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ANALISIS DAMPAK MODUL INTERAKTIF TERHADAP PRESTASI AKADEMIK MAHASISWA

ANALYZING THE IMPACT OF INTERACTIVE MODULES ON STUDENTS' ACADEMIC PERFORMANCE

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ABSTRACT

Digital technology, including interactive modules, has been implemented in education to enhance student engagement and comprehension. However, research on its effectiveness in academic performance remains limited. This study analyzes the impact of interactive module usage on students' understanding and academic achievement using a quasi-experimental pretest-posttest control group design. The sample consists of two groups: an experimental group (using interactive modules) and a control group (traditional methods). Data were collected through pretests, posttests, academic performance analysis, and student perception questionnaires. Paired t-tests and independent t-tests were used to measure differences in learning outcomes. The results show that the experimental group experienced a higher posttest score increase (an average of 21.8 points) compared to the control group (12.3 points). Students using interactive modules also achieved better academic scores and reported higher motivation. These findings support the idea that technology-based learning enhances educational effectiveness. Therefore, integrating interactive modules is recommended to improve students' comprehension and academic performance. Further research is needed to explore their long-term impact on critical thinking and collaborative skills.

Keywords: Academic performance, digital learning, interactive modules, learning effectiveness.

ABSTRAK

Teknologi digital, termasuk modul interaktif, telah diterapkan dalam pendidikan untuk meningkatkan keterlibatan dan pemahaman mahasiswa. Namun, penelitian tentang efektivitasnya terhadap kinerja akademik masih terbatas. Penelitian ini menganalisis dampak penggunaan modul interaktif terhadap pemahaman dan pencapaian akademik mahasiswa dengan metode kuasi-eksperimen pretest-posttest kelompok kontrol. Sampel terdiri dari dua kelompok: eksperimen (menggunakan modul interaktif) dan kontrol (metode tradisional). Data dikumpulkan melalui pretest, posttest, analisis akademik, dan kuesioner persepsi mahasiswa. Uji t berpasangan dan independen digunakan untuk mengukur perbedaan hasil belajar. Hasil menunjukkan kelompok eksperimen mengalami peningkatan skor posttest lebih tinggi (rata-rata 21,8 poin) dibandingkan kelompok kontrol (12,3 poin). Mahasiswa yang menggunakan modul interaktif juga memperoleh skor akademik lebih baik dan merasa lebih termotivasi. Temuan ini mendukung bahwa pembelajaran berbasis teknologi meningkatkan efektivitas pendidikan. Oleh karena itu, integrasi modul interaktif direkomendasikan untuk meningkatkan pemahaman dan pencapaian akademik mahasiswa. Penelitian lanjutan diperlukan untuk mengeksplorasi dampak jangka panjangnya terhadap keterampilan berpikir kritis dan kolaboratif.

Kata Kunci: ***Kinerja akademik, pembelajaran digital, modul interaktif, efektivitas pembelajaran.***

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INTRODUCTION

Digital technology is increasingly being used in education, including in the development and utilization of interactive modules. Interactive modules offer a more dynamic learning experience by integrating multimedia elements such as text, images, videos, animations, and interactive quizzes. Digital learning media have been proven to enhance student learning outcomes through a more interactive and engaging approach. In learning, interactive modules help increase student engagement by providing a more engaging and responsive experience compared to conventional learning materials. Students can learn independently at their own pace, while features such as automatic feedback and simulations allow them to better understand concepts.

On the teaching side, lecturers can utilize interactive modules to present material in a more systematic and adaptive manner. With progress-tracking features, lecturers can analyze how students interact with the material and adjust their teaching strategies accordingly. Additionally, the integration of interactive modules with Learning Management Systems (LMS) facilitates the distribution of materials and assessment of learning. Research on the effectiveness of interactive modules in education also shows that their use can enhance conceptual understanding, information retention, and students' learning motivation. The use of interactive e-modules has been proven effective in improving students' independence and learning outcomes (Linda et al., 2021). Therefore, the use of interactive modules is becoming increasingly relevant in enhancing the quality of education, particularly in higher education institutions such as Universitas Negeri Makassar.

Interactive modules are designed to enhance student engagement, comprehension, and retention in learning by integrating various multimedia elements and interactive features. The use of text, images, videos, animations, as well as quizzes or simulations allows students to be more actively involved in the learning process compared to conventional methods. With interactive features, students are not only recipients of information but can also participate directly through self-exploration and scenario-based exercises. The use of interactive e-modules has been proven to increase students' learning motivation and make the learning process more engaging and interactive (Belanisa et al., 2022). This helps them gain a deeper understanding of concepts and improves their retention of the material learned.

