E-ISSN: 2798-0472 **DOI:** 10.52562/biochephy.v4i2.1413

BIOCHEPHY: Journal of Science Education

http://journal.moripublishing.com/index.php/biochephy

INTERACTIVE LEARNING INNOVATION: IMPROVING UNDERSTANDING OF THE CONCEPTS OF MOTION AND FORCE IN PROSPECTIVE TEACHER STUDENTS

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Abstract: This research aims to measure the effectiveness of interactive learning media in increasing understanding of the concepts of movement and force in prospective elementary school teacher students. The research subjects were 26 students who took a test based on the Quizizz application, consisting of 12 multiple choice questions and short answers. The research results showed a gradual increase in answer accuracy, especially on the final questions, with the highest accuracy of 70% on the 12th question. Meanwhile, the initial questions showed low accuracy, which indicated the need to strengthen basic concepts. Analysis of processing time shows that students who spend more time tend to get better results. The frequency distribution of correct answers shows that the majority of students are in the middle ability category, while only a few achieve high performance. These findings imply the need to use varied learning strategies, such as interactive simulations, virtual experiments, or problem-based discussions, to increase in-depth understanding of concepts. Thus, interactive learning media can be an effective solution in supporting the learning process in the field of science education.

Keywords: interactive learning, understanding concepts, motion, force, quizizz

***Abstrak**: Penelitian ini bertujuan untuk mengukur efektivitas media pembelajaran interaktif dalam meningkatkan pemahaman konsep gerak dan gaya pada mahasiswa calon guru sekolah dasar. Subjek penelitian adalah 26 siswa yang mengikuti tes berbasis aplikasi Quizizz, yang terdiri dari 12 soal pilihan ganda dan jawaban singkat. Hasil penelitian menunjukkan peningkatan akurasi jawaban secara bertahap, terutama pada soal akhir, dengan akurasi tertinggi sebesar 70% pada soal ke-12. Sementara itu, pada soal awal akurasinya rendah, yang mengindikasikan perlunya penguatan konsep dasar. Analisis waktu pengerjaan menunjukkan bahwa siswa yang menggunakan waktu lebih banyak cenderung memperoleh hasil yang lebih baik. Distribusi frekuensi jawaban benar menunjukkan bahwa sebagian besar siswa berada pada kategori kemampuan sedang, sementara hanya beberapa yang mencapai kinerja tinggi. Temuan ini menyiratkan perlunya menggunakan strategi pembelajaran yang bervariasi, seperti simulasi interaktif, eksperimen virtual, atau diskusi berbasis masalah, untuk meningkatkan pemahaman konsep secara mendalam. Dengan demikian, media pembelajaran interaktif dapat menjadi solusi yang efektif dalam mendukung proses pembelajaran di bidang pendidikan IPA.*

***Kata Kunci:** pembelajaran interaktif, memahami konsep, gerak, gaya, quizizz*

INTRODUCTION

Science education at elementary school level is an important basis for building a scientific mindset in students. Elementary school teacher candidates as educational subjects have a big responsibility in instilling basic science concepts, including movement and force (Nurhayati et al., 2023; Imawan & Ismail, 2023). However, the challenge that often arises is how to simplify these

abstract concepts so that students can understand them well (Bakirci et al., 2022; Tsibulnikova, 2022; Wenno et al., 2022). Therefore, effective and innovative learning strategies are needed to support prospective teacher students' understanding of this material.

In the digital era, technological developments provide great opportunities in the world of education (Haleem et al., 2022: Rahmatullah et al., 2022; Bonfield et al., 2020). One innovation that is now widely implemented is the use of interactive learning media. This media not only provides interesting visualizations, but also creates a dynamic learning environment and encourages active student involvement (Pavlik, 2023: Prabawati et al: 2021). Thus, interactive learning media becomes a relevant tool for increasing the understanding of prospective elementary school teacher students in mastering movement and force material.

Motion and force are important concepts in science education that explain various physical phenomena in everyday life. A good understanding of this concept is needed by prospective elementary school teacher students to ensure students are able to connect it with their real experiences (Zhang et al., 2023: Rasmitadila et al., 2022; Bahtiar & Ibrahim, 2022). However, traditional lecture-based learning is often less effective in bridging this understanding, so innovations such as interactive media are a potential solution.

Interactive learning media offers a deeper learning experience by combining visual, audio and simulation elements (Tuma, 2021: Daryanes et al., 2021; Ibrahim et al., 2024). For prospective elementary school teacher students, this not only helps them understand the concept of motion and force theoretically, but also trains them in conveying material to students in an interesting and easy to understand manner (AlGerafi et al., 2023; Rahim et al., 2022). In addition, interactive media encourages students' active involvement in the learning process, which contributes to increasing their understanding.

