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The effect of discovery learning model assisted by flipbook media on student learning outcomes on plantae material class X senior high school

Fitriyana*, Kurnia Ningsih, Laili Fitri Yeni

Department of Biology Education, Tanjungpura University, Pontianak, Prof.Dr. Hadari Nawawi street, Bansir laut, West Kalimantan

*Corresponding author: fitriyana774@gmail.com



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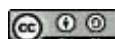
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ABSTRACT

This study aims to measure the effectiveness of the Discovery Learning model using Flipbook media in enhancing the understanding of Plantae material. This research adopted a quasi-experimental design with a non-equivalent control group. Two entire classes were selected as samples: class X MIA 2 as the experimental group and class X MIA 4 as the control group. The research instrument was a 20-item multiple-choice test, administered as a pre-test and post-test. The comparison of average scores between the experimental group (15.89) and the control group (15.17) showed an improvement in the experimental group. Statistical analysis using the Mann-Whitney U test indicated no statistically significant difference between the two learning groups. The 13.68% improvement in students' learning outcomes in the Plantae material may be attributed to the application of the learning model used in this study.



INTRODUCTION

Education is a shared journey between educators and students to achieve learning objectives, namely the development of critical thinking skills and independent learning. Education as an integral effort to shape the whole human being, emphasizing the development of spiritual, moral, intellectual, and social aspects (Cifuentes & Fernandez, 2017; Ciuchi, 2021). Students must become the main actors in the learning process by directly engaging in meaningful activities (Buelow et al., 2018; Holmes, 2018). To achieve the educational goals outlined in the curriculum, as stated in Indonesia Minister of Education and Culture Regulation No. 81A of 2013 concerning General Learning Guidelines, the learning process must: (1) prioritize students, (2) create an engaging and challenging learning atmosphere, and (3) offer diverse learning experiences through the use of enjoyable, relevant, effective, efficient, and meaningful methods and strategies.

The learning process is the result of interactions between students and educators that involve various elements such as subject matter, teaching methods, learning media, assessment, and effective classroom management (Amerstorfer & Von Münster-Kistner, 2021). The quality of this interaction is greatly influenced by the interrelationship and support among these components. The main goal of learning is to bring about behavioral changes in students (Geitz et al., 2016; Lu et al., 2021). These changes may include improvements in knowledge, skills, attitudes, or values. Effective learning involves direct student experience with the subject matter (Miftahussaadah & Subiyantoro, 2021). These experiences may come in the form of experiments, projects, or other real-life activities (Budiasuti et al., 2021; Nanda et al., 2023). In the effort to improve learning quality, continuous innovation is needed. One interesting model is Discovery Learning, which positions students as explorers of knowledge. According to Sunarto & Amalia (2022), Discovery Learning emphasizes the process of discovery. In this model, students are not given information directly, but are encouraged to find knowledge themselves through exploration and investigation.

Discovery Learning is considered highly effective in fostering students' critical thinking, creativity, and problem-solving abilities (Kurino et al., 2024; Subagtio et al., 2021). However, its success depends heavily on careful planning and teacher support. Khasinah (2021) states that Discovery Learning effectively increases students' learning motivation because it allows them to find answers to their own questions, making learning more meaningful. Unlike traditional learning, the discovery-based method developed by Bruner encourages students to actively construct their own knowledge (Iwantoro et al., 2022).

Discovery Learning motivates students to continuously seek answers to problems they face, thereby actively involving them in the learning process (Sari & Rohman, 2021; Setyorini, 2022). According to Sunarto & Amalia (2022), the steps in Discovery Learning are systematically arranged, starting with stimulation to spark curiosity, identifying problems, collecting evidence, analyzing data, verifying findings, and finally drawing broader conclusions. This approach is one effective way to enhance student achievement. When combined with a suitable learning medium, Discovery Learning can effectively equip students with problem-solving skills.

Variety in learning media can help students relate the material to real life (Carrión-Martínez et al., 2020). The appropriate use of media can make learning more enjoyable and meaningful, enabling students to absorb material more easily (Juliani & Ibrahim, 2023). One such medium is the Flipbook. According to Nurulhidayah et al. (2020), integrating engaging learning media—specifically Flipbook—is highly recommended in implementing the Discovery Learning model.

This study applied Flipbook, an interactive digital learning medium that allows users to directly interact with the *Plantae* material through animations, quizzes, or simulations. This Flipbook was created as a learning tool to introduce Grade X students to the plant world, particularly mosses, ferns, and seed plants, in terms of morphology and their benefits to humans. The media presents information through text, images, and possibly animations or videos to enhance student interest and understanding (Mursidi et al., 2022; Nurfadillah et al., 2022).

This study examines the cognitive improvement of Grade X students on plant material after applying the Discovery Learning model assisted by Flipbook media. The data used were the final scores obtained by students in both study groups. Learning outcomes are considered good when students achieve the school's minimum standard score of 76 or above.

Through this research, it is expected to determine how significant the impact of using the Discovery Learning model with Flipbook media is. Thus, this study can raise awareness among students and teachers about the importance of training students to reflect on and control their own learning processes.

METHODS

This study adopted a quasi-experimental design to examine the effect of the independent variable on the dependent variable. This design compares an experimental group that receives treatment with a control group that does not. However, because the subjects were not randomly assigned, there is potential for systematic differences between the two groups that could affect the results. Therefore, conclusions regarding the effect of the treatment must be interpreted carefully, considering the limitations of this design.

The research population consisted of six science classes at one of high school in Pontianak, who had no prior experience learning about the Plantae material. The sample was selected using purposive random sampling. Two classes—X MIA 2 and X MIA 4—were randomly selected to be the experimental and control groups. These two classes were assumed to have characteristics similar to the overall population.