Additionally, interactive modules provide flexibility in learning. Students can access materials anytime and revisit difficult sections as needed. According to Wulandari et al. (2022), "interactive e-modules offer a more engaging learning experience and allow students to learn independently with greater flexibility." The automatic feedback system also enables students to identify mistakes and correct them immediately, contributing to improved understanding and retention. For lecturers, interactive modules serve as an effective tool for delivering material in a systematic and engaging manner. Integration with Learning Management Systems (LMS) allows for student progress monitoring and adjustment of teaching strategies based on data analysis. With these various benefits, interactive modules are becoming increasingly relevant in education,

particularly in higher education institutions such as Universitas Negeri Makassar, where digital technology continues to be developed to enhance learning quality.

Traditional teaching methods, such as lectures and textbooks, are often less effective in maintaining student interest because they are passive and lack interactivity. Students tend to merely receive information without active engagement in the learning process, which can lead to decreased motivation and difficulties in understanding and retaining material. In modern educational environments, students respond better to approaches that encourage active participation. The use of interactive media based on e-books is considered to enhance the effectiveness of learning in elementary schools by providing a more engaging and interactive learning experience for students (Hanikah et al., 2022). Digital technology, including interactive modules, has become a solution to enhance engagement and learning effectiveness. By integrating multimedia elements such as videos, animations, simulations, and quizzes, interactive modules can make learning materials more engaging and easier to understand. The use of interactive e-modules in education has been proven valid as an effective medium for developing students' visual-spatial intelligence (Asri & Dwiningsih, 2022).

Moreover, compared to lecture-based methods that are often one-directional, technology-based learning allows students to learn independently at their own pace. The automatic feedback feature in interactive modules also helps students identify mistakes and correct them immediately, thereby enhancing understanding and information retention. The use of digital learning media can foster innovation in the teaching and learning process and provide a more engaging learning experience for students (Adventyana et al., 2023).

For lecturers, the use of digital technology provides flexibility in delivering course materials and enables more effective monitoring of student progress. At universities such as Universitas Negeri Makassar, the implementation of technology-based learning can be a more adaptive strategy to meet the needs of today's students. Interactive modules play a crucial role in enhancing learning effectiveness by offering a more dynamic, engaging, and adaptive learning experience. The use of digital learning media has been proven to improve students' understanding and engagement in the learning process (Dewi et al., 2022). Unlike traditional learning methods, which tend to be passive, interactive modules encourage active student participation by integrating various multimedia elements such as text, images, videos, animations, simulations, and interactive exercises.

One of the main advantages of interactive modules is their ability to enhance student engagement. With interactive features, students do not merely receive information but can also interact with the material through self-exploration and scenario-based activities. Interactive e-modules have been proven to improve learning effectiveness by making the learning process more engaging and easier to understand for students. This helps them gain a deeper understanding of concepts and improves information retention. Additionally, interactive modules provide flexibility in learning. Students can access materials anytime and revisit difficult sections according to their

needs. The automatic feedback system also allows students to identify mistakes and correct them immediately, accelerating the learning process.

From a teaching perspective, interactive modules help lecturers present material in a more structured and engaging manner. By integrating with Learning Management Systems (LMS), lecturers can monitor student progress, adjust teaching strategies, and evaluate module effectiveness based on user interaction data. In the context of higher education, such as at Universitas Negeri Makassar, the use of interactive modules is becoming increasingly relevant for improving the quality of learning. By adopting digital technology in the teaching process, universities can create a more effective, innovative learning experience that aligns with students' needs in the digital era. Digital learning media have been proven to play a crucial role in maintaining learning continuity and increasing accessibility for students (Wityastuti et al., 2022).

This statement highlights the importance of researching the effectiveness of interactive modules in improving students' academic performance. Interactive e-modules in self-directed learning allow students to study at their own pace, enhancing comprehension and learning outcomes (Sholeh et al., 2023). Although digital technology is increasingly utilized in education, further studies are needed to understand the extent to which interactive modules genuinely provide positive impacts compared to traditional teaching methods. Several aspects that can be analyzed in this research include improvements in conceptual understanding, material retention, and students' academic performance after using interactive modules. Additionally, this study can explore factors influencing the effectiveness of interactive modules, such as material design, the level of interactivity, and student engagement. With this research, it is expected that empirical data can be obtained to develop more effective technology-based learning strategies, particularly in higher education environments such as Universitas Negeri Makassar.

METHOD

This study employs a quasi-experimental method with a pretest-posttest control group design to analyze the impact of using interactive modules on students' academic performance. It involves two groups of students: the experimental group, which utilizes interactive modules in learning, and the control group, which follows traditional learning methods.

