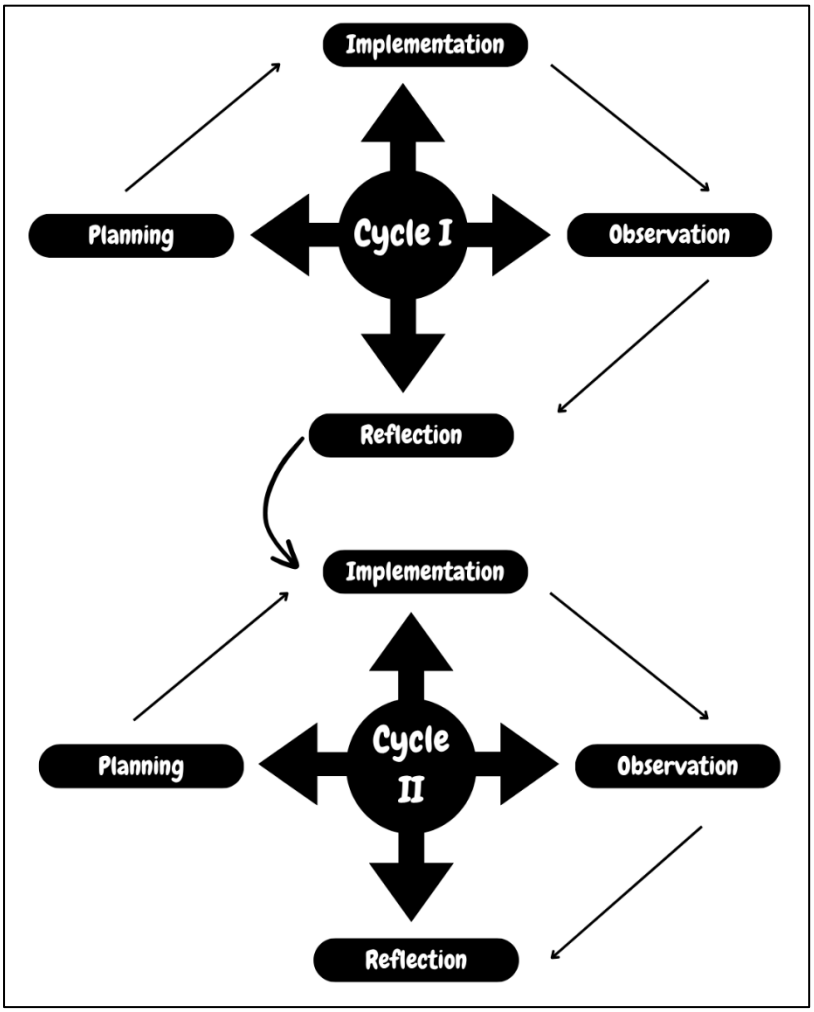

FIGURE 1 / Kemmis & McTaggart Model Classroom Action Research Design

FIGURE 2 / Initial View of Androidsite

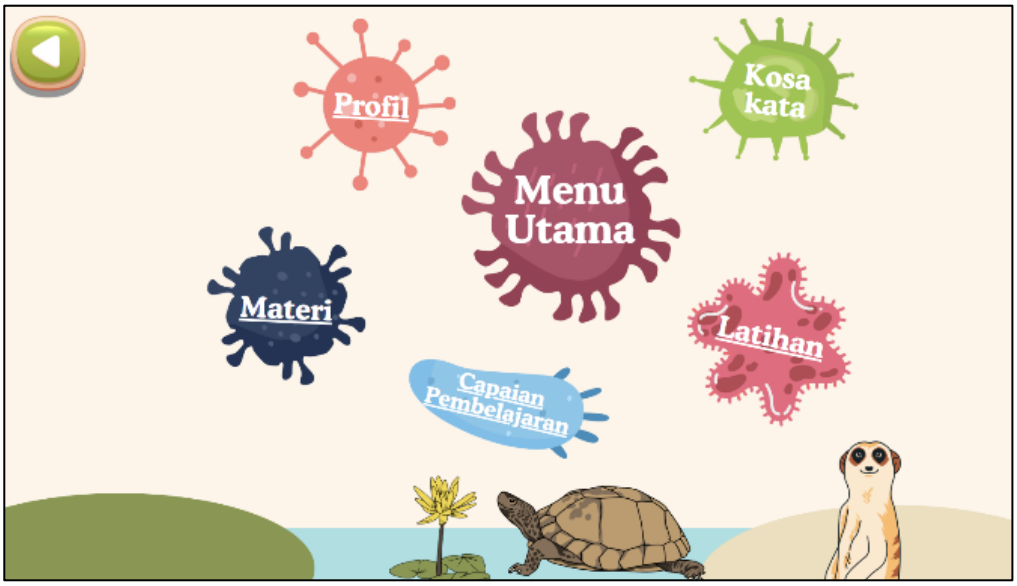