In practice, prospective elementary school teachers who use interactive learning media show a significant increase in conceptual understanding. Simulating the motion of objects, using animation, and virtual experiments allow them to see firsthand how the concepts of motion and force are applied. This provides a more concrete learning experience than just reading or listening to explanations.

Apart from the benefits for understanding concepts, interactive learning media also helps student teachers in developing technology-based pedagogical skills (Muslimat et al., 2021). By mastering this media, they not only learn about the material, but also how to deliver learning that is interesting and relevant to students' needs in the digital era. This is an important step in producing teachers who are competent and adaptive to changing times.

Furthermore, the effectiveness of interactive learning media is not only limited to increasing understanding of the concepts of motion and force. This media also provides additional motivation for prospective elementary school teacher students to study independently. When they feel interested and involved in the learning process, it is easier for them to understand the material and apply it in various contexts.

Thus, the use of interactive learning media can be a strategic solution in elementary science learning, especially in motion and force material. Not only does it increase the conceptual understanding of prospective teacher students, this media also prepares them to become educators who are creative, innovative, and able to face educational challenges in the future. This is in line with the need to produce a generation of teachers who are able to bridge science with the real world, so that students can learn more effectively and meaningfully.

METHOD

This research used descriptive quantitative methods with research subjects of 26 prospective elementary school teacher students. Data collection was carried out by administering a test based on the Quizizz application, which consisted of 12 questions, with details of multiple choice questions and short answers. This test instrument is designed to measure students' understanding of the concepts of motion and force after learning using interactive media. The data obtained was

analyzed to determine the level of students' understanding of concepts and the effectiveness of the interactive learning media used in the learning process.

RESULT AND DISCUSSION

This section presents the research results obtained from data analysis of concept understanding tests for prospective elementary school teacher students regarding movement and force material after using interactive learning media. The data presented includes students' level of understanding based on test results consisting of multiple choice questions and short essays given through the Quizizz application. These results are then analyzed to assess the effectiveness of interactive media in increasing students' conceptual understanding, which will be discussed in more depth in the next discussion. The following image displays the distribution of research results in detail.

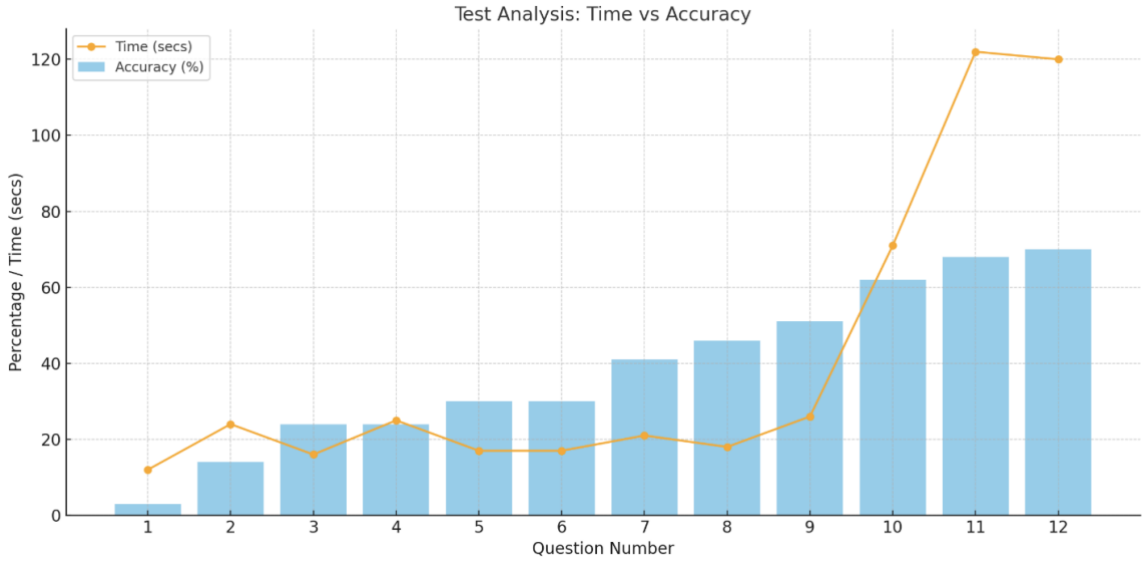

Figure 1. Accuracy Rate Vs Time

The test results show that the level of accuracy of participants in the "Motion and Force" material in the Elementary Science Education course has increased gradually as the question number increases. In the initial questions (questions 1–6), accuracy was low, with the highest percentage only reaching 30% (questions 5 and 6), while the first question had the lowest accuracy, namely 3%. This can be caused by a lack of basic understanding or a higher level of difficulty of the questions at the start of the test. On the other hand, the time spent answering questions at the beginning tended to be shorter, which indicates that participants may have answered in a hurry or did not understand the questions enough.

In the later questions (questions 7–12), there was a consistent upward trend in accuracy, with the final question (question 12) achieving the highest accuracy at 70%. The time spent answering these questions also increases, especially on questions 10, 11, and 12 which take more than one minute per question. This increase shows that participants are starting to better understand the concepts of motion and force and are spending more time analyzing questions. This is in accordance with previous research which shows that allocating more time to analyze questions can increase the accuracy of answers (Saxena et al., 2020; Akimov & Malin, 2020). The research also found that mastering basic concepts gradually helped test takers to answer more complex questions in the final stage.

These findings have the implication that understanding of basic concepts, especially Newton's Laws, needs to be strengthened through an interactive and contextual learning approach. Research by Alabidi et al. (2023) revealed that the use of experimental or simulation-based learning media can significantly increase students' understanding of motion and force material. Therefore, lecturers are advised to integrate virtual laboratory activities or hands-on experiments to help

students understand the material in more depth. Apart from that, evaluation strategies such as providing practice questions with gradual levels of difficulty can also increase students' readiness to face similar tests in the future. Below are also presented the accuracy results with scores obtained by prospective teachers.

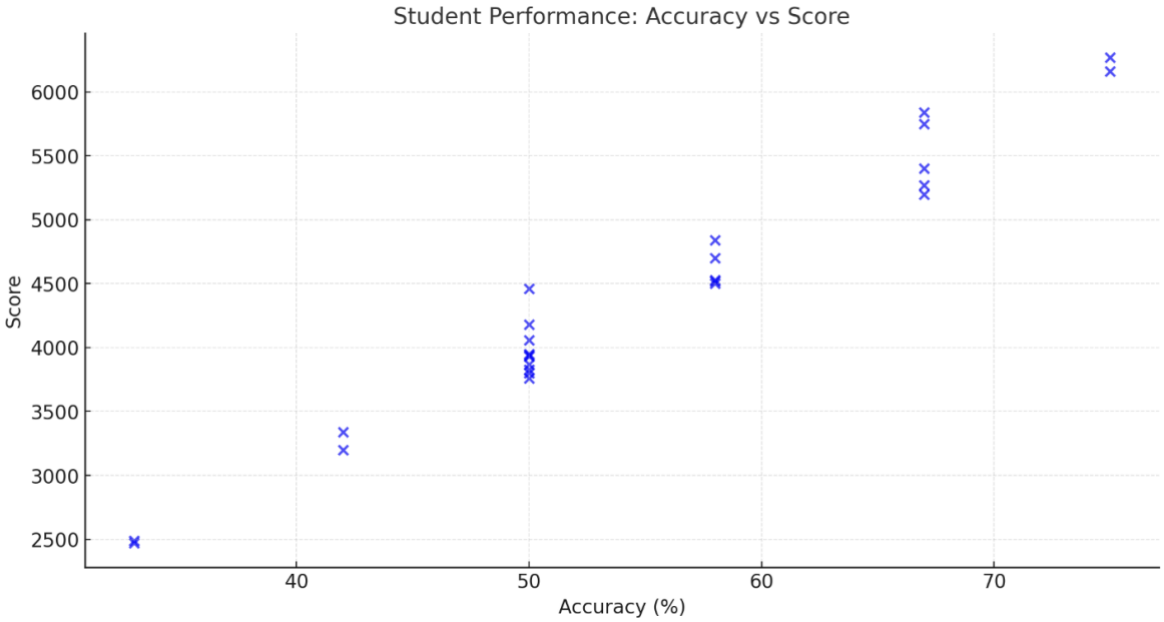

Figure 2. Level of Accuracy vs Score

This graph also reflects variations in the level of individual understanding of the material being tested. Research by Fathi et al. (2020) highlights that the diversity of accuracy levels is often influenced by the teaching methods applied. Students with high accuracy tend to benefit from student-centered learning approaches, such as interactive discussions or problem-based learning, which allow them to explore concepts in depth. In contrast, students with low accuracy may need a more structured and repetitive approach to fully understand basic concepts.

Most students are in the accuracy range 50%-67%, which shows moderate ability, but requires improvement. A study by Theobald (2002) on metacognition shows that students with moderate accuracy often have problems in managing learning strategies independently. This emphasizes the need for learning strategy training, such as creating a directed study schedule or applying active learning methods to improve understanding of concepts and accuracy of answers.

