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Development of Interactive Learning Media through Chat Bots on Reproduction Material in Elementary Schools

Kusyuliarto[1], Budi Murtiyasa[1,*], Anatri Desstya[1], Laili Etika Rahmawati[1]

[1] Master of Elementary Education, Faculty of Teacher Training and Education, Universitas Muhammadiyah Surakarta, Surakarta, Indonesia

[*] Corresponding author: budi.murtiyasa@ums.ac.id.me

Abstract

Purpose: The purpose of this study was to describe the conceptual understanding ability of elementary school students in Surakarta in learning Natural and Social Sciences (IPAS) through the Chat Bot application. The type of research in this article is development through the ADDIE model.
Methodology: The type of research in this article is development through the ADDIE model. The subjects of this study were grade VI teachers, principals, and 114 grade VI students of Sampangan, Wiro Paten, and Kedung Lumbu State Elementary Schools, Pasar Kliwon District, Surakarta City. The data obtained related to the Chat Bot application were declared valid by two validators. Data collection techniques consisted of questionnaires and interviews, for data analysis through interview results, observation results, percentages and average scores.
Results: The results of this study showed an average based on five indicators that were very good. The indicator interpreted with an average of 2.43 good categories. The indicator gave examples with an average of 2.69 very good categories. The indicator was classified with an average of 2.90 very good categories. The indicator drew conclusions with an average of 2.72 very good categories. The indicator explains with an average of 2.86 very good categories. The average of the five indicators is 2.72 very good categories.
Applications/Originality/Value: The Chat Bot application in learning science reproduction in Elementary Schools in Surakarta is considered effective because it is able to improve the understanding of abstract concepts to be more real and easy to understand.

Introduction Section

Information and communication technology reform has brought significant changes in the aspect of education. The use of technology in learning has grown rapidly in recent decades, from the introduction of computer-based software to audio-visual media (1). Artificial intelligence or AI, is the latest innovation in educational technology that produces interactive and adaptive learning media, one of which is ChatBot AI (2). Chat Bot AI presents learning media that is not only informative, but also interactive. According to (3) ChatBot AI as a software application that allows people to interact with each other online via text or text-to-speech. Chat Bot AI can act as a virtual assistant in education, providing material explanations, answering questions, and providing practice questions to students. ChatBot AI brings many opportunities and challenges to Education, especially at the Elementary School level.

Students' knowledge needs to be improved along with the demands of the digital era, so that the quality of learning provided is able to form their basic knowledge. One of the learning in elementary school that includes concepts to understand natural and social phenomena that occur in everyday life is the Science Lesson (4). However, based on the results of observations that have been carried out in Sampangan, Wiro Paten, and Kedung Lumbu State Elementary Schools, problems were found in grade VI students in science learning. These problems occur due to the lack of interactive learning media. This resulted in students being less active in participating interactively, so they had difficulty understanding abstract concepts (5). In line with (6) which concluded that the lack of learning media facilities provided by schools was the main problem of students' low conceptual understanding of science learning.

Science lessons cover material with abstract concepts that are difficult for students to understand, such as the human digestive system (7). Improving understanding of concepts related to reproduction material is considered important, because it is basic science and is widely applied in everyday life. In line with (8) conceptual understanding is a higher level of output than just knowledge, because it requires a process of knowing and understanding more deeply. Based on the problems that have been explained, Chat Bot AI based on artificial intelligence is a potential solution to answer learning problems in the current information era. This is reinforced by the opinion (9) that AI ChatBot-based learning is a growing field of study. AI Chat Bots can help teachers manage classes more effectively, as they have the ability to handle basic questions and provide direct guidance to students. It also allows students to interact with technology and can increase

student engagement in learning in various subjects. According to previous studies by (10) stated that the use of technology in learning can increase student engagement by up to 30% compared to conventional learning approaches.

There are several previous studies that have been conducted by researchers related to the development of interactive learning media through Chat Bot AI. First, the results of research in Greece on the use of AI chatbot technology for interactive ICT-based learning, can be integrated to learn foreign languages and cultural content simultaneously (11). Second, the results of research in Hong Kong show that the use of AI chatbot technology for language learning is able to encourage affective communication skills (12). Third, the results of research in Indonesia show that the use of Chatbots integrated into social media can help students who have difficulty learning English (13). Fourth, the results of research in Taiwan on the application of AI chatbots for learning can improve learning achievement and self-efficacy in the field of nursing (14). Fifth, the results of research in Turkey on the application of the AI Chatbot application in 5th grade science learning on material on changes in form were able to provide a positive contribution to the learning process of students (15).

