

## Learning Outcomes and Reading Literacy Improvements through the Android Application "My Biotech" on Biology Technology Innovation Material

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### ABSTRACT

*This study is a classroom action research conducted at SMA Negeri A Bondowoso, specifically in class XC with a total of 36 students, during the second semester of the academic year 2022/2023. In this research, both quantitative and qualitative data were collected. The results of a questionnaire completed by students and teachers in observation sheets during learning were used to generate quantitative data. Qualitative data was collected through observations and interviews with students and teachers. Data collection techniques include observation and testing. Two colleagues were involved as student activity observers. The results improved significantly between cycles I and II. The results of student activity in asking questions during learning were as high as 45% in cycle I to 49% in cycle II. The increase in reading literacy leads to increased listening skills from 51% in cycle I to 58% in cycle II. The increase in students' posttest results was 71% in cycle I and 84% in cycle II. Finally, according to the results of student responses, students who liked biotechnology material increased their acquisition from 47% in cycle I to 52% in cycle II.*

**Peningkatan Hasil Belajar dan Literasi Membaca melalui Aplikasi Android "My Biotech" pada Materi Inovasi Teknologi Biologi**

**ABSTRAK:** Penelitian ini adalah penelitian tindakan kelas yang dilaksanakan di SMA Negeri A Bondowoso yaitu pada kelas XC dengan jumlah siswa 36 dan dilakukan pada semester genap tahun ajaran 2022/2023. Jenis data yang digunakan dalam penelitian ini, yaitu data kuantitatif dan data kualitatif. Data Kuantitatif didapat dari hasil angket yang diisi oleh siswa dan guru dalam lembar observasi selama pembelajaran. Data Kualitatif diperoleh dari hasil Observasi dan Wawancara kepada siswa dan guru. Teknik pengumpulan data dengan cara observasi dan tes. Observer aktivitas siswa melibatkan dua orang teman sejawat. Terdapat hasil peningkatan yang signifikan antara siklus I dan siklus II. Pada penilaian aktivitas siswa, Hasil keaktifan siswa dalam bertanya selama pembelajaran pada siklus I sebanyak 45%, selanjutnya dihasilkan peningkatan sebesar 49% pada siklus II. Kemudian peningkatan dari hasil literasi membaca, pada aspek keterampilan menyimak pada siklus I sebesar 51% menjadi 58% pada siklus II. Peningkatan hasil post test siswa pada siklus I sebesar 71% dan siklus II sebesar 84%. Terakhir, pada hasil respon siswa, siswa yang menyukai materi bioteknologi mengalami peningkatan dari yang sebelumnya diperoleh sebesar 47% pada siklus I, naik secara signifikan dengan perolehan 52% pada siklus II.

## INTRODUCTION

Education plays a critical part in the growth of a nation. It is one of the primary areas in Indonesia that is still being considered and promoted (Haka et al., 2023). However, Indonesia's current education state has several obstacles and problems that must be addressed (Puspita et al., 2019).

The difficulty for Indonesian education is the poor PISA (Program for International Student Assessment) reading, literacy, and science rating, which is still far below expectations and even labeled as low. According to PISA test results, Indonesia performed poorly in 2018. For example, Indonesian students in reading ability placed 74th out of 78 nations (Zhai et al., 2021).

Kurikulum Merdeka is a competency-based curriculum focusing on curricular learning and building the learner profile in Pancasila ideals to enhance soft skills and student character. The autonomous curriculum is an improvement on the curriculum from 2013. It was created as a more flexible curriculum framework that focuses on improving learners' character and competence (Resa, 2023). The following are the curriculum's primary characteristics: 1) Interdisciplinary project-based learning for soft skills and character development based on the Pancasila learner profile; 2) Emphasis on fundamental resources to allow for in-depth acquisition of basic abilities such as literacy and numeracy. 3) Teachers' ability to adapt learning to the capacities of their students and make adaptations to the context and local material (Nugroho, 2022)