For students with accuracy below 50%, research results by Bahtiar et al. (2024) show that interventions such as direct feedback and remedial-based learning are very effective in improving learning outcomes. Meanwhile, students with high accuracy can be given additional challenges in the form of HOTS (Higher Order Thinking Skills) questions which are in accordance with Bloom's (1956) research on the taxonomy of learning, which emphasizes the importance of analysis and evaluation skills to encourage deeper learning. With this strategy, each student group can be facilitated according to their needs.

The graph above shows the frequency of students based on the number of correct answers ("Correct") obtained in an evaluation. Most of the students showed moderate ability, with the highest frequency being in the category 3 correct answers (10 students), followed by categories 4 correct answers (8 students), and 5 correct answers (6 students). On the other hand, only a few students showed very low performance (1–2 answers are correct, 1 and 2 students respectively) or very high (6 correct answers, 3 students). This reflects a distribution of abilities that tends to be normal, with the majority of students at an intermediate level of ability.

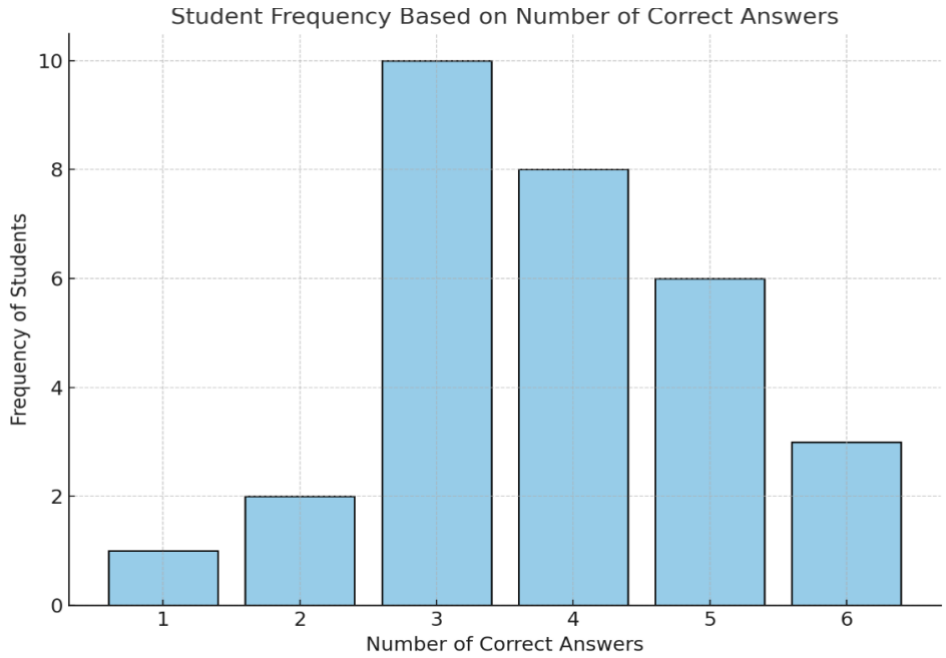

Figure 3. Frequency of correct answers

These results can be linked to previous research which shows that the level of students' understanding of the material depends on the teaching method and their level of involvement during the learning process. According to research by Aflah & Fajar (2022), students who are actively involved in discussion-based learning tend to have a higher level of understanding than those who only listen passively to lectures. Additionally, the evaluation method may also influence these results. Questions with a medium level of difficulty tend to produce a distribution of performance as seen in the graph, where the majority of students show medium ability.

Furthermore, other research by Anderson and Krathwohl (2001) who developed a revision of Bloom's taxonomy stated that the achievement of learning outcomes at the remember And understand occurs more frequently in college students than in college students analyze And evaluate, which requires higher order thinking skills. The results of this graph seem to be in line with these findings, where only a few students achieved the maximum score (6 correct answers), possibly because the questions in this evaluation require more complex analytical or application skills.

Therefore, to improve student performance, a more varied and interactive learning approach is needed, such as project-based learning or the flipped classroom. This approach has been proven in various studies to be able to improve students' conceptual understanding and critical thinking skills. This is expected to increase the number of students who achieve high performance in future evaluations.

CONCLUSION

Based on the results of the research and discussion above, it can be concluded that interactive learning media is proven to have the potential to increase students' conceptual understanding of elementary school teacher candidates regarding motion and force. This was demonstrated by a gradual increase in answer accuracy on the final questions, where participants showed better understanding when they spent more time analyzing the questions. Even though the majority of students are in the medium ability category, these results indicate the need for more targeted learning strategies, such as the use of simulation-based approaches or virtual experiments, to strengthen understanding of basic concepts. Apart from that, variations in teaching methods, such as interactive discussions and evaluations with gradual levels of difficulty, are also expected to be able to support the achievement of more optimal learning outcomes in the future.

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