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Students' Conceptual Understanding and Self-Directed Learning on Blended Learning

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ABSTRAK

Pembelajaran fisika dibutuhkan pemahaman konsep agar siswa dapat menganalisis hubungan antar konsep untuk menjelaskan suatu fenomena alam. Namun, siswa mengalami miskonsepsi dan kesulitan dalam memahami dan menganalisis konsep fisika. Sehingga untuk melatih pemahaman, diperlukan pembelajaran self-directed learning siswa. Penelitian ini bertujuan untuk menganalisis pemahaman konseptual siswa, kemandