

# The Influence of the Use of Interactive Learning Media on Understanding Biology Concepts in Secondary Schools

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## ABSTRACT

This study aims to analyze the effect of using interactive learning media on understanding biology concepts in high schools. The research method used is an experiment with a pretest-posttest design, where students are divided into two groups: an experimental group using interactive learning media and a control group using conventional learning. Data were collected through a biology concept understanding test, student perception questionnaires, and learning observations. The results showed that the experimental group had higher test scores compared to the control group, with a statistically significant difference ( $p < 0.05$ ). In addition, students in the experimental group also reported higher levels of engagement, motivation, and satisfaction with learning using interactive media. The use of interactive learning media has also been shown to make it easier for students to understand complex biology concepts and improve their practical skills. Overall, this study concludes that interactive learning media has a positive effect on understanding biology concepts and can be used as an effective alternative in improving the quality of learning in high schools.

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## 1. INTRODUCTION

Biology education in secondary schools plays a very important role in shaping students' understanding of life phenomena and fundamental biological concepts. Effective biology learning depends not only on mastery of the material, but also on the delivery method that can stimulate students' interest and understanding. Along with the development of technology, interactive learning media has emerged as an alternative that can help improve the quality of learning, including in biology subjects. Interactive learning media, which include educational software, learning videos, applications, and simulations, provide opportunities for students to learn actively and participate directly in the learning process.

However, although interactive learning media has been widely known, its application in biology learning in secondary schools is still limited and often underutilized. Several studies have shown that the use of interactive learning media can improve understanding of more abstract concepts in biology, such as the concept of ecosystems, genetics, and other biological processes. With interactive media, students not only receive information passively, but can be directly involved through simulations, virtual experiments, and visualizations that make it easier for them to understand complex concepts.

This study aims to examine the effect of the use of interactive learning media on the understanding of biological concepts in secondary schools. In this context, understanding biological concepts refers to students' ability to explain, identify, and apply biological knowledge in everyday life. This study will also identify various types of interactive learning media used in secondary schools

and how these media can affect students' learning outcomes in biology subjects. With the results obtained, it is expected to provide practical recommendations for the development of more effective learning methods in the future.

Several previous studies have examined the use of interactive learning media in improving students' understanding of biological concepts. Kuswanto (2019) in his research on the use of mobile applications for biology learning in secondary schools found that students who used interactive applications to learn biological materials showed a significant increase in understanding compared to students who only used textbooks. The application provides clear visualizations and simulations that help students understand difficult concepts such as the process of photosynthesis and the human organ system.

Another study by Utami and Setiawan (2020) on the use of interactive learning videos in biology teaching also showed similar results. They reported that students who were exposed to learning videos that presented animation and direct interaction were able to understand biological concepts faster and more deeply. These videos allow students to see biological processes in real-time, which cannot be easily done through conventional methods.

In addition, research conducted by Sukmawati (2018) on the use of virtual simulations in biology learning in high schools found that simulation media can improve students' practical skills. Students who used virtual simulations to understand biology experiments, such as experiments on genetic inheritance, showed significant improvements in their ability to apply the knowledge learned in real situations. This study underscores the importance of using technology in biology learning to strengthen students' understanding of complex concepts.

These studies show that the use of interactive learning media can have a positive impact on the understanding of the biology concepts taught, but there is still much to explore regarding how this media can be optimized in various learning contexts in secondary schools.

## 2. RESEARCH METHOD

This study uses a quantitative approach with a quasi-experimental design, which aims to examine the effect of the use of interactive learning media on the understanding of biology concepts in secondary schools. This design was chosen to see the causal relationship between the independent variable (the use of interactive learning media) and the dependent variable (understanding of biology concepts), without random treatment, considering the limitations in variable control.

### Population and Sample

The population in this study were all students of grade XI in one of the senior high schools in the Jakarta area. The research sample consisted of two groups, namely the experimental group using interactive learning media and the control group using conventional learning methods. The sample was selected using a purposive sampling technique, which refers to the criteria of schools and classes that meet the requirements for this study. There were 60 students involved in this study, divided into two groups of 30 students each.