Different from previous studies, this study developed an AI ChatBot in the form of Smojo AI as a learning medium for science subjects on vegetative reproduction sub-chapter to improve students' conceptual understanding. The Smojo AI application developed by the researcher is a technology-based learning media that is bite-sized, simple, and fun with an attractive appearance. Smojo AI is equipped with features to display learning materials interactively, practice questions, pretests, and posttests. This feature allows students to more easily understand the concept of the material through visualization, evaluate their initial abilities, and monitor learning progress through an integrated posttest. Students can carry out learning activities based on images and audio which are part of the features in the Smojo AI application that we developed. This was not found in previous studies.

The purpose of this study was to develop the conceptual understanding skills of several Elementary School students in Surakarta in learning Natural Sciences and Social Sciences (IPAS) through the Smojo AI application. Through this research, it is hoped that interactive learning media based on Smojo AI can be an effective solution to improve the quality of science learning in elementary schools, as well as prepare students to face challenges in the digital era.

Research Methods

This study uses the Research and Development (R&D) method. Hanafi (2017) explains that R&D is a method for making products and then testing the effectiveness of the method. The research design used refers to the ADDIE research and development media, namely Analyze, Design, Development, Implementation, Evaluation. The stages in this research can be seen in Figure 1.

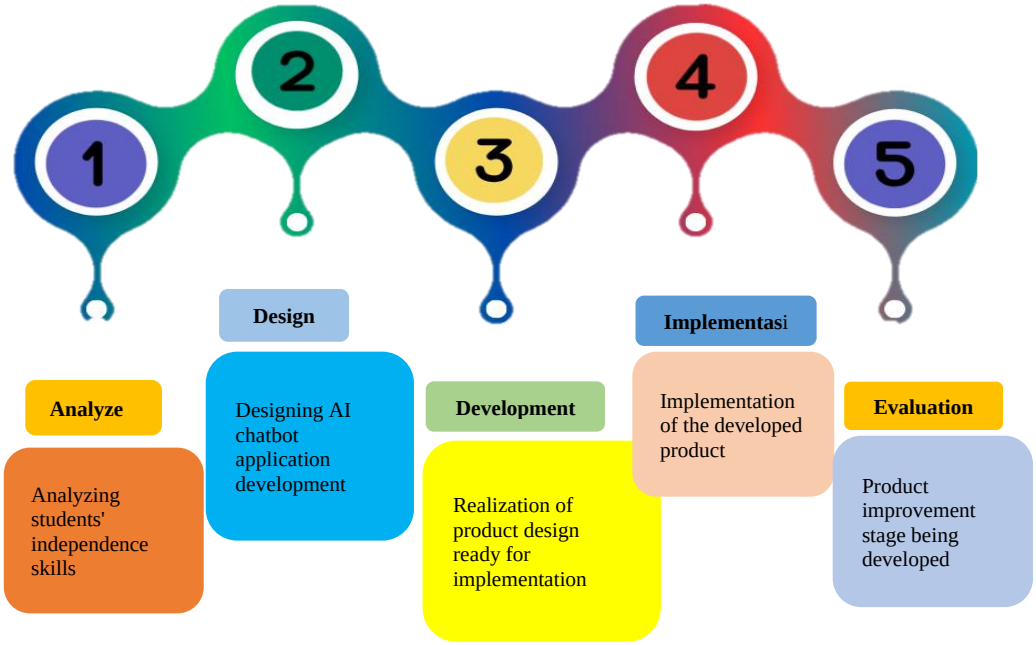


Figure 1. Smojo AI Application Product Development Stages

Figure 1 shows the stages carried out in this study, which can be described as follows. The analyze stage, collecting data on constraints, learning needs and characteristics of students related to the material on reproduction in Elementary Schools. The design stage designs an interactive learning media framework using an AI chatbot. The development stage develops a chatbot prototype that functions according to the design, followed by the editing process until the finishing

stage. The implementation stage applies the product that has been developed into the classroom, then makes adjustments based on the implementation results. The evaluation stage is carried out by experts and users, after being evaluated by media experts, it is then revised again until the media is considered final and ready to be implemented.