FIGURE 3 / Androidsite Menu Display

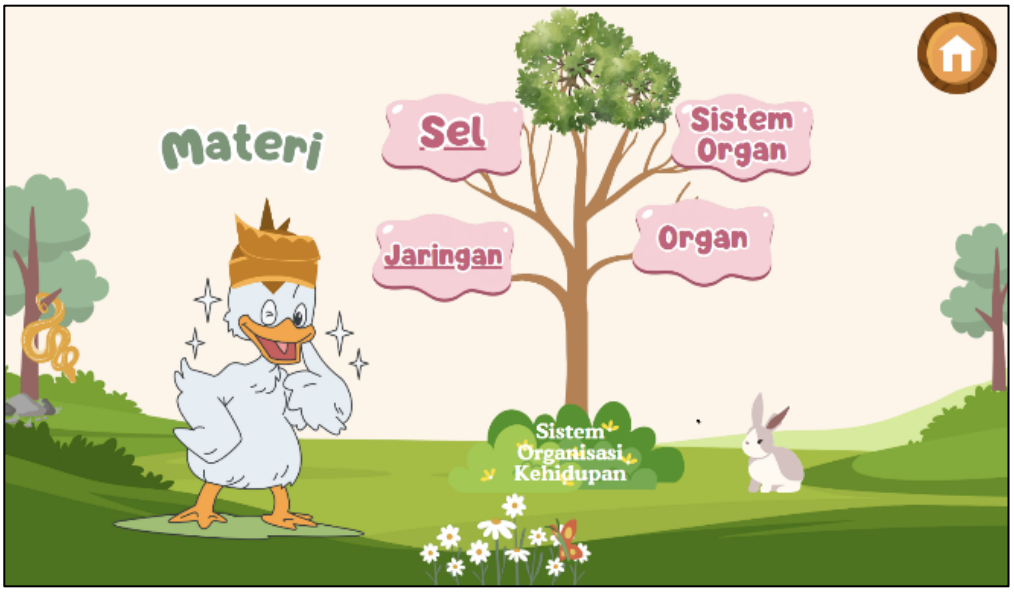

FIGURE 4 / Material Display

FIGURE 5 / Learning Video Display

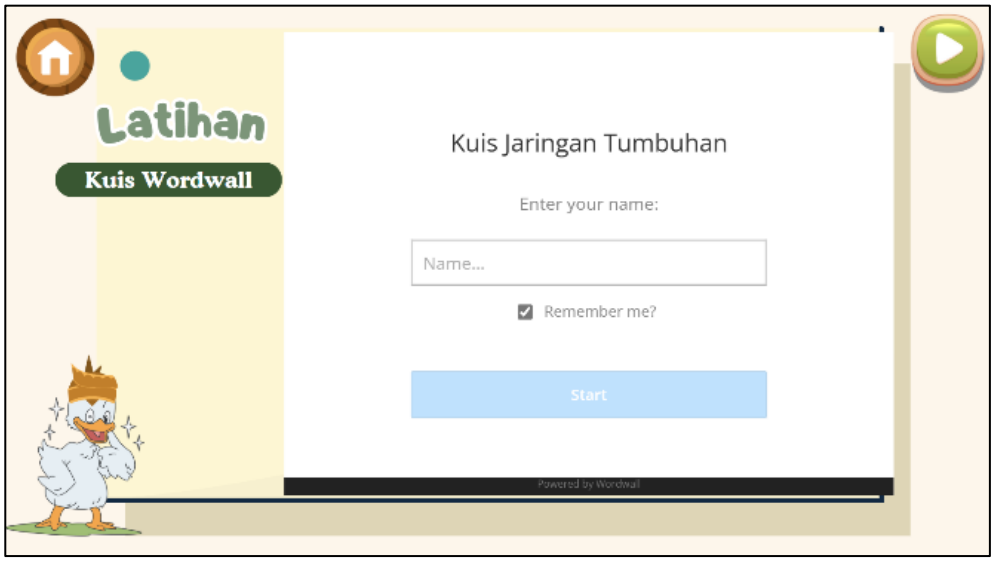

FIGURE 6 / Interactive Quiz Display