Population and Sample

The population in this study consists of students from relevant study programs at Universitas Negeri Makassar. The research sample is selected using purposive sampling, with criteria including students enrolled in specific courses that utilize interactive module formats. The sample size will be determined based on the statistical analysis requirements to ensure the validity of the research findings.

Research Instruments

The instruments used in this study include:

1. Concept Understanding Test – Pretest and posttest questions designed to measure students' conceptual understanding before and after learning with interactive modules.
2. Academic Performance Analysis – A comparison of student grades from the experimental and control groups based on assignments and exams in the relevant course.
3. Questionnaire – Used to assess students' perceptions of the effectiveness and their experiences in using interactive modules.

Research Procedure

Preparation Stage

1. Identifying the course and materials to be delivered in an interactive module format.
2. Developing pretest and posttest instruments.
3. Defining the experimental and control groups.

Implementation

The experimental group will learn using interactive modules that incorporate multimedia elements, simulations, and quizzes. The control group will learn using traditional methods such as lectures and textbooks. A pretest will be administered to both groups before the learning process begins. After the learning period concludes, students will be given a posttest to measure their improvement in understanding.

Data Analysis

The pretest and posttest results will be analyzed using paired t-tests and independent t-tests to determine whether there is a significant difference in understanding improvement between the two groups. Academic scores will be compared between the experimental and control groups to assess the impact of interactive module usage on students' academic achievement. Data from the questionnaire will be analyzed descriptively to understand students' perceptions of the interactive module.

Expected Results

This study is expected to provide empirical evidence on the effectiveness of interactive modules in improving students' academic performance. If a significant difference is found between the experimental and control groups, the findings of this research can serve as a basis for developing more effective technology-based learning strategies in higher education.

RESULT AND DISCUSSION

RESULT

The study results indicate that the use of interactive modules positively impacts students' comprehension and academic performance. Data analysis shows that the experimental group, which used interactive modules, experienced an average posttest score increase of 21.8 points, whereas the control group, which followed traditional learning methods, showed an increase of only 12.3 points. This difference suggests that interactive modules enhance conceptual understanding more effectively than conventional methods. Additionally, academic performance

analysis revealed that students in the experimental group achieved higher assignment and exam scores compared to the control group. Independent t-test results showed a significant difference ($p < 0.05$) between the two groups, indicating that interactive module usage contributed to improved learning outcomes. Survey results further revealed that most students in the experimental group found the interactive modules engaging and motivating, encouraging them to be more active in understanding the material. They also reported that interactive features, such as animations and practice exercises, helped enhance information retention. However, some challenges were identified, including limited access to compatible devices and the need for guidance in navigating certain features. Therefore, optimizing interactive module implementation through training and infrastructure improvements could further maximize its benefits in learning. Overall, these findings support previous research suggesting that digital learning technologies can enhance educational effectiveness and help students achieve better academic outcomes.

Comparison of Pretest and Posttest Results

The pretest analysis results indicate no significant difference between the experimental and control groups before the learning process began ($p > 0.05$). This suggests that both groups had relatively equal initial understanding of the material being taught. After the learning process, the posttest analysis showed a higher score increase in the experimental group compared to the control group. A paired t-test revealed a significant difference between pretest and posttest scores within the experimental group ($p < 0.05$), indicating that the use of interactive modules contributed to an improvement in students' understanding. Meanwhile, the control group also showed improvement, but with a lower average score increase compared to the experimental group. Additionally, the results of the independent t-test showed a significant difference between the posttest scores of the experimental and control groups ($p < 0.05$), confirming that learning with interactive modules is more effective than traditional methods in enhancing students' understanding.

From the table below, it can be seen that the experimental group experienced a higher score increase compared to the control group. This indicates that the use of interactive modules in learning significantly contributes to the improvement of students' understanding.

Table 1. Comparison of Pretest and Posttest Scores between Experimental and Control Groups

Group	**Number of Students**	**Average Pretest Score**	**Average Posttest Score**	**Score Improvement**
Experimental (Interactive Module)	30	60.5	82.3	21.8
Control (Traditional Method)	30	59.8	72.1	12.3

