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Implementation of Interactive Learning Model Based on Learning by Asking with the Assistance of Virtual Mentors to Improve Learning Outcomes Students

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Abstract: This research aims to apply an interactive learning model based on asking questions with the use of a virtual mentor. The method used in this research is quasi-experimental. The research results showed that the validation scores for interactive learning media by material experts and media experts were respectively 72 and 58 in the very appropriate category. The results of learning media readability test were 82.18 in the very good category. The pretest result of students in control class was 48.6 while the posttest was 73.68. Experimental class, pretest score was 49.87 and posttest score was 80.76. The N-gain values for the control and experimental classes are 0.48 and 0.61 respectively. Based on the research results, it is known that student learning outcomes increased in both the control and experimental classes, but the increase in the experimental class was higher than in the control class. This is because the experimental class uses an interactive learning model based on learning to ask questions assisted by a virtual mentor. The conclusion of this research is that the implementation of an interactive learning model based on learning by asking with the help of a virtual mentor is effective in improving student learning outcomes.

Keywords: Interactive learning; Learning by asking; Learning Outcomes; Virtual Mentors

Introduction

The rapid development of science and technology in the modern era requires educators to continue to innovate, especially in learning that leads to 21st century skills. 21st century skills require the world of education and students to be able to apply technology in education. One type of technology that has been developing recently in the world of education is artificial intelligence technology (Martín-Gutiérrez et al., 2017). Technological developments in the world of education generally include the learning process, especially the use of learning media (Birgili et al., 2021). In the development process, the use of technology in the world of education requires teachers' abilities in designing and implementing learning media in the implementation of the learning process (Henriksen et al., 2018) while students are required to be able to use technology in the learning process (Permana et al., 2019). In the Global Digital Citizen Foundation, the abilities that students must master in the 21st century are the ability to solve problems in real time, creativity in the digital and non-digital world, high-level thinking skills, collaboration, communication and tolerance (Gürsoy, 2021).

The results obtained by students or students after completing certain learning packages are called learning outcomes (Uliyandari et al., 2019). There are three aspects of assessing student learning outcomes, namely aspects of the learning process (cognitive), skills (psychomotor), and attitudes (affective) (Tumulo, 2022). The cognitive aspect is related to intellectual learning outcomes which include six main aspects, namely knowledge, memory, understanding, application, analysis and evaluation (Schuster et al., 2020). The

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psychomotor aspect is related to learning outcomes which include students' skills and abilities in acting. Meanwhile, the affective aspect is related to assessing students' attitudes which includes five main aspects, namely acceptance, answers or reactions, assessment, organization and internalization (Widiantono, 2017). One way to improve student learning outcomes is through innovative and interesting learning (Uliyandari et al., 2022). This learning can be done by applying a learning model that suits the characteristics of students.

The learning model is a conceptual framework that can be used as a guide in carrying out an activity process (Sulastri, 2015). One model that can be used is the interactive learning model. The interactive learning model is a learning model that helps students understand the material and helps students to be able to solve the problems they face and improve their independent attitude in learning (Majid, 2014). This interactive learning model also emphasizes students' ability to ask questions and find answers to their own questions. Learning developed using this interactive learning model also really helps teachers in determining specific steps to collect, change and sort questions so that an integrated learning structure is formed (Widiyanto, 2020).

According to Majid (2014), interactive learning has seven characteristics, namely a variety of group, classical and individual activities, a high level of mental involvement, both students' thoughts and feelings, the teacher's role as resource person, facilitator and manager. A democratic class, implementing varied and multidirectional communication patterns, as well as a class atmosphere that is flexible, democratic, challenging, and remains controlled by the goals to be achieved, has the potential to produce a more effective accompanying impact, which can be utilized inside or outside the classroom.