Education in the 21st century must be readily available to everybody, even those living in rural places or with limited financial resources (Aspi, 2022). This is possible with the help of information technology. However, in Indonesia, the use of technology in education is still suboptimal (Muliaman, 2020). As a result, teachers must master technology to present content more efficiently and effectively (Aripin, 2020)

Kurikulum Merdeka does not rely solely on material accomplishment targets

but encourages learning on more critical material (BSKAP, 2022). Biological Technology Innovation is one of the essential components in the second semester of the tenth-grade biology subject (Phase E) studied in the Kurikulum Merdeka. This material comprises several important sub-materials, such as differences between conventional and modern biotechnology, fermentation mechanisms and genetic engineering, the use of microorganisms and tissue culture in biotechnology, and an analysis of the effects of biotechnology use on human life.

According to observations, 52% of students believe biological technology innovation material is challenging to understand due to the material's dense and interconnected sub-materials. As a result, a strategy, model, and learning approach that can improve student interest in the content is required. As a result, media that helps students understand the topic and is assisted by technology is needed.

The "My Biotech" application, which can be downloaded on smartphones running the Android operating system as mobile learning, is the biology learning media product developed in this research. This "My Biotech" application was created with Construct 2 software, which differs from prior research, which was created with Android Studio software (Nazar, 2020); (Asikin, 2020). The growing popularity of Android smartphones among students, particularly high school students, pushes researchers to create the "My Biotech" application as an innovative learning medium.

Researchers developed the features of the "My Biotech" App while keeping learning objectives in mind. According to (Nurvitasari, 2022), Learning objectives can be met if students master the material they have learned. It also reveals that students are claimed to grasp the subject matter if they can demonstrate their understanding in various methods, including offering definitions, detecting issues, conducting

computations, and summarizing the material in their native language. The "My Biotech" application has several benefits, including the Core Competence (KI) and Basic Competence (KD) menu features, which help students understand the concepts and core material to be learned. The Material menu feature is packaged briefly, concisely, clearly, and attractively with attractive illustrations. The learning video feature enables students to watch the material as a whole, and the quiz feature is used to evaluate the results during learning.

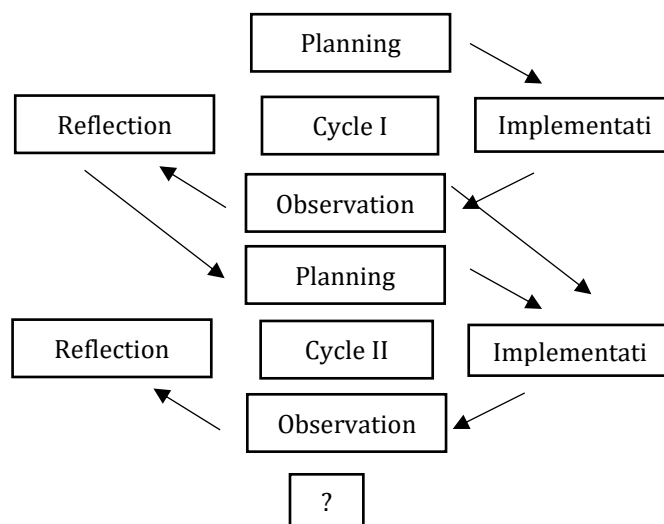
The design of learning application elements is intended to determine whether the application is appealing to students (Gunawan, 2021). Material information features, reading features with voice explanations from the teacher, material evaluation features in the form of multiple choice questions, and video features are all included in the learning application design. This application design will be used to develop a learning application that students can utilize for independent learning. The capabilities of the "My Biotech" application include incorporating multimedia components. Multimedia is a type of media that mixes multiple elements such as text, graphics, audio, and video to provide viewers with a more exciting and participatory experience (Novaliendrya, 2020) So that students who use this application can more readily and not monotonously understand biotechnology innovation information.

The "My Biotech" application is used as a learning media in research for biological technology innovation material. This is done to excite students about utilizing the media because they have never learned media with the "My Biotech" application feature before. This research differs from earlier studies in that it primarily focuses on training reading literacy and improving student learning outcomes through student participation.

**METHOD**

Classroom Action Research tries to address student challenges to obtain

solutions and enhanced learning results. This class action research was conducted in two (two) cycles. Each cycle lasted as long as one meeting. Each cycle has four stages: 1) planning, 2) action implementation, 3) observation/observation, and 4) reflection.



**Figure 1.** The Spiral Model of the Classroom Action Research

A total of 36 students from class XC SMA Negeri A Bondowoso participated in the research. The research was carried out from April 18 to May 9, 2023, during the even semester of the 2022/2023 academic year. In this research, both quantitative and qualitative data were collected. The findings of questionnaires filled out by students and teachers on observation sheets throughout learning, such as student posttest results, student activeness assessments, and student reading literacy outcomes, provide quantitative data.

**Table 1.** Students' Activeness Indicator

Indicator	1	2	3	4
Activeness in asking questions				
Activeness in discussion				
Students make conclusions				
Activeness to respond to questions				
Presentation of group discussion results				
<b>Total</b>				

Modified from (Arikunto, 2017)

Scoring criteria:  
 4 = High  
 3 = Moderate  
 2 = Low  
 1 = Poor

Formula:  

$$\frac{\sum skor}{\sum skor\_maks} \times 100\%$$
 (Arikunto, 2017)

**Table 2.** Students' Activeness Achievement

Achievement (%)	Criteria
75-100	High
51-74	Moderate
25-50	Low
0-24	Poor

(Arikunto, 2017)

**Table 3.** Reading Literacy Indicator

Indikator	1	2	3	4
Listening Skills				
Reading Skills				
Speaking Skills				
Writing Skills				
Total				

Modified from (Hartati. Marni, 2021)

Scoring criteria:

4 = High

3 = Moderate

2 = Low

1 = Poor

Formula:

$$\frac{\sum skor}{\sum skor\_maks} \times 100\%$$

(Arikunto, 2017)

**Table 4.** Students' Reading Literacy Achievement

Achievement (%)	Criteria
75-100	High
51-74	Moderate
25-50	Low
0-24	Poor

(Arikunto, 2017)

**Table 5.** The Comparison between the First and the Second Cycles

Aspects	Cycle 1	Cycle 2
Learning Model	Problem-based Learning	Problem-based Learning
Material	Biology technology innovation	Biology technology innovation
Learning material	PDF file	"My Biotech" android application
Content	Differences between conventional and modern biotechnology	Materials and features (videos and quizzes) about biotechnology
Learning Process	Students study the material from the PDF file distributed by the teacher	Students learn the material from the Android application "My Biotech."
Learning Outcomes	Students work on evaluation questions	Students design Mind Map

## RESULTS AND DISCUSSION

A considerable increase in student activity was observed when cycle I and II's results were compared. This study evaluates five activeness: questioning, discussing, concluding, answering questions, and presenting group discussion results.

The lowest student activeness results were found in cycle I, where student activeness in asking questions during

Individual Achievement=

$$\frac{\sum skor}{\sum skor\_maks} \times 100\%$$

Classical Achievement=

$$\frac{\sum siswa\_tuntas\_belajar}{\sum seluruh\_siswa} \times 100\%$$

(Arikunto, 2017)

Description:

Individual achievement: If students achieve a score > 70.