This study analyzed three main variables:

- a) the implementation of the Discovery Learning model using Flipbook media as the independent variable,
- b) changes in students' scores on plant material as the dependent variable, and
- c) controlled factors such as lesson content, time allocation, and teacher characteristics.

Data for this study were collected from several sources, including student test results (20 multiple-choice questions), lesson plans (RPP), student worksheets (LKPD), and the Flipbook learning aid.

The primary instrument for data collection was the pre-test and post-test, administered before and after the treatment. These tests were used to measure the changes in students' abilities. The data analysis technique included statistical analyses such as normality tests, the Mann-Whitney U test, and effect size calculation to test the research hypotheses. The effect size calculation was used to determine how much influence the Discovery Learning model assisted by Flipbook media had on student learning outcomes in the Plantae material for Grade X high school students.

RESULTS AND DISCUSSION

Students' ability to understand the Plantae material was assessed based on their final test scores. According to the theory of Setyorini (2022), to measure the success of learning, we need to observe the behavioral changes shown by students. In this study, those changes were measured through post-test scores obtained by students in both the experimental and control classes after receiving different treatments. The learning provided had a significant effect on improving students' learning outcomes, as seen in the difference in average pre-test and post-test scores.

Based on the average learning outcome scores in the Plantae material, both the experimental and control classes showed improvement. During the pre-test, students in both classes had similar abilities. However, different levels of improvement were observed after the post-test. In the experimental class, the average score increased from 10.6 to 15.89, with a mastery rate of 60%, meaning 21 out of 35 students met the minimum standard. In the control class, the score increased from 9.91 to 15.17, with a mastery rate of 54.29%, or 19 out of 35 students.

The Mann-Whitney U test analysis showed a z-value of -1.262, which falls outside the critical region (-1.96 to 1.96). Statistically, this indicates a significant difference between the two groups. The improvement in the experimental class was attributed to the use of the Discovery Learning model with Flipbook media. This model has been shown to effectively enhance student understanding, as supported by Nurulhidayah et al. (2020).

The Discovery Learning model stimulates students' curiosity, encouraging them to search for answers independently (Sulastris et al., 2024). By applying this model, students are equipped with critical thinking skills that allow them to analyze information, solve problems, and find innovative solutions (Kurino et al., 2024; Subagtio et al., 2021). In addition, the use of printed Flipbooks successfully increased student motivation in the experimental class (Sunarto & Amalia, 2022). The media presents material attractively with various illustrations, which help draw students' attention, clarify content, and assist in understanding scientific concepts more easily (Mursidi et al., 2022).

Learning in the control group followed conventional methods commonly used by teachers, such as lectures supported by PowerPoint presentations. At the beginning of the lesson, students were given motivation and specific learning goals to complete group tasks in the LKPD. During the delivery of the material, student attention was generally high. However, some individuals showed low participation, indicated by few questions and limited active interaction in class.

During the group task implementation using the LKPD, some students showed low participation. Despite being provided with worksheets and personal notes, the results of group presentations indicated an imbalance in contributions among members. This finding is consistent with Yanuar & Pius (2023), who stated that in conventional learning models, students tend to play a passive role due to the dominant role of the teacher. Nevertheless, the teacher still provided additional information to ensure a deeper understanding of the material so that students could complete the LKPD more effectively.

Table 2. Comparison of learning mastery percentages and effect size

Class	Average Mastery Percentage (%)	Effect Size	Impact Interpretation
Experimental	82.14	0.35	Moderate
Control	78.15	-	-

Based on Table 2, the proportion of students who achieved all learning objectives in the experimental class (82.14%) was significantly higher than in the control class (78.15%). The success of the experimental class is attributed to the use of the creative and engaging Discovery Learning model through Flipbook media. The use of Flipbook and Discovery Learning significantly enhanced

students' understanding of the subject matter. Moreover, collaboration between high- and low-ability students in groups contributed to improved motivation. This result is also supported by previous research indicating that the applied model enables students with diverse abilities—including those with lower academic performance—to contribute effectively within their groups (Alcalá et al., 2019; Durak, 2022; Ganotice et al., 2022; Nakata et al., 2020; Zheng et al., 2020).

Post-test analysis on the first learning objective showed that the percentage of control class students who could identify the general characteristics of Plantae (94%) was higher than the experimental class (91%). This difference was likely due to shorter emphasis on this topic in the experimental class. However, on the second objective—classifying Plantae based on the presence of vascular tissue and reproductive organs—the experimental group (94%) outperformed the control group (84%). This outcome is attributed to the Flipbook media, which provided clear visualizations and explanations of plant classification concepts. This finding supports by previous research indicating that images in learning improve student engagement and comprehension (Juliani & Ibrahim, 2023; McMillan et al., 2023).

The effect size calculation yielded a value of 0.35, indicating a moderate influence of the Discovery Learning model assisted by Flipbook media on students' learning outcomes in the Plantae material. When converted into a standard normal distribution, this corresponds to an area size of 0.1368. The implementation of Discovery Learning with Flipbook successfully improved student learning outcomes by 13.68%. This study confirms that the chosen instructional model significantly contributes to enhancing students' conceptual understanding.

CONCLUSION

This study reveals that the implementation of the Discovery Learning model assisted by Flipbook media successfully improved the learning quality of Grade X high school students, especially in the topic of Plantae. Data analysis shows that the Discovery Learning model has a greater positive impact on improving student scores compared to conventional methods. Based on the calculated effect size value of 0.35, it indicates that the Discovery Learning model using Flipbook media provides a moderate contribution to improving students' learning outcomes in Plantae material. Future researchers are encouraged to broaden the scope of research by examining the effect of the Discovery Learning model on students' motivation during the learning process to gain a more comprehensive understanding.

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Authors' Note

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