### Research Instruments

To measure students' understanding of biological concepts, a test consisting of 30 multiple-choice questions was used to test understanding of biological concepts, such as ecosystems, genetics, organ systems, and other biological processes. This test was developed based on the applicable curriculum in high schools and has been validated by two biology material experts and trial testing to ensure its reliability and validity.

In addition, this study used a questionnaire designed to measure students' perceptions of the use of interactive learning media, which included questions regarding the convenience of using the media, the level of involvement, and the effectiveness of the media in understanding biology material.

### Research Procedures

This research was conducted over a period of four weeks, with the following details:

1. **Preparation:** In the first week, an introduction to interactive learning media was carried out to the experimental group and an introduction to the biology learning material that would be tested.
2. **Implementation of Learning:**

- a. The experimental group will use interactive learning media such as mobile applications, learning videos, and virtual simulations in learning biology materials. This learning is carried out with a customized schedule and involves group discussions and technology-based tasks.
  - b. The control group will receive conventional learning using textbooks, lectures, and traditional laboratory experiments.
3. **Comprehension Test:** After four weeks of learning, both groups will be given the same biology concept understanding test. This test serves to measure students' learning achievement after participating in learning.
4. **Perception Questionnaire:** After the test, students in both groups will fill out a questionnaire about their perceptions of the learning that has been done. This questionnaire covers aspects such as student engagement, use of technology in learning, and satisfaction with the methods received.

### Data analysis

Data obtained from the biology concept understanding test and perception questionnaire will be analyzed using descriptive and inferential statistics.

- a. **Descriptive Statistics** used to describe the average test score of students' understanding and perception of learning media.
- b. **T-test** used to analyze the difference between the average test scores between the experimental group and the control group. The T-test was conducted to test whether there was a significant difference in the understanding of biological concepts between students who used interactive learning media and those who used conventional methods.
- c. **Questionnaire Analysis** using frequency analysis to describe students' perceptions of interactive learning media, as well as to see to what extent the media can increase student engagement and understanding.

### Reliability and Validity of Instruments

To ensure the reliability of the instrument, the biology concept understanding test and questionnaire were piloted on a group of students who were not involved in the main study. The results of the pilot test were used to calculate the reliability coefficient using the Cronbach's Alpha formula. The validity of the instrument was carried out by asking for the opinions of biology material experts and education experts to assess the suitability of the test questions with the competencies that students must master and the relevance of the questionnaire items to the aspects being measured.

### Research Ethics

This study followed the applicable ethical procedures. All participants were given clear information about the purpose of the study, the procedures to be followed, and the right to withdraw from the study at any time without any consequences. In addition, the confidentiality of students' personal data and research results was well maintained. All students involved in the study gave their voluntary consent to participate in this study. With this approach, it is hoped that the research can provide a clear picture of the influence of the use of interactive learning media on the understanding of biology concepts in secondary schools.

## 3. RESULTS AND DISCUSSIONS

Based on the methods that have been explained, the results of this study indicate a significant effect of the use of interactive learning media on the understanding of biological concepts in secondary schools. The results obtained include data from the biological concept understanding test and student perception questionnaires. The following is a detailed description of the research results:

### Biology Concept Understanding Test

A comprehension test consisting of 30 multiple-choice questions was given to both groups after four weeks of learning. The questions covered topics such as ecosystems, genetics, organ systems, and other biological processes.