According to Widianto (2017) the interactive learning model is divided into seven stages, namely: preparation stage, at this stage the teacher and students select and search for information about the background of the topic, then collect sources related to the material to be studied. Initial knowledge stage, at this stage students try to express their initial knowledge about the topic to be studied. Meanwhile, the teacher tries to explore students' basic knowledge about the topic to be studied. At the exploration activity stage, the teacher provides an explanation of the topic to be explored. In exploration activities, students are involved in more depth regarding the topic to be studied. Student question stage, at this stage all students are invited to ask questions about the topic being studied. Investigation Stage, at this stage the teacher and students choose questions to be answered through investigation. Final knowledge stage, at this stage the knowledge of each student or group is collected and compared with the initial answers. Reflection stage, at this stage what has been tested or proven to be implemented and what still needs to be strengthened.

The interactive learning model based on Learning by Asking is a learning model that refers to interactions between students and educators, students and teachers, or also students and learning media through developing students' questioning skills. An interactive learning model based on asking questions can make students learn more enthusiastically and can increase students' self-confidence when expressing their opinions (Raztiani et al., 2019). Learning by asking questions allows students to ask questions actively during the learning process (Kariadi et al., 2018). Thus, this learning model has the potential to be applied in an effort to improve student learning outcomes.

Apart from interesting learning models, the use of learning media is also one of the things that greatly influences student learning outcomes. The use of learning media that keeps up with the times can help students have extensive experience in science (Nitsche et al., 2023). Apart from that, the use of digital technology-based learning media is also very easy to update according to the demands of the times (Flórez-Aristizábal et al., 2019). The use of innovative and technology-based learning media is expected to increase students' interest, motivation and activeness in learning so that it has an impact on improving learning outcomes (Lim et al., 2021). Student activity in learning can be seen from student involvement in the learning process such as asking questions, giving responses, working together, discussing, when the teacher delivers material, students listen well, carry out experiments, and carry out mental activities in solving problems (Engeness, 2021).

The media that can be used to support the interactive learning model is Virtual Mentor. Virtual mentor-based learning media is learning media that adopts artificial intelligence so that it can guide the learning process like a virtual mentor. One of the advantages of this virtual mentor is that it can carry out two-way communication or ask questions to students who use it. This virtual mentor application adopts AI (Artificial Intelligence) technology so that it is able to respond to the user's voice and can provide answers to questions asked by students (Knox, 2020). Virtual mentors also allow users to explore unlimited information (Pahlevi et al., 2020). Virtual mentor technology also allows students to learn anytime and anywhere (Santoso, 2021). However, unfortunately, currently the use of virtual mentor applications as a learning medium is still very limited, especially in the world of education in Indonesia.

The science management and laboratory management course is one of the mandatory subjects in the FKIP Unib science education study program and the UIN Fatmawati Bengkulu science education study program. This course is dominated by practical activities in the laboratory, therefore complete laboratory equipment and special practical time are needed to train students' understanding. The optimal implementation of practicum activities is also determined by the availability of facilities and infrastructure that can support practicum activities (Hadisaputra et al., 2017). In order to overcome the limited practicum time and the lack of complete facilities and infrastructure in the science laboratory, an Android-based application is needed to guide students through virtual learning using an Android-based application (Saputra et al., 2021).

Therefore, this research was conducted with the aim of implementing an interactive, questioning-based learning model with the help of a virtual mentor to improve the learning outcomes of science education students. Special material for introducing science laboratory equipment in science engineering and laboratory management courses.

Method

This research was carried out in the odd semester of 2022/2023 in the Science Education Study Program, FKIP, Bengkulu University and the Science Education Study Program, Faculty of Tarbiyah and Tadris, UIN Fatmawati Soekarno Bengkulu. The research samples were undergraduate students of Science Education, FKIP, Bengkulu University who took engineering and science laboratory management courses and undergraduate students of Science Education, Faculty of Tarbiyah and Tadris, UIN Fatmawati Sukarno Bengkulu who took science laboratory management courses.

This research is a type of quasi-experimental research with a pre-test post-test control group design. First of all, both groups, both the experimental class and the control class, will receive a pre-test. Then the experimental class will be given special treatment by the researcher, while the control class will not be given any treatment. Next, both groups carried out a post-test. The pre-test and post-test scores were used to see whether the treatment given to the experimental class had an effect on improving student learning outcomes and how big the effect was when compared to the control class which did not receive treatment.