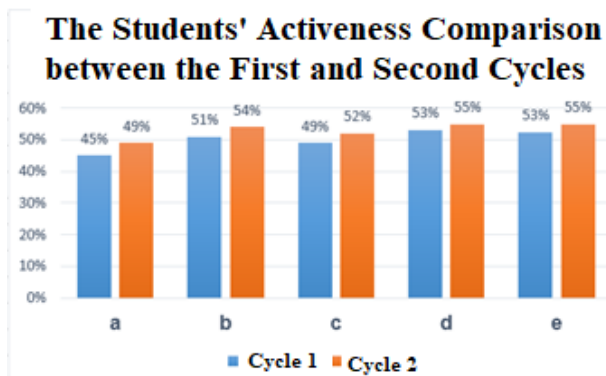
Classical achievement: If > 80% of all students achieve a score > 70 (SMA Negeri A Bondowoso)

Qualitative data was gathered through observations and interviews with students and teachers, the findings of Mind Map assessments, and student response questionnaires. The data collection techniques employed were observation and testing. Observation is obtaining data by observing students' actions while learning. Two colleagues participated as observers of student activity. Tests were used to determine the results of students' reading literacy contained in the student worksheet and producing Mind Map in groups.

learning was as high as 45%, followed by a 49% increase in cycle II. Students' activeness increased significantly along with their enthusiasm in participating in learning by using the android application "My Biotech" in cycle II. Similarly, multiple activities measured during the learning produced a significant rise in several characteristics.

According to Pratama et al. (2020), teachers can encourage student activity in a variety of ways, one of which is through the

use of learning media related to technology, which will create interaction in learning so that students will be born in terms of asking questions and creating a conducive learning environment. Mellisa & Saputri (2023) claim that the android application media "My Biotech" can promote learning activity by including learning objectives, competencies, stimuli, instructions, activities, participation, feedback, short tests, and conclusions. The Android application "My Biotech" provides content and features (videos and quizzes) that encourage student participation while learning. Windari et al. (2023) also state that student-centered learning via interactive media will make students more involved in their learning.

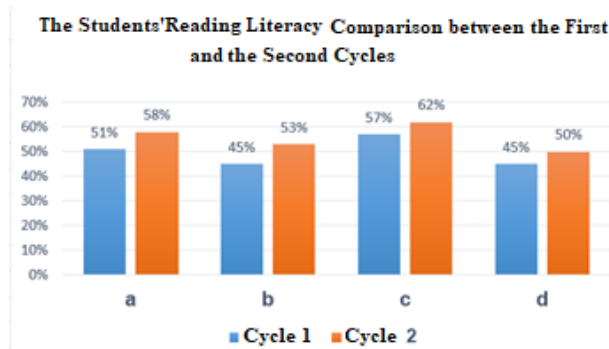


**Figure 2.** Students' Activeness Achievement

**Description:**

- a Activeness in asking questions
- b Activeness in discussion
- c Students make conclusions
- d Activeness to respond to questions
- e Presentation of group discussion results

Cycle 1 and cycle 2 improvements have a positive influence on students learning the subject of biotechnology. The diversity in learning between cycles 1 and 2 increases students' excitement for learning the content. The "My Biotech" application has a major impact on student engagement in learning, making learning more meaningful and entertaining. Novitasari & Dian (2022) found in their research that the usage of media by utilizing Android will boost the attraction of students so that they may participate interactively in learning.



**Figure 3.** Learning Literacy Outcome

**Description:**

- a Listening Skills
- b Reading Skills
- c Speaking Skills
- d Writing Skills

There was a considerable rise in reading literacy results from cycle I to cycle II. Reading literacy is assessed through a sequence of instructions on student worksheets that include listening, reading, speaking, and writing skills. The four characteristics were tested during the learning process through discussion activities, group problem-solving, and student worksheet presentations.

The greatest improvement was in the element of listening skills in cycle I, which increased from 51% to 58% in cycle II. In cycle II, this increase happened when instructional resources in the Android application "My Biotech" were made available. Compared to cycle I, teaching materials in the form of biotechnological material in PDF files were used. During cycle II, students were shown to be quite excited about listening to the learning content offered in the Android application "My Biotech."

(Naik, 2020) argues that improving the elements that influence students' literacy skills, both internal and external influences can increase their literacy skills. According to (Murdani, 2022), teachers can help students improve their literacy abilities by motivating them, offering quality reading materials, and guiding them through literacy activities.