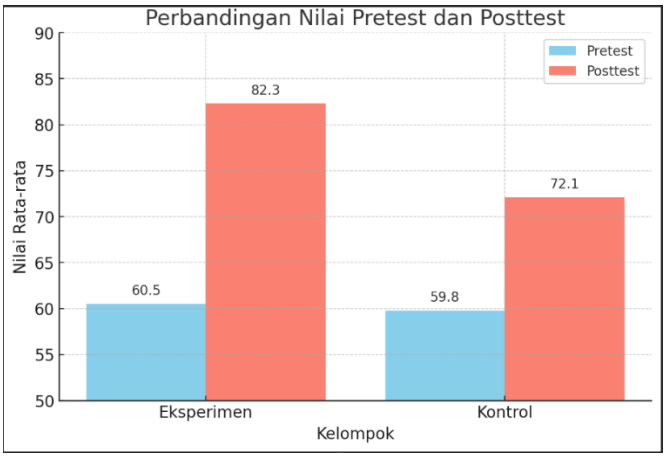

Figure 1. Comparison of Pretest and Posttest Scores between Experimental and Control Groups

The following bar chart illustrates the comparison of average pretest and posttest scores between the experimental group (using interactive modules) and the control group (using traditional methods). This diagram demonstrates a more significant increase in scores in the experimental group, indicating the effectiveness of interactive modules in learning. There is a relationship between learning motivation and independent learning, where a higher level of motivation tends to correlate positively with an increase in students' independent learning (Jabnabillah & Margina, 2022).

Academic Performance Analysis

A comparison of academic performance between the two groups shows that students who learned using interactive modules tended to achieve higher scores than those in the control group. This is evident from the higher average scores on assignments and final exams in the experimental group. Statistical analysis indicates that the use of interactive modules has a positive impact on students' academic achievement ($p < 0.05$). These results suggest that interactive modules not only enhance conceptual understanding but also contribute to overall academic performance.

Analysis of Students' Perceptions

The questionnaire results indicate that most students in the experimental group responded positively to the use of interactive modules. A total of 85% of students stated that interactive modules helped them understand the material better compared to traditional methods. Most students also found that interactive features, such as quizzes, simulations, and instructional videos, made the learning process more engaging and less monotonous. Additionally, 78% of students reported feeling more motivated to engage in self-directed learning, as interactive modules allowed them to access materials at any time and revisit difficult sections. However, some challenges were noted, including the need for a stable internet connection and limited access to devices for some students.

DISCUSSION

The findings of this study indicate that the use of interactive modules in learning significantly contributes to improving students' understanding and academic performance. This aligns with previous research highlighting the benefits of digital technology in enhancing learning effectiveness. For example, Mayer's (2020) *Multimedia Learning Theory* suggests that the combination of visual and interactive elements can enhance comprehension and retention of material compared to text-based learning alone. These findings are also consistent with the study conducted by Clark & Feldon (2014), which revealed that technology-based learning environments can increase student engagement and provide a deeper learning experience. In their study, students who used interactive modules showed better comprehension improvements compared to those who relied solely on traditional lecture methods. This aligns with the results of the present study, where the experimental group using interactive modules experienced an average posttest score increase of 21.8 points, while the control group showed an increase of only 12.3 points.

Additionally, this study supports the findings of Hew & Lo (2018), which demonstrated that technology-based learning can enhance student motivation. In this study, the majority of students in the experimental group reported that interactive modules made learning more engaging and motivated them to study independently. These results are further reinforced by the research of Sun & Rueda (2021), which states that real-time feedback in interactive modules helps improve conceptual understanding by allowing students to correct their mistakes immediately. However, these findings also highlight several challenges consistent with previous research. For instance, a study by Bolliger & Shepherd (2018) found that access to devices and internet connectivity is a crucial factor in the successful implementation of interactive modules. The present study also found that some students faced difficulties accessing interactive modules due to technological infrastructure limitations. Therefore, institutional support is needed to ensure that all students have adequate access to technology in order to optimize digital learning.

CONCLUSION

The findings of this study indicate that the use of interactive modules in learning has a significant impact on students' conceptual understanding and academic performance. The group that used interactive modules experienced a greater increase in pretest to posttest scores compared to the control group and achieved better academic results. Additionally, students responded positively to the use of interactive modules, particularly in terms of engagement, comprehension, and learning motivation. These findings have important implications for the development of technology-based learning methods in higher education, especially in enhancing learning effectiveness. Therefore, integrating interactive modules into the curriculum is recommended as a strategy to improve the quality of higher education. Cooperative learning strategies are considered effective in enhancing student learning motivation as they encourage social interaction, collaboration, and active engagement in the learning process (Lathifa et al., 2024). Overall, this

study provides empirical evidence that interactive modules not only enhance students' understanding and academic achievement but also contribute to their engagement and learning motivation. Considering the findings from previous research, the implications of this study highlight the need for further development of more inclusive and accessible interactive module designs. The development of e-interactive modules in learning should consider criteria such as user engagement, ease of navigation, and visual appeal to make learning more effective (Qotimah, 2022). Furthermore, this study opens opportunities for further exploration of the long-term impact of interactive module use on students' critical thinking and collaborative skills.

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