JISE 12 (1) (2023): 19-25

Journal of Innovative Science Education

http://journal.unnes.ac.id/sju/index.php/jise

The Effectiveness of Using Mobile Learning-Based E-Plantbook with a Scientific Approach to Increase Student Learning Outcomes

Maila Shofa Maghfiroh✉, Enni Suwarsi Rahayu, Talitha Widiatningrum

Pascasarjana, Universitas Negeri Semarang, Indonesia

Article Info

Article History :
September 2022
Accepted
November 2022
Published
April 2023

Keywords:
e-plantbook, scientific, mobile learning, learning outcomes.

Abstract

The use of learning resources that have not yet ideal creates difficulties for students, particularly on Plantae material at SMA Negeri 1 Kembang, Jepara Regency, Central Java Province. Students had difficulties in identifying, mentioning, explaining the characteristics, body structure, and grouping plants into divisions based on general characteristics. In addition, the absence of the data from observations and phenetic and phylogenetic analyzes of plants and the role of plants in survival on earth (particularly in the surrounding environment), had an impact on the difficulty of achieving Core Competency Plantae. This study aims to analyze the effectiveness of the e-plantbook with a scientific approach to student learning outcomes at SMA Negeri 1 Kembang, Jepara Regency, Central Java Province. E-plantbook is a mobile learning applications-based e-book naming on Plantae material. E-plantbook can be used as an alternative learning resource for students. This research method is quasi-experimental to measure the effectiveness of using e-plantbook with a non-equivalent research design pretest-posttest control group design to measure learning outcomes. The average of student learning outcomes in the cognitive aspect is 89. E-plantbook is assessed to be effective based on a) the results of the t test for increasing cognitive learning outcomes with a significance of 0.000 (< 0.05) which indicates a significant difference in learning outcomes between the experimental class and the control class, b) N Gain cognitive learning outcomes of 0.71 in the experimental class is greater than the control class (0.45), and c) the average score of the psychomotor aspect of the experimental class (3.80) with a very good category and greater than control class (3.53) with very good category. The use of e-plantbooks in the learning process could encourage student-centered learning because students were more active and students could learn independently.

✉ correspondence :
Jalan Kelud Utara III No.37, Kota Semarang,
Jawa Tengah, Indonesia 50237
E-mail: mailashofa@students.unnes.ac.id

p-ISSN 2252-6412
e-ISSN 2502-4523

INTRODUCTION

The development of the digitalization era encourages the development of the education world in improving the quality, relevance and effectiveness of education, particularly the 2013 Curriculum. The Minister of Education and Culture Regulation (Permendikbud) number 22 of 2016 concerning graduate competencies and content standards states that the learning principle used is the use of information and communication for improving learning efficiency and effectiveness (Iffatul et al., 2018). The achievement of these goals cannot be separated from the role of learning resources to improve the quality of learning holistically. The improvement of the quality of learning can facilitate students actively to interact with learning resources so that students achieve learning goals effectively, efficiently and fun. Learning resources that can be studied independently will build the quality of student learning processes and outcomes through the construction of their own knowledge. This is because students can learn actively, meaningfully and emphasize the whole meaning of life skills (Akbar, 2013).

The biology teacher of SMA Negeri 1 Kembang, Jepara Regency, Central Java Province through an interview in August 2021, it provided information that the Plantae material had been implemented in 2013 Curriculum learning. However, there were still many obstacles related to the learning process during the Covid-19 pandemic. The teacher has difficulty in conveying Plantae material because there are many kinds of plants which are divided into mosses, ferns and seed plants so that the delivery of the material is not optimal. In addition, time constraints and the absence of practice in the field that have made the learning is not fully conveyed. The use of learning resources that are not yet ideal creates difficulties for students, particularly when identifying, mentioning, explaining characteristics, body structures, and grouping plants into divisions based on general characteristics. In addition, the absence of the data from observations and phenetic and phylogenetic analyzes of plants and the role of plants in survival on earth (particularly in the surrounding environment), so that it has an impact on the difficulty of achieving the Core Competence of *Plantae* material.

The learning approaches that are in accordance with the 2013 Curriculum include the scientific. The scientific approach is related to process and scientific skills. The scientific approach can encourage students to actively construct concepts through observations, identify and formulate problems, formulate hypotheses, collect and analyze data, and draw conclusions and communicate concepts that are "found" (Liana, 2020). This approach invites students to be actively involved in the learning process to find out various learning resources wherever and whenever (Oktafiani et al., 2021). One of ways to create meaningful learning is applying a scientific approach. According to Fauziah (2013) the scientific approach invites students to directly infer the existing problems in the form of problem formulations and hypotheses, a sense of care for the environment, curiosity and love of reading. Practically, students will have the opportunity to conduct investigations and inquiries as well as develop and present their work (Machin, 2014).