- a. **Experimental Group (Interactive Learning Media)**
  - 1) Average test score: 85.6 (with a standard deviation of 4.3)

- 2) Score range: 80-92
  - 3) Highest score: 92
  - 4) Lowest score: 80
- b. **Control Group (Conventional Learning)**
- 1) Average test score: 72.1 (with a standard deviation of 5.6)
  - 2) Score range: 65-78
  - 3) Highest score: 78
  - 4) Lowest score: 65

### Statistical Analysis

T-test for two independent samples showed a significant difference between the experimental and control groups with a p value  $<0.05$ . These results indicate that the use of interactive learning media has a positive effect on students' understanding of biology concepts in secondary schools. The experimental group using interactive learning media obtained a higher average score compared to the control group using only conventional learning methods. This shows that interactive learning media can improve the understanding of biological concepts more effectively.

### Student Perceptions of Interactive Learning Media

After the test, students in both groups were asked to fill out a questionnaire that measured their perceptions of the learning that had taken place. This questionnaire focused on aspects such as student engagement, comfort with media use, and effectiveness of media in learning biology.

### Experimental Group Questionnaire Results:

- a. **Student Engagement:**
  - 1) 92% of students feel more involved in learning using interactive media compared to conventional learning.
  - 2) Students stated that the simulations and applications used made it easier for them to understand abstract concepts in biology, such as the process of photosynthesis and the role of microscopes in the study of cells.
- b. **Satisfaction with Learning Media:**
  - 1) 88% of students are satisfied with learning using interactive media and think that this media makes learning more interesting and enjoyable.
  - 2) 85% of students stated that this media helped them understand biology material better and more deeply.
- c. **Ease of Access and Use:**
  - 1) 85% of students felt that interactive learning media was easy to access and use.
  - 2) 80% of students felt more motivated to learn biology after using this media.

### Control Group Questionnaire Results:

- a. 55% of students in the control group stated that they felt that learning with conventional methods was less interesting and often monotonous.
- b. 70% of students find it difficult to understand some of the more complex biology concepts without the aid of visual or interactive media.

### Learning Observation

During the implementation of learning, observations were made on both groups by the researcher. The following are the findings of the observation results during the learning process:

- a. **Experimental Group (Interactive Learning Media):**
  - 1) Students actively discuss and collaborate using learning media, such as simulation applications and interactive videos. They are able to explain the material they have learned using deeper concepts and can relate the material to real-life examples.
  - 2) Observations show that students are more enthusiastic in following learning materials about ecosystems and genetics because of the visualizations offered by interactive media.

b. **Control Group (Conventional Learning):**

- 1) Students appear more passive and mostly follow learning through lectures and textbook-based teaching.
- 2) When given practical assignments, students appear less enthusiastic and have difficulty connecting theory with practice.

**Observation of Student Learning Outcomes in Practical Work**

Students in the experimental group who used interactive learning media also showed better abilities in conducting experiments and understanding practical materials. Examples of experiments conducted are experiments on photosynthesis and genetic inheritance.

a. **Experimental Group:**

- 1) After participating in an interactive simulation of photosynthesis, students are able to explain the steps of photosynthesis more clearly and demonstrate a deeper understanding of the process.
- 2) Students also demonstrated higher skills in experiments on genetic inheritance, because they were familiar with simulations that visually illustrated the process.

b. **Control Group:**

- 1) Even though they conducted experiments with the available tools and materials, students appeared to have difficulty explaining the results of their experiments in relation to the theories they had learned.

**Analysis of Learning Outcomes**

Based on the test results and observations, it can be concluded that interactive learning media plays an important role in improving the understanding of biology concepts in high school. Learning using interactive media allows students to not only passively obtain information, but also develop critical thinking and problem-solving skills. Students who use interactive learning media are more actively involved in the learning process and are able to relate theory to real-life examples. Students who use conventional learning methods, although they can follow the material well, tend to be more passive and have difficulty understanding complex concepts. This shows that although conventional learning is still relevant, the use of interactive learning media can be a more effective method in improving students' understanding of biology.

**Discussion**

The results of this study provide strong evidence of the positive influence of the use of interactive learning media on the understanding of biology concepts in secondary schools. Based on data obtained from comprehension tests, student perception questionnaires, and observations during learning, several things can be stated related to the findings of this study.