The design notation is as follows, the letter O represents observation of the impact of treatment (measurement of the dependent variable), in this study, namely pre-test and post-test; X is the treatment, ----- (dotted line) shows the placement of subjects that are not random so that the group formed begins with the letter NR (Non-Random Assignment) (Hastjarjo, 2019).

NR O1 X O2

NR O1 O2

Figure 1. Design of control group and experimental group (Hastjarjo, 2019)

The instruments used in this research were questionnaires and test questions in the form of pretest and posttest evaluation questions. The questionnaires used in this research include validation questionnaires by material experts and media experts, as well as student response questionnaires to the learning media used. This assessment is used to ensure that the virtual mentor learning media is suitable for use in supporting the learning process by implementing an interactive learning model based on learning by asking in the experimental class. Meanwhile, pretest and posttest evaluation questions are used to see improvements in student learning outcomes before and after the learning process in both the control and experimental classes.

The questionnaire data analysis technique was carried out by changing qualitative data into quantitative data by converting to a 5 scale table. Meanwhile, student learning outcome data was analyzed by carrying out a gain score test to see the increase in student learning outcomes in both the control and experimental classes.

Result and Discussion

Development of Interactive Learning Media with the Help of Virtual Mentors

The development of learning media aims to help students understand the material presented by lecturers, especially in the introduction of laboratory equipment. The development of learning media is carried out by collecting materials used in making learning media such as syllabus, lesson plans, material about the introduction of laboratory equipment and also evaluation questions. Discussions with allied lecturers were also carried out by researchers in order to obtain quality learning media.

Based on the results of the discussion, an interactive learning media based on virtual mentors was created to improve student learning outcomes in the Science Education FKIP, University of Bengkulu. Making learning media is done by making story boards and designing learning media scenarios. Story boards are carried out by designing the interactive learning application layout while learning media scenarios are carried out in the form of compiling evaluation questions. The process of making interactive learning

media is carried out based on the design that has been made. The following presents several views of the virtual mentor-based interactive learning media that have been designed:

Home page, contains the menu button which is used to enter the main menu page. On this page is also added the symbol of the University of Bengkulu and the symbol of UIN Fatmawati Soekarno as the university of origin of the researchers. This page is used to attract students' attention so that they are interested in learning the material in the learning media.

Figure 2. Star page view

Home or main menu, in this menu the user can access all menus in the learning media. The menus contained in this main menu are learning CPL and CPMK, materials, evaluation (questions), about me, and the application share menu which is used to share applications via QR code.

Figure 3. Home page view

CPL and CPMK, this page contains CPL, CPMK, sub CPMK, and learning objectives so that students know the achievements and learning objectives that must be achieved after carrying out learning using the interactive learning media.

Figure 4. CPL and CPMK pages

Material, this page contains the material presented in the learning media. The material delivered through this application is an introduction to laboratory equipment.

Figure 5. Material Pages

Evaluation, this page consists of evaluation questions totaling 10 multiple choice questions. These

questions are used to test students' understanding of the learning material that has been delivered.

Figure 6. Evaluation pages

QR Code, used to distribute applications to mobile users (students), students only need to scan the application's QR code, then students can already install the application.

Figure 7. QR Code Pages

Ask button, this button can be used by students to ask questions related to applications that are still not understood after carrying out the learning process. This question can be asked directly (orally) or in writing.