To overcome this problem, a solution is offered in the form of using a mobile learning application based e-plantbook learning resource with a scientific approach which is expected to help teachers and students achieve Core Competence of plantae material. The achievement of Core Competence is expected to improve learning outcomes, both in cognitive and psychomotor aspects. The e-plantbook learning resource makes it easier for students to identify minimal traits and characteristics in the division taxon, analyze the various benefits of plants for the survival of life and analyze plant phenetics and phylogenetics. This condition is expected to improve students' critical thinking and scientific attitude.

E-plantbook is a mobile learning applications-based e-book for Plantae material. Mobile learning media can be used as learning media and learning innovations that utilize mobile devices (Daryanto, 2015). Learning innovation is a new paradigm from an instructional focus leading to an approach that is centered on active engagement (Justice&Rice, 2009). The use of mobile learning applications is something that is practical and flexible in the learning process, because it can be implemented and accessed anywhere and anytime (Maweikere et al., 2020). In the last decade, a large number of initiatives have been created in order to utilize

technology and mobile applications for educational purposes. There is great potential in using mobile devices to change the way traditional classroom learning becomes more interactive and interesting (Ardiansyah & Nana, 2020).

The e-plantbook contains material and plant visualizations that are easy for students to understand. The E-PlantBook also contains color images/photos presented in the original. In addition, the e-plantbook contains references so that it is easy to trace and more practical because the learning process can be mediated by handheld devices, namely mobile phones (Burden, 2019). Teachers can use e-plantbooks to stimulate independent learning (Mulyono et al., 2012). E-plantbook can also be one of the ideal learning resources for students to achieve the Basic Competence of *Plantae* material.

The purpose of this study was to analyze the effectiveness of a mobile learning application-based e-plantbook with a scientific approach to improve student learning outcomes.

METHOD

The type of research used is Quasi-Experimental. The research design used is a non-equivalent pretest-posttest control group design. This research was conducted at SMA Negeri 1 Kembang, Jepara Regency, Central Java Province. The sample class was taken as many as 30 in the control class X MIPA 2 and as many as 30 in the experimental class was carried out in the X MIPA 1 class by using purposive sampling technique.

The data collection methods include observation, interviews, tests, and documentation. The observation method is used to analyze the literature and curriculum, as well as determine the attitude of students' (psychomotor) skills. The interviews were conducted to determine the responses of teachers and students regarding the learning process. The test was conducted to determine student learning outcomes. The documentation was carried out to find out student data in the form of names, number of students and photos during the learning activities.

The learning outcomes are in the form of students' cognitive aspects that were calculated by using the Paired-Samples t-Test to determine the difference in scores between before and after the use of additional learning resources in the form of an e-plantbook application, the Independent-Samples t-Test test to determine the significance of the difference in class average scores of experimental and control classes, as well as the N-gain test to determine the effectiveness of a mobile learning-based e-plantbook with a scientific approach. The effectiveness can be seen by understanding and increasing students' competence. The criteria for the effectiveness of the e-plantbook are the average student learning outcomes classically is ≥ 70 and classical learning completeness, namely 75% of students achieving the standard minimum of minimum completeness of learning mastery. Learning outcomes in the form of psychomotor aspects refer to the results of the Student Worksheet discussion tasks including skills in observing plants in the e-plantbook and in working on reports.

The effectiveness test can be measured by using student learning outcomes consisting of cognitive aspects (through a test instrument of 20 questions) and psychomotor (through non-test instruments). The early learning activity was carried out in the control and experimental classes by giving pretest questions. Then the control class learning activity was carried out without any additional learning resources in the form of an e-plantbook application. In the experimental class, the learning process was carried out by using additional learning resources in the form of an e-plantbook application.