The reading literacy tasks in this study are separated into two treatments, cycle 1

and cycle 2. Students in Cycle 1 read teaching materials in the form of biotechnology material bundled as PDF files. In cycle 2, students read biotechnology material using the My Biotech app. The teacher assigned individual and group assignments during each cycle. In cycle 1, the assignment was to work on student worksheets in groups and present the results in front of the class. Individual assignments in cycle 1 were assessed by completing posttests connected to biotechnology material. Cycle 2 begins by working on student worksheets in groups with presentations of results in the form of Mind Maps based on the outcomes of reading literacy when accessing the "My Biotech" application, followed by working on posttest questions at the end of learning in cycle 2. According to Syara et al. (2020), reading learning seeks to enhance a person's knowledge and potential while allowing them to engage in society. Students will be drawn to interesting material since it is novel to them, and it will boost their cognitive capacities (Suece, 2023). Learning motivation is a crucial aspect of improving reading comprehension. Learning motivation is significant since it can assist a person in improving and learning new things.

Creating a suitable learning atmosphere will not be possible if students are not motivated to learn. As a result, teachers must strive to create a secure and enjoyable learning environment by instilling learning motivation in their students. As a result, creative learning media is required in cycle 2 to demonstrate an improvement in the learning process.

### **Perbandingan Siklus I dan Siklus II (Penilaian Produk STUDENT WORKSHEET)**

Referring to the results of reading literacy assessments obtained from group assessments of student worksheets. A mind map results from student discussions while working on student worksheets. Cycle I student worksheet results were a table of differences between conventional and

modern biotechnology, which students obtained after reading and analyzing the articles presented in the student worksheet. The results of the student worksheet were then presented in cycle II in the form of mind maps related to the articles that each group selected, which included five different topics.

The process of analyzing and exploring concepts in student activities while working on student worksheets increased significantly. In contrast, in cycle I, students in groups could only formulate a few concepts about the differences between conventional and modern biotechnology. However, in cycle II, students became more creative in exploring the concept of biotechnology material, resulting in Mind Map products that broadly describe the material's construction. This is supported by reading literacy results in listening skills, which increased by 58% in cycle II after students were given and used teaching materials in the form of the Android application "My Biotech."

This reflects the increased development of student reading literacy activities and discussions in cycle II. The use of media in learning is critical. This is because the times demand increasingly diverse skills, also known as 21st-century skills. Education can provide students with 21st-century skills, including using appropriate learning media. Learning media is used to help students understand concepts learned, according to (Cahyani, 2019), the use of the "My Biotech" learning application can increase student motivation to learn biotechnology material. The features of this application assist students in more thoroughly and enjoyably understanding the material/content of learning content (Figure 5).

The increase in posttest results occurred in cycle II, when the average number of students who completed the posttest above the minimum criteria was 84%, compared to 71% in cycle I. There are 36 students in class XC, with a biology completeness criterion of 70. Individual

completeness analysis was used to measure the results of this posttest assessment, which revealed a significant increase between cycles I and II. Learning success is determined by the teacher or students and by the active participation of students guided by the teacher. Students should participate fully in all stages of learning and actively contribute to their understanding.



Figure 4. The Cover Display of the Digital Learning material (PDF) used in Cycle 1



Figure 5. The Main Menu Display of the My Biotech App as a Learning Material in Cycle 2

According to Yolida et al. (2022), the effectiveness of learning media can be seen in students' learning activities and student learning day tests. Learning outcomes will demonstrate students' ability to achieve

learning experiences. They will serve as a reference for changes in behavior that will be achieved in the basic competencies and materials studied. Mukhooyaroh et al. (2022) emphasized the importance of motivation to provide students with power and physical activity. Jabaliah et al. (2021) argue that interaction occurs when two elements are combined into a video contained in the media, and students are significantly motivated to see the lesson. As a result, students are motivated to focus on learning materials during the learning process. An engaging presentation using Android media during learning will increase students' motivation to pay attention. According to Wulandari & Djukri (2022), the underlying thing in the Android media "My Biotech" that interests students is the presentation of interesting and involving learning. Rasmi et al. (2023) claim that animated videos in the media will be more engaging and motivating to students.