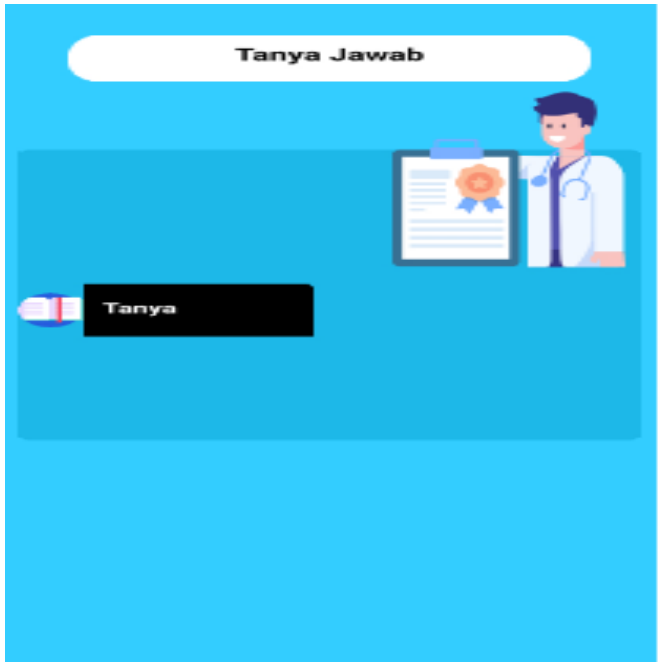

Figure 8. Ask button

AI (Artificial Intelligence) technology, artificial intelligence which is able to make this application able to speak so that users of this application seem to be guided by someone in carrying out the practicum, this voice assistant is called AI Assistant, and this AI technology also allows interactive learning media applications to be able to detect voice, so users can communicate and ask and answer questions with the AI assistant as a virtual mentor. Artificial Intelligence technology itself is computer technology or machines owned by humans that have artificial intelligence that can be adjusted according to human desires (Kharisma et al., 2023).

Testing the suitability of learning media is carried out by material expert validators and media experts. This learning media validation is carried out to see the validity of a learning media that has been developed (Pakaya et al., 2023). Validation by lecturers who are experts in learning materials focuses on two main aspects, namely the learning aspect (learning objectives, material delivery, and evaluation) and the material aspect (relevance of material and material selection). Meanwhile, media expert validation focuses on aspects of the appearance of learning media (text display, color combinations, images, and navigation buttons) and aspects of use (instructions for use, and interaction with the media). The validation results obtained from

material experts and media experts are converted into quantitative data by giving scores. The results of validation by these experts are also used as a reference for revising the product and improving it so that it becomes a learning medium that is suitable for use (Ananda et al., 2023). The results of the assessments by material experts and media experts are presented in Tables 1 and 2 respectively.

Table 1. The Results of Validation Material Experts

Assessment aspects	Number of items	Score obtained	Category
Material	10	40	Very worth it
Learning	7	32	
Amount	17	72	

Table 2. The Results of Validation by Media Expert

Assessment aspects	Number of items	Score obtained	Category
Appearance	10	40	Very worth it
Used	7	32	
Amount	13	58	

Based on tables 1 and 2 it is known that the material expert validator gives an assessment of 72 which if converted into percentages gets a score of 84.70% in the very worth it category. Similar results were also given by the media expert validator who gave a score of 58. If presented, the media expert's score was 89.23%, which is in the very decent category. Thus, the final result of the two validators is that interactive learning media based on virtual mentors is very suitable to be used as a support for learning with interactive learning models to improve student learning outcomes Based on tables 1 and 2, it is known that the material expert validator gave an assessment of 72 which, if converted into a percentage, obtained a score of 84.70% in the very feasible category. Similar results were also given by the media expert validator who gave a score of 58. When presented, the media expert score of 89.23% is included in the very feasible category. Thus, the final result of the two validators is that virtual mentor-based interactive learning media is very suitable for use as a learning support with an interactive learning model to improve student learning outcomes.

Based on the validation questionnaire by the material expert validator, it is known that the learning media developed is in the very suitable category because the learning media developed has learning objectives that are in accordance with CPMK engineering courses and science laboratory management, the material presented in this learning media is clear and coherent and relevant to learning objectives, the depth of the material presented is appropriate to the student's level of thinking, the use of communicative language, the material presented can motivate students, apart from that the learning media developed is also equipped with evaluation test questions to measure students' understanding of the material introducing science laboratory equipment that has been developed.