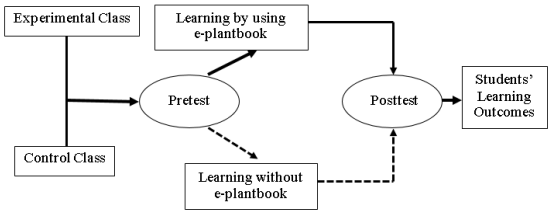

Figure 1. Stages of using e-plantbook

Information : _____ using e-plantbook
---------- without using e-plantbook

RESULTS AND DISCUSSION

Learning Outcomes by Using Mobile Learning-based E-PlantBook with a Scientific Approach

The students' learning outcomes of control and experimental classes that each of which amounted to 30 people, it can be assessed by using cognitive aspects to determine students' abilities (through test instruments) and psychomotor aspect to determine student skills (through non-test instruments).

a) Learning outcomes in cognitive aspect

The average of learning outcomes in the control class had a pretest score of 63.2 and posttest 79.8, while the experimental class had an average pretest score of 63 and an average posttest score of 89 as shown in Figure 2. The results of the data analysis showed an increase in the score of the average posttest in both the control and the experimental classes. The increase in the experimental score was higher than the control class. These results indicate that the use of e-plantbook as a learning resource could improve learning outcomes.

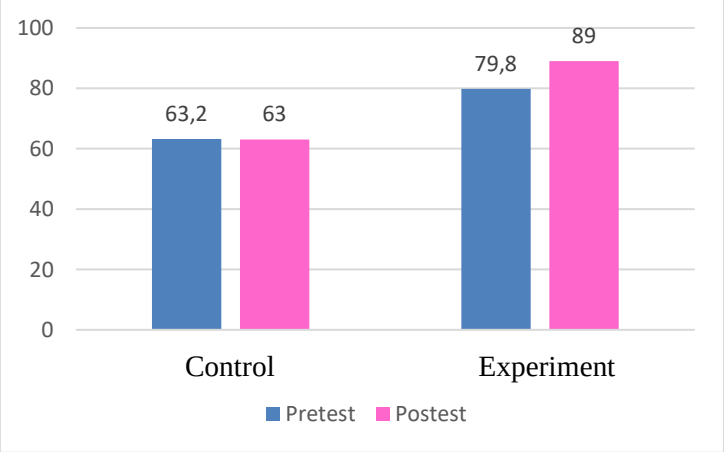

Figure 2. The Comparison of pretest and posttest results

The increase in the results of the pretest and posttest scores of the experimental class was due to the use of the e-plantbook. The e-plantbook was designed and developed with mobile learning-based scientific approach. The scientific approach is student-centered learning so it establishes the Student Self Concept (Sukmawati, 2017). Student Self Concept involves science process skills in constructing concepts, laws, or principles through observing, formulating problems, proposing/formulating hypotheses, collecting the data with various techniques, analyzing data, drawing conclusions, and communicating (Hosnan, 2014). This is in line with the research of Sihotang & Sibuea (2015) which states that when students have carried out various stages in a scientific approach, students gain learning experiences from their involvement in a more concrete learning process (Sihotang & Sibuea, 2015).

The analysis results of the Paired-Samples t-Test function to find out the significance of the increase in the average score in the pretest-posttest experimental and control classes are as follows.

Table 1. T-test results for pretest and posttest

Class	n	Std. Deviation	df	Tcount	Sig. (2-tailed)
Pretest - Postest of Experimental Class	30	8.444	29	16.542	,000
Pretest - Postest of Control Class	30	5.366	29	16.979	,000

Based on Table 1. It can be seen that the score of sig (2-tailed) is 0.000. If the score of sig. (2-tailed) of 0.000 < 0.05, it indicates a difference in score between before and after the use of additional learning resources in the form of an e-plantbook application. The difference in the average posttest score was then analyzed by using the Independent-Samples T Test to determine the significance of the difference in the average score of the experimental and the control classes. The results of the t-test analysis can be seen in Table 2.

Table 2. The results of the t-test of the average posttest score of the experimental and control classes

Class	n	Mean	Levene's Test	df	Tcount	Sig. (2-tailed)
Experimental	30	88.67	2.871	58	5.592	,000
Control	30	79.83				

Based on Table 2. It is obtained that the score of sig. (2-tailed) of 0.000. If the score of sig. (2-tailed) of 0.000 <0.05, then there is a difference in learning outcomes between the experimental class and the control class which is statistically significant or significantly.

The results of the calculation of N-gain on the average learning outcomes is 0.42 for the control class and 0.71 for the experimental class. The N-gain of the experimental class is higher than the control class. The experimental class has a high N-gain category and the control class has a medium N-gain category. This shows that students' ability to master concepts increases due to the use of e-plantbook with mobile learning-based scientific approach.