The subjects of this study were grade VI teachers, principals, and 114 grade VI students of Sampangan, Wiro Paten, and Kedung Lumbu State Elementary Schools, Pasar Kliwon District, Surakarta City, who had used the Smojo AI application learning media for animal reproduction material, vegetative sub-chapter. Data collection was carried out through direct action, as well as interviews with two students randomly. The object of the research material was learning interest with a formal object in the form of a questionnaire on understanding the concept of reproduction material. Data were obtained through the results of a questionnaire on understanding the concept of vegetative reproduction material, which contained questions according to the indicators. Indicators of understanding the concept are categorized: 1) interpreting, 2) giving examples, 3) grouping, 4) drawing conclusions, 5) explaining (16). Data collection was conducted using three techniques, namely questionnaires, interviews, and documentation. The questionnaire contained questions regarding the understanding of the concept of the material that were closed, using a Likert scale of 4, categorized from 4 to 1 sequentially. The description is as follows: "Strongly Agree", "Agree", "Disagree", and "Strongly Disagree".

Efforts to strengthen the data on filling out the questionnaire and to find out the opinions of students were conducted by interviews after the learning was completed. The Smojo AI Application learning instruments and media were first tested for their validity using the Aiken value test and reliability test to obtain valid and reliable results by two experts. The validation process of the instrument and learning video used Inter-Raters Cohen's Kappa and Cohonen Validity by Aiken's Value. The results showed that the points listed on the instrument were said to be valid and could be used in developing students' conceptual understanding of the human digestive system material. There are three data analysis techniques, namely data reduction, reviewing data and drawing conclusions.

Results and Discussion

The study has been conducted for two weeks. Before implementing the Chat Bot application on grade VI students, a validity test was first conducted by two experts on the Chat Bot application, especially in science learning. Based on the suitability and completeness indicators, it shows high validity, there is a suitability of the material in the Chat Bot application, containing images with the material on vegetative reproduction in the sub-chapter that is coherent and complete. The second indicator of the quality of content and images shows high validity criteria, the Chat Bot I application is in accordance with the characteristics of students, easy to understand, so that it can improve students' understanding of concepts. The Communicative Indicator shows high validity, communicative language so that students can understand the material displayed in the Chat Bot application. These results can be seen in Table 1 and Table 2.

Table 1. Validity results of the Chat Bot application from media experts

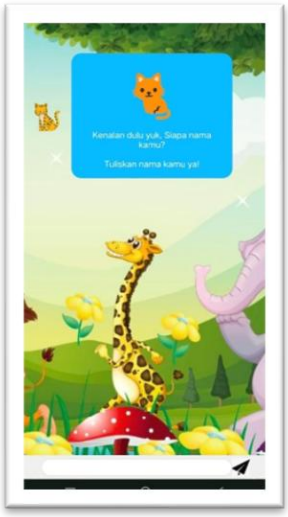
No	Indicator	Mean	Description
1	Suitability and completeness of materials	0,85	High validity
2	Software Eligibility	0,87	High validity
3	Language Eligibility	0,88	High validity
	Accumulated Average	0,86	High validity

Table 2. Results of material validation from material experts

No	Indicator	Mean	Description
1	Suitability and completeness of materials	0,88	High validity
2	Software Eligibility	0,89	High validity
3	Language Eligibility	0,88	High validity
	Accumulated Average	0,88	High validity

The implementation of student learning is carried out by implementing the Chat Bot application learning media on the vegetative sub-chapter propagation material via smartphone so that students can access learning anytime and anywhere. The Chat Bot application is designed to provide explanations with informative conversation formats, interactive quizzes,

and simple simulations that increase active student participation. Chatbot has enormous potential to improve teaching and learning (17). Contains explanations of the material through interactive Q&A according to questions asked by students. AI technology in education helps many things, including direct assistance, fast access to information, better learning outcomes, and enjoyable learning experiences. The appearance of the Smojo AI application can be seen in figures 2, 3, 4, and 5.



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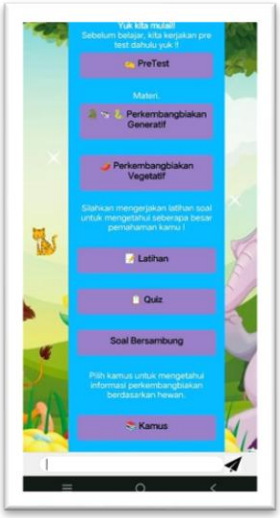