Meanwhile, according to media expert validators, the learning media developed is in the very feasible category because the learning media developed has a clear and neat text writing structure, has very good combinations and colors, and the navigation buttons are also arranged and can function very well. Healthy. Apart from that, the learning media developed also has very clear and very interactive instructions for using the media. This is in line with research conducted by Windawati et al. (2016) regarding the development of chembond interactive media as a medium for learning chemical bond material in the classroom in the very feasible category.

Readability of Interactive Learning Media Based on Learning by Asking with the Help of a Virtual Mentor

The readability test of the developed interactive learning media was carried out by distributing questionnaires to 68 students consisting of S1 Science Education students at Bengkulu University and students from the Tarbiyah and Tadris faculties of UIN Fatmawati Soekarno Bengkulu. The questionnaire contains 8 statement items. Following are the results of the readability questionnaire scoring that has been distributed to students.

Table 3. The Readability Results of Virtual Mentor Based Interactive Learning Media

Aspects of the statement	Percentage (%)	Category
Material wrinkles	82.31	Very good
Material attractiveness	83.33	Very good
The importance of the material	88.50	Very good
Ease of understanding the material	82.31	Very good
Easy to read text	78.22	Good
Siutability of animation with the material	82.31	Very good
Instruction for using media	80.22	Good
Ease of use of media	80.41	Good
Average	82.20	Very good

Based on Table 3, the highest score was given by students to the important aspects of the material with a score of 88.5% in the very good category. This shows that students consider the material introducing laboratory equipment to be very interesting and important to learn. Apart from that, students also considered the learning media developed to be very interesting and practical to use. Practical and interesting learning media are very

popular with students (Setiawaty et al., 2023). Meanwhile, the lowest score was in the text readability aspect with a score of 78.2% in the good category. A score in the good category shows that the text in the learning media developed is good, can be read and understood by students, but is still not optimal. This may be due to the fact that the appearance of the letters on the media is still considered small, making students have to pay close attention to the letters when reading the material on the learning media being developed.

Student Learning Outcomes after Implementing an Interactive Learning Model Based on Learning by Asking with the help of a Virtual Mentor

The differences in student learning outcomes can be seen from the student learning outcomes in the control class and the experimental class. The control class in this research is a class that in its learning process applies conventional learning methods or learning methods commonly used by lecturers in implementing the learning process in class. Meanwhile, the experimental class is a class which in implementing the learning process applies an interactive learning model based on learning by asking with the help of a virtual mentor. In this research, both the control class and the experimental class have gone through the homogeneity test stage so that it is declared that both classes are homogeneous and can be used in research. The samples from the control class and experimental class were a combination of science students from FKIP, Bengkulu University and science students from the terbiyah and tadris faculties of UIN Fatmawati Soekarno Bengkulu.

Based on the research results, it is known that there are differences between student learning outcomes in the control class and student learning outcomes in the experimental class. This difference can be seen from the results of the pretest and posttest which were carried out in both the control and experimental classes. The pretest and posttest data for the control class and experimental class can be seen in Figure 9.

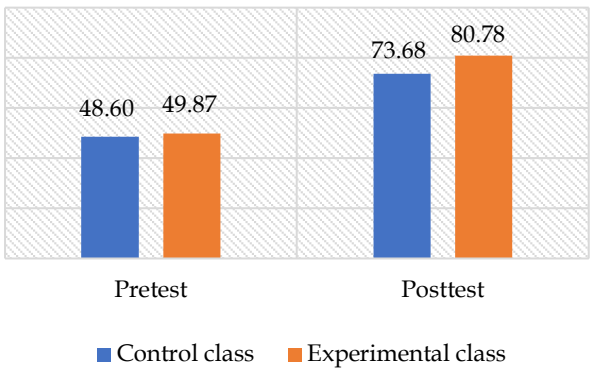

Figure 9. Differences in pretest and posttest results of students in the control class and experimental class

Based on Figure 9, it is known that both the control class and the experimental class experienced an increase in learning outcomes seen from the difference between students' pretest and posttest scores. In the control class, the average student pretest score on the introduction to laboratory equipment was 48.6, while the posttest score was 73.68. Meanwhile, in the experimental class, it was found that the student's pretest score was 49.87, while the posttest score was 80.78.