The increase of students' cognitive aspects of learning outcomes is due to the use of an e-plantbook containing easy-to-understand material. The completeness of the content can be seen from the presentation, content, language and completeness of images and video links as an innovative learning resource. The material contains the results of the identification of the types of mosses (Bryophyta), ferns (Pterydophyta) and seeds (Spermatophyta) found in the Kembang Nature Reserve, Jinggotan Village, Kembang District, Jepara Regency. The location is 750 m from the student's school, so the types of plants contained in the e-plantbook are found in the area where students live. These results are in line with Adawiyah et al. (2019) that the highest score was obtained by students because they received various information through multimedia. Sensory organs used will be faster to receive and process information. The more likely the information will be received, the more easily understood (Adawiyah et al., 2019)

b) Learning outcomes of psychomotor aspect

The assessment results of the student activities on the psychomotor aspect refer to the results of the Student Worksheet discussion assignments given by the teacher directly. Assessment of psychomotor aspects includes group collaboration, skills in observing plants in the e-plantbook and working on group report assignments, conformity of report results, discipline and responsibility. The results of the psychomotor aspect assessment can be seen in Figure 3.

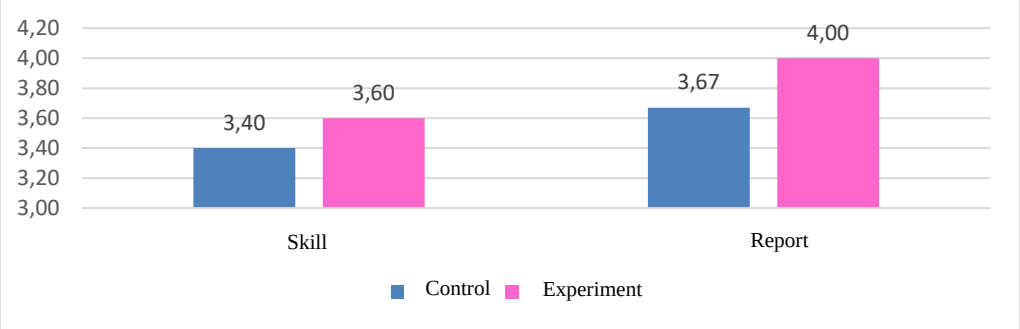

Figure 3. The comparison of assessment result of psychomotor aspect

The average results of psychomotor activity during discussions in the control and experimental classes were 3.53 and 3.80 (maximum score of 4.00), respectively, which were categorized as very good

category. The increase in experimental class learning outcomes on each indicator occurs because the e-plantbook is included from an electronic book (e-book) which can act as an alternative source of independent learning (Oktafiani et al., 2021).

The low report indicators in the control class are due to the monotonous textbooks used by students and do not contain many examples of plants. As a result, students in the control class had difficulty in identifying plants compared to students in the experimental class. The results of Ardiansyah & Nana's (2020) research show that the use of mobile learning can improve learning outcomes. This media is included in the good category as a learning medium. The suitability of students' skills and talents can also affect the results achieved (Ardiansyah & Nana, 2020). The implementation of a scientific approach to the development of the e-plantbook also affects student learning outcomes. This is in line with Machin's research (2014) which shows that the scientific approach has a positive effect on cognitive, affective and psychomotor learning outcomes and has achieved the specified classical mastery, which is more than 85% of all students who take part in the learning process (Machin, 2014).

The Effectiveness of Using an E-plantbook with Mobile Learning-Based Scientific Approach

The effectiveness mobile learning application-based e-plantbook with a scientific approach is measured through student learning outcomes which include cognitive and psychomotor aspects. Both aspects show an increase in student learning outcomes through face-to-face learning. The effectiveness based on the use of mobile learning application-based e-plantbook with a scientific approach to learning outcomes has a positive effect on the learning outcomes. This positive influence is due to the use of e-plantbooks can make students more active in the learning process and not depend on teachers or independently (Azrai & Refirman, 2013).

In the 2013 curriculum, the government has established a scientific approach in the learning process as a characteristic of the curriculum. This approach has 7 criteria to create graduates who are productive, innovative, creative, and effective, namely based on facts and phenomena, free from prejudice, encouraging students to think critically, analytically and accurately, encouraging students to think hypothetically, encouraging students to think rationally and objectively, theoretical and empirical concepts-based, and the learning objectives are formulated in a simple, clear and interesting way (Liana, 2020).

Based on the results of the study, it can be seen that the E-PlantBook with mobile learning-based scientific approach can affect student learning outcomes. This is in line with the theory which states that learning using a scientific approach is learning that emphasizes providing direct experience using either observation, experimentation, or other means so that the reality that will speak as information or data obtained besides being valid can also be accounted for (Fidya et al. ., 2018).