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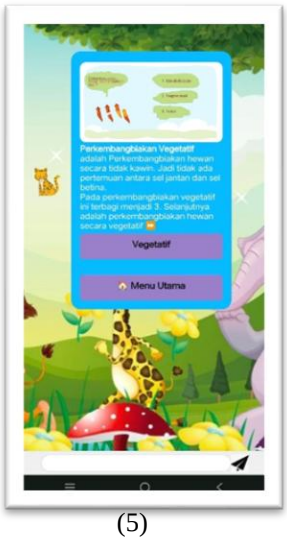
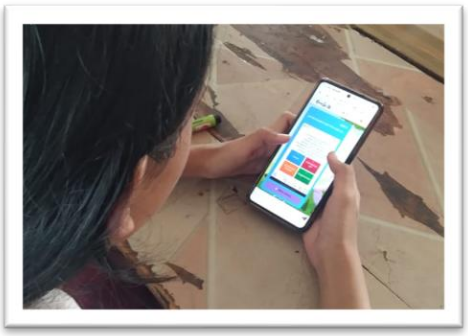


(5)

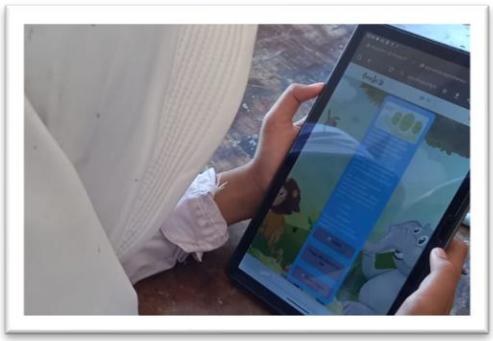
Figure 2, 3, 4, dan 5. The appearance of the Smojo AI application

Based on images 2, 3, 4, and 5, there are images displayed in the Chat Bot Application as visual media, making it easier for students to understand the concept of the material presented. Students become more excited, enthusiastic, and interested in learning because they do not feel bored with conventional learning that is only centered on the teacher. In line with (18) Student involvement is essential to enable them to have learning experiences that can lead to change and increase knowledge. Student involvement in accessing the Smojo AI application can be seen in figures 6, 7 and 8.



(6)

(7)



(8)

Figures 6, 7 and 8. Students access the Smojo AI Application

The results obtained from the data from the questionnaire on understanding concepts through the Chat Bot Application learning media and interviews. Show that the interpreting indicator is included in the good criteria, students are able to re-explain the material in their own words, and can connect new information with the knowledge they already have. The second indicator gives examples showing very good criteria, students are able to convey relevant and varied examples according to the concepts being studied. The third indicator groups shows very good criteria, students are able to group objects or concepts based on characteristics or properties that are in accordance with the predetermined criteria, although they still need a little help in explaining the reasons for the grouping in detail. The fourth indicator draws conclusions showing very good criteria, students are able to integrate the concepts that have been studied to produce logical conclusions, the fifth indicator explains showing very good criteria, students are able to describe concepts clearly, use the right terms, and connect the knowledge that has been learned with relevant situations or contexts, so that others can understand the explanation well. These results can be reviewed based on Table 3.

Table 3. Results of analysis of indicators of students' conceptual understanding through Chat Bot.

No	Indicator	Mean	Description
1	Interpret	2,43	Medium
2	Giving Examples	2,69	High
3	Classify	2,90	High
4	Draw a conclusion	2,72	High
5	Explain	2,86	High
	Rata-rata Akumulasi	**2,72**	High

Good conceptual understanding has an interpreting indicator. Students have a good conceptual understanding if they are able to re-express the information obtained both verbally and in writing. (19). The interpreting indicators can be seen based on Table 4.

Table 4. Interpreting indicators

No	Indicator	Mean	Description
1	Students are able to identify important information	2,60	High
2	Students are able to explain concepts in their own language	2,50	Medium
3	Students are able to use information to solve problems	2,20	Medium

Students are interested in the Chat Bot learning media because there are animations and materials that are easy to understand. Learning takes place pleasantly with detailed explanations so that students can explore the material given. This is in line with the opinions of students in the following interviews, with "R" (Researcher) and "S" (Student).

R: "What do you think about the Chat Bot learning media in science learning?

S1: "Learning with Chat Bot is easier to understand and not boring"

S2: "It makes it very easy for us to learn independently, there are animation-based materials and practice questions that can make us learn gradually"

R: "You have learned about vegetative reproduction. In your opinion, what is vegetative reproduction?

S1: "Vegetative reproduction is a way for plants to reproduce without using seeds"

R: "Vegetative reproduction in plants is divided into how many?

S2: Into two parts, namely artificial and natural vegetative reproduction."

The second indicator is about giving examples. Based on an interview with the class teacher, he revealed that students will be more active when asked to give examples that are relevant to everyday life. The ability of students to give examples shows the extent to which they really understand the material being studied. (20). The Indicator of Giving Examples can be seen in Table 5.

Table 5. Indicator of Giving Examples

No	Indicator	Mean	Description
1	Students are able to provide relevant examples	2,60	High
2	Students are able to apply concepts in various situations	2,72	High
3	Students are able to explain the relationship between concepts	2,76	High

Students are able to mention and explain examples of plants that reproduce vegetatively, both naturally such as stem tubers, rhizomes, and shoots, or artificially such as cuttings and grafting.

R: "Based on the vegetative propagation material that has been studied, can you give an example of natural vegetative propagation?"

S1: "Yes, for example, stem tubers are in potatoes, rhizomes are in ginger, and shoots are in bananas]"

R: "That's a good example, then can you give an example of artificial vegetative propagation?"

S2: "Yes, artificial vegetative such as cuttings, grafting, bending, grafting or connecting, and attaching."

The third indicator is about classifying. This skill helps students understand the differences and similarities between objects or concepts, which are the basis of many subjects (21). Classifying indicators can be reviewed in table 6.

Table 6. Classifying Indicators

No	Indicator	Mean	Description
1	Students are able to classify objects or concepts	2,84	High

2	Students are able to classify concepts in various situations	2,88	High
3	Students are able to explain the basis of classification	3,00	High

Students are able to group plants that reproduce vegetatively, such as bulbs in shallots, roots in ginger, and shoots in bananas. Students are able to identify types of natural and artificial vegetative reproduction in various situations, such as planting cassava with stem cuttings or propagating roses through grafting. Students are able to explain that plant classification based on the method of vegetative reproduction is carried out because each plant has a different way of reproducing itself without seeds, such as through shoots, tubers, or cuttings. AI applications are believed to be able to support students in improving the learning process and achieving the expected educational goals (22). This is in line with the results of interviews conducted with students as follows.

R: "Have you ever seen plants that reproduce by budding anywhere?"

S1: "In my yard, there is a banana tree that reproduces by budding"

R: "Good! That's one example, Are there other examples of plants that reproduce vegetatively?"

S2: "Yes sir, ginger can reproduce by rhizomes'

R: "Exactly! Now, let's look at this AI learning media. With this simulation, you can see the difference in the way banana trees reproduce using buds and ginger using rhizomes. You can see the difference in environmental conditions such as soil or humidity needed by each plant. What do you think?"

S2: "This is interesting sir, we can immediately see how it grows in different conditions."

The fourth indicator is drawing conclusions. Conclusions play an important role in the learning process because they help students summarize the information they have learned, organize their thinking patterns, and focus their understanding (23). The indicators for drawing conclusions can be reviewed in table 7.

Table 7. Indicators for drawing conclusions

No	Indicator	Mean	Description
1	Students are able to draw conclusions from observation results	2,72	High
2	Students are able to draw conclusions from analysis of various concepts in various situations	2,84	High
3	Students are able to draw conclusions from information obtained through AI learning media	2,60	High

After seeing a simulation of how vegetative reproduction works in various plants, students can conclude which ones reproduce by means of shoots, tubers, or rhizomes, as well as the factors that influence the success of these methods. This is in accordance with the results of interviews conducted with students as follows.

R: "Today we will use AI learning media to learn more about vegetative reproduction in plants. After you are finished, I want you to be able to draw conclusions from the concepts you have learned in various situations. Who can explain first, what is vegetative reproduction?"

S1: "I, sir, That is a way for plants to reproduce without using seeds"

R: "Good! That's a good example. Now, how about we try to draw conclusions from different situations? Imagine environmental conditions such as dry or wet soil. What do you think, are there plants that can still reproduce vegetatively in those conditions?"

R: "Yes, sir, ginger can reproduce with rhizomes'

S2: "I don't think so, sir. From the simulation, I saw that plants like ginger are better suited to grow in moist soil because their rhizomes need a lot of water. So, in conclusion, the environment influences how plants grow."

The fifth indicator is the ability to explain. The ability to explain material is very important for elementary school students because it plays a role as a foundation in the development of critical thinking skills and effective communication (24). This helps to strengthen their understanding, because explaining something requires a deep understanding of the topic being discussed. The indicators for explaining conclusions can be reviewed in table 8.