**The Influence of Interactive Learning Media on Understanding Biology Concepts**

The results of the biology concept understanding test showed that the experimental group using interactive learning media had significantly higher scores compared to the control group using conventional methods. This is consistent with the findings reported by several previous studies showing that interactive learning media can improve students' understanding of subject matter that is difficult to understand visually and abstractly, such as concepts in biology (Kuswanto, 2019; Utami & Setiawan, 2020). Interactive media, such as simulation applications and learning videos, provide clear visualizations and allow students to directly see biological processes that cannot be explained only with words or pictures in textbooks.

Experimental group students were able to understand concepts such as photosynthesis, genetic inheritance, and ecosystems better, proving that the use of technology in learning can help them overcome difficulties in understanding complex materials. This also shows that interactive learning media not only enriches the subject matter but also improves students' ability to connect theory with more real practices.

### **Students' Positive Perceptions of Interactive Learning Media**

The questionnaires filled out by the experimental group students showed very positive results regarding the use of interactive learning media. Most students felt more involved and motivated in the learning process. This can be explained through the constructivism theory which emphasizes the importance of active and interactive learning experiences. According to this theory, students learn better when they can interact directly with the material being studied, not just listening to lectures or reading texts. The use of interactive media allows students to learn independently, collaborate, and get direct feedback, which increases their involvement in the learning process.

In addition, the level of student satisfaction with interactive learning media also shows that this media is considered very effective in helping them understand concepts that are difficult to understand with traditional learning methods. This is in line with research by Sukmawati (2018), which shows that technology-based media can make learning more interesting, effective, and motivate students to learn.

### **Improving Practical Skills and Concept Application**

Observations of the students' practical skills in the experimental group also revealed that they were better able to apply the theories they had learned to practical experiments. For example, when studying photosynthesis, students in the experimental group were able to explain the process well and relate it to the experiments they were conducting. They also showed better skills in applying knowledge about genetic inheritance in practical experiments, thanks to the simulations they had previously learned.

Unlike the control group, which relied solely on textbooks and conventional teaching, the experimental group was able to visualize and understand more abstract concepts more easily. This suggests that interactive media can help students not only understand theory but also apply it practically in scientific activities or experiments.

### **Difference between Conventional Learning and Interactive Learning**

Conventional learning applied to the control group showed limitations in improving students' understanding, especially in abstract materials that require visualization. Although lecture and textbook methods remain relevant in education, the results of this study indicate that technology-based learning, such as interactive learning media, is more effective in improving students' understanding of biology concepts that are difficult to master through conventional approaches.

The control group tended to be more passive in participating in learning, and most students relied on direct instruction from the teacher and the material contained in the textbook. This led to decreased student engagement in the learning process and reduced opportunities for independent exploration that could enrich their understanding.

### **Implications for Educational Practice**

This study provides important implications for educational practice, especially in teaching biology in secondary schools. First, the use of interactive learning media can be a very effective tool to improve students' understanding of complex biological concepts. Therefore, the integration of technology into the biology education curriculum needs to be encouraged, by providing training to teachers so that they can utilize this media optimally.

Second, the results of this study indicate that the use of interactive learning media can increase student engagement and motivation, which are important factors in achieving educational goals. Therefore, schools should consider investing in technology that supports interactive learning and provide appropriate training for teachers.

## **4. CONCLUSION**

Based on the results of the research conducted, it can be concluded that the use of interactive learning media has a significant influence on improving the understanding of biological concepts in secondary schools. Students who use interactive media show better understanding in biological materials compared to students who use conventional learning methods. This is reflected in higher test scores, greater involvement in learning, and higher satisfaction with the learning methods used. In addition, interactive learning media has been proven to increase student motivation, facilitate understanding of complex concepts, and support practical skills in biology. Although conventional

learning remains relevant, the use of technology in learning provides a more in-depth and effective experience in the learning process. Overall, this study suggests that the use of interactive learning media be more widely implemented in schools, especially in biology teaching, to improve the quality of learning and student learning outcomes.

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