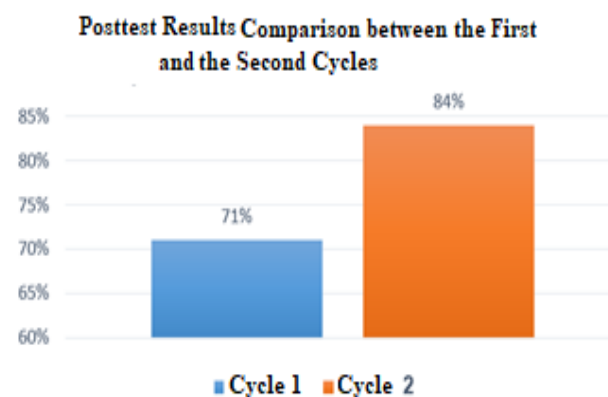
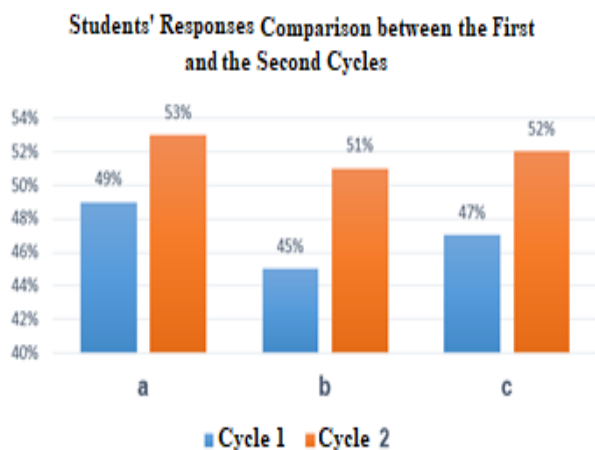


Figure 6. Posttest Outcomes

There is a significant increase in student responses to learning from cycle I to cycle II. Each aspect is at the end of cycle I and cycle II learning. There was a significant increase in each question in the student response questionnaire in some aspects of student response that were assessed. Students who liked the biotechnology material increased from 47% in cycle I to 52% in cycle II, a significant increase. The average number of students who liked the teaching materials and media used in each cycle increased from 45% in Cycle I to 51% in

Cycle II. Each aspect has improved significantly due to using teaching materials like the Android application "My Biotech," where students appear enthusiastic about using the application and learning biotechnology material.



**Figure 7.** Students Responses

**Description:**

- a Students favor the PBL learning model
- b Students favor learning materials and media
- c Students favor Biotechnology Materials

The study found that students responded positively to the "My Biotech" application. This demonstrates that the app can be an effective biology learning medium. This study supports the viewpoint (Kartini, 2020) that interesting learning makes students happy and makes it easier for students to absorb knowledge. The "My Biotech" application can inspire teachers to create innovative learning materials. The use of technology in the creation of learning media can keep the learning environment fun and effective.

**CONCLUSIONS AND SUGESTION**

There is a significant improvement between cycles I and II. In the assessment of student activity, the results of student activeness in asking questions during learning were 45% in cycle I and 49% in cycle II. Then, there was an increase in reading literacy results, specifically in the aspect of listening skills, from 51% in cycle I to 58% in cycle II. The process of analyzing and

exploring student concepts in student worksheets has significantly improved due to the improvement in the results of student worksheet products. In cycle I, students only developed a few ideas about the differences between traditional and modern biotechnology. However, in cycle II, students were more creative in exploring the concept of biotechnology, as evidenced by the Mind Map. The increase in student posttest results was 71% in cycle I and 84% in cycle II. Finally, in the results of student responses, the number of students who liked the biotechnology material increased from 47% in cycle I to 52% in cycle II.

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