Table 8. Indicators for drawing conclusions

No	Indicator	Mean	Description
1	Students are able to explain the process of the observed material	3,00	High
2	Students are able to explain the benefits of the observed material	2,88	High
3	Students are able to explain the relationship between the observed material and everyday life.	2,72	High

Students are able to explain the basic concept of vegetative reproduction in plants. They explain how shoots, tubers, and rhizomes play a role in natural vegetative reproduction. Students explain how cuttings and grafting are done as part of artificial vegetative reproduction. This is in line with the results of interviews conducted with students as follows.

P: "After studying the material on vegetative reproduction through the Smoho AI application media, can you explain what is meant by vegetative reproduction in plants??"
PD 1: "Vegetative reproduction is a way for plants to reproduce without seeds, using parts of the plant body, such as shoots or tubers"
P: "Exactly! Now, can you explain the difference between natural and artificial vegetative reproduction?"
PD2: “Natural vegetative propagation occurs without human assistance, such as shoots on bamboo or tubers on potatoes, while artificial vegetative propagation is done with human assistance, such as grafting or cuttings.’

Based on the presentation in Table 3, the average of the five indicators of understanding the concept of students at Sampangan State Elementary School through the Chat Bot learning media consisting of interpreting, giving examples, classifying, drawing conclusions, and explaining is 2.72 in the very good category. Based on these results, it can be concluded that students at Sampangan State Elementary School have good conceptual understanding skills supported by learning media through Chat Bot based on references from the five indicators.

Based on the research data, the interpretation indicator shows a good category, this proves that the implementation of the Chat Bot application in science learning is able to improve students' interpretation skills. Through interviews with students, it was revealed that there are animations, materials and simulations that are easy to understand so that learning takes place fun and students can explore the material given. This is able to improve students' interpretation skills (25).

The indicator of giving examples shows a very good category. This proves that students are better able to apply the concepts learned by learning using the Chat Bot application. They can provide relevant and varied examples according to the material, showing a deeper understanding compared to conventional methods (26). In addition, the use of interactive features and visualizations in the Chat Bot application helps students relate abstract concepts to real situations, making it easier for them to understand the material and provide appropriate examples.

The classifying indicator shows a very good category. Students are able to group objects or concepts correctly based on relevant characteristics, as seen in the interview session. They clearly explain the differences between natural and artificial vegetative propagation, and classify various types of plants according to their reproductive methods, demonstrating a deep understanding of the material being studied. Students can relate it to a broader context. For example, they can distinguish plants that reproduce through shoots and rhizomes around their environment. This confirms that the use of the Chat Bot application helps students improve their classification skills more systematically and deeply.

The indicator of drawing conclusions shows a very good category. Students are able to formulate conclusions logically and accurately based on the information they have learned, as expressed in the interview session. They can connect various concepts and phenomena learned with real situations, and draw conclusions from the results of their observations, for example the role of the environment in influencing the process of vegetative reproduction. This understanding shows that they not only understand the material in depth but are also able to apply this knowledge in different situations.

The Explaining indicator shows a very good category. Students are able to explain the material clearly using their own language in the interview session. They can explain the concept of vegetative propagation in detail, distinguish between natural and artificial propagation, and provide concrete examples to support their explanations. This shows that students not only understand the material, but are also able to convey the knowledge in a way that is easy for others to understand, this indicates a deep understanding of the concept and good communication skills.

Conclusion

Based on the results of expert validation and analysis of five indicators of conceptual understanding. The Chat Bot application in learning about science propagation is considered effective because it is able to provide visualization of abstract concepts to be more real and easy to understand. The results of the study revealed that the average overall ability to understand the concept of vegetative propagation of science students at Sampangan, Wiro Paten, and Kedung Lumbu Elementary Schools is in the very good category. Students who use the Chat Bot application in learning show higher interactive activity and involvement compared to conventional methods. This interactive media provides students with the opportunity to learn independently through question and answer features and simulations, which significantly improves their conceptual understanding during the learning process. Compared to the teacher-focused approach, this method has succeeded in increasing students' enthusiasm and motivation to participate more actively.

The Chat Bot application meets the valid criteria as evidenced by the assessment of two validators and is effective in improving students' conceptual understanding as evidenced by the analysis of the questionnaire sheet. This study has five indicators as a reference in testing students' conceptual understanding based on interpreting, giving examples, classifying, drawing conclusions, and explaining. This study is expected to provide a positive contribution to the development of interactive learning media in Elementary Schools, as well as being a reference for the development of other technology-based learning methods. In addition, further research is expected to explore other aspects of the use of Chat Bot applications and their impact on various subjects, as well as expand the scope of the research.

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