FIGURE 7 / Profile View

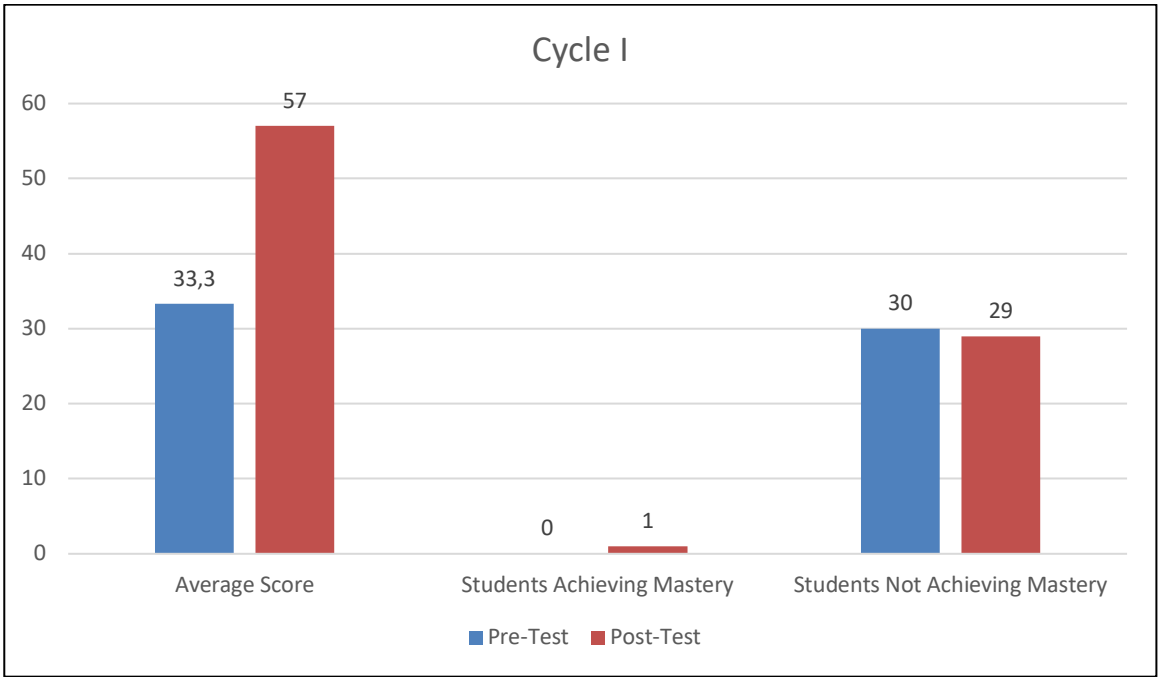

FIGURE 8 / Cycle I Learning Outcome Graph

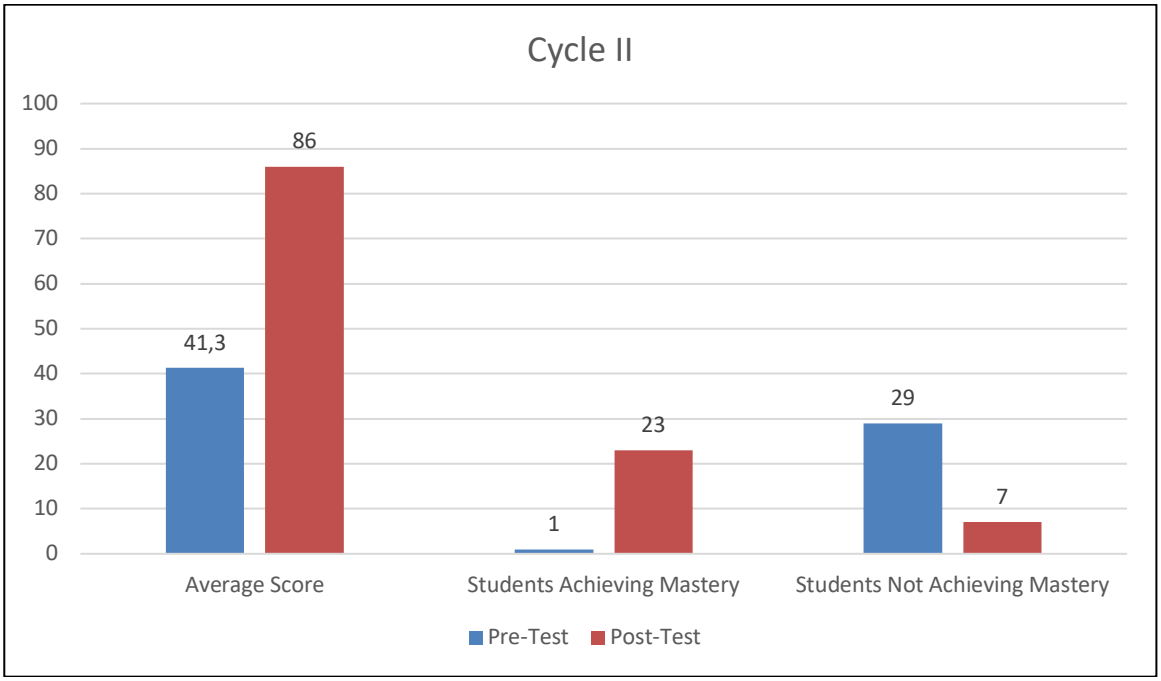

FIGURE 9 / Cycle II Learning Outcome Graph