CONCLUSION

The use of e-plantbook with mobile learning-based scientific approach can improve student learning outcomes in cognitive and psychomotor aspects. The e-plantbook was assessed to be effective based on a) the results of the t-test of increasing cognitive learning outcomes with a significance of 0.000 (<0.05) which show a significant difference in learning outcomes between the experimental and the control classes, b) N Gain cognitive learning outcomes of 0.71 in the experimental class is greater than the control class (0.45), and c) the average score of the psychomotor aspect of the experimental class (3.80) with the very good category and greater than the control class (3.53) in the very good category. Based on this data, it can be stated that the e-plantbook is effective as a learning resource for Plantae material.

ACKNOWLEDGEMENT

This journal article was written based on research results funded by the DIPA FUND of Universitas Negeri Semarang through the 2022 Student Research Program (Postgraduate). The contents are entirely being the responsibility of the author.

REFERENCES

Adawiyah, R., Harjono, A., Gunawan, G., & Hermansyah, H. (2019). Interactive e-book of physics to increase students' creative thinking

skills on rotational dynamics concept. *Journal of Physics: Conference Series*, *1153*(1).

Akbar, S. (2013). *Instrumen Perangkat PembelajaranNo Title*. PT Remaja Rosdakarya Offset.

Ardiansyah, A. A., & Nana, N. (2020). Peran Mobile Learning sebagai Inovasi dalam Meningkatkan Hasil Belajar Siswa pada Pembelajaran di Sekolah. *Indonesian Journal Of Educational Research and Review*, *3*(1), 47.

Azrai, E. P., & Refirman. (2013). Efektifitas Penerapan E- book sebagai Sumber Belajar Mandiri dalam Pembelajaran Biologi. *Semirata FMIPA Universitas Lampung*, 243–250.

Burden, K. (2019). *Future Scenarios For Mobile Science Learning*. 9–25.

Daryanto. (2015). *Media pembelajaran*. Gava Media.

Fidya, F., Sihaloho, M., & Botutihe, D. N. (2018). Pengaruh Penggunaan Pendekatan Saintifik terhadap Hasil Belajar Siswa pada Materi Hidrolisis Garam. *Jambura Journal of Educational …*, *13*, 143–149.

Hosnan, M. (2014). *Pendekatan Saintifik dan Kontekstual dalam Pembelajaran Abad 21*. Ghalia Indonesia.

Iffatul, D., 1□, A., Rahayu, E. S., & Anggraito, Y. U. (2018). Development of E-Module Based Android for Teaching Material of Plantae Kingdom Topic. *Journal of Biology Education*, *7*(1), 1–8.

Justice, C., Rice, J., W. W. (2009). Academic Skill Development - Inquiry Seminars Can Make a Difference: Evidence from a Quasiexperimental Study. *International Journal For The Scholarship Of Teaching And Learning*, *3(1): 1-23*.

Liana, D. (2020). Berpikir Kritis Melalui Pendekatan Saintifik. *MITRA PGMI: Jurnal Kependidikan MI*, *6*(1), 15–27.

Machin, A. (2014). Implementasi pendekatan saintifik, penanaman karakter dan konservasi pada pembelajaran materi pertumbuhan. *Jurnal Pendidikan IPA Indonesia*, *3*(1), 28–35.

Maweikere, A., Nanlohy, F. N., Studi, P., Biologi, P., Manado, U. N., Biologi, J., & Manado, U. N. (2020). *Implementasi Aplikasi Mobile Learning Berbasis Android pada Materi*. *1*(2), 59–64.

Mulyono, Y., Bintari, S. H., Rahayu, E. S., & Widiyaningrum, P. (2012). Pengembangan Perangkat Pembelajaran Dengan Pendekatan Scientific Skill Teknologi Fermentasi Berbasis Masalah Lingkungan. *Lembaran Ilmu Kependidikan*, *41*(1), 20–26.

Oktafiani, R., Widiatningrum, T., & ... (2021). The Effectiveness of Using Interactive E-Books of Spending Plant Through Online Learning. *Journal of Innovative …*, *10*(37), 244–250.

Sihotang, C., & Sibuea, A. M. (2015). Pengembangan Buku Ajar Berbasis Kontekstual Dengan Tema "Sehat Itu Penting." *Jurnal Teknologi Informasi & Komunikasi Dalam Pendidikan*, *2*(2), 169–179.

Sukmawati, W. (2017). Pembelajaran Kontekstual dengan Saintifik Inkuiri untuk Meningkatkan Literasi dan Sikap Sains Siswa. *BIOEDUSCIENCE Jurnal Pendidikan Biologi Dan Biosain*, *1. No.1*, 31–37.