The magnitude of the increase in student learning outcomes in both the control and experimental classes can be seen by comparing the N-gain values in the control and experimental classes. A comparison of the N-gain values for the control class and experimental class can be seen in Figure 10.

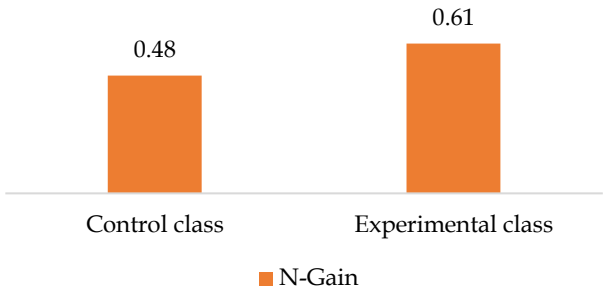

Figure 10. Comparison of the N-gain values of the experimental class

Based on the histogram above, it is known that the N-gain value for the control class is 0.48 which is included in the "medium" category and the N-gain value for the experimental class is 0.61 which is also included in the "medium" category. This shows that both the control class and the experimental class experienced an increase in student learning outcomes, only the increase in student learning outcomes in the experimental class using an interactive learning model based on asking questions with the help of a virtual mentor was higher when compared to the control class which used conventional learning methods. This difference in the increase in learning outcomes is due to the use of different treatments for each class (Yerimadesi et al., 2022). The high increase in learning outcomes in this experimental class shows that the interactive learning model based on questions and answers with the help of virtual mentors is more effective in increasing science education students' understanding of science engineering and laboratory management subjects, especially in the introduction to laboratory equipment. Apart from that, the use of Android-based learning media assisted by virtual mentors using smartphones can also strengthen students' conceptual understanding of the material they have studied (Setyoko et al., 2023).

The effectiveness of implementing an interactive learning model based on asking questions with the help of a virtual mentor in improving student learning outcomes is because the learning process is made more interactive so that students have the opportunity to ask questions and solve problems from the questions asked. Using different learning media than usual can also improve student learning outcomes (Alika et al., 2021). Apart from that, the use of virtual mentor-based learning media that was developed is also something new for students because it utilizes AI (Artificial Intelligence) technology so that it allows students to communicate with the media used. Communication can be done verbally, because the learning media developed can detect sounds and answer students' questions verbally, such as Google Assistant. Artificial Intelligence technology is the latest achievement in the world of computing so it is very effectively used to solve problems (Sugiharto et al., 2023). The use of AI-based learning media is also very effective in improving students' skills in the learning process so that it has an impact on improving student learning outcomes (Prananta et al., 2023). The use of interactive multimedia can also improve students' mastery of concepts and learning outcomes (Festiyed et al., 2023). By implementing interactive learning models and also interactive learning media based on virtual mentors, it can increase students' motivation and interest in learning so that students are more focused in participating in learning activities so that results student learning increases.

This is in line with the results of research conducted by Sumiyati (2017) regarding the application of the activity-based interactive learning model to improve the learning achievement of class VI students in PKN learning at SD Negeri 09 Kebawetan. The results of the research show that implementing learning using an interactive, activity-based learning model can improve learning achievement and understanding of concepts for class VI PKN students at SD Negeri 09 Kabawetan, Kabawetan District, Kepahiang Regency, Bengkulu Province.

Conclusion

Based on the research results, it is known that the learning outcomes of science education students in the control class and experimental class have increased, but in the experimental class the increase in student learning outcomes is greater, namely 0.61 in the medium category. This shows that the application of an interactive learning model based on asking questions with the help of a virtual mentor is effective in improving the learning outcomes of science education students.

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Author Contributions

M.U; Research coordinator, conceptual, methodology, material developer, implementation of learning models and learning media, drafting articles. N.W; Learning media developer, article draft review, validation and documentation. N.L; Validation, reviewing article drafts, data analysis, making story boards, and documentation.

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Conflicts of Interest

The authors declare no conflict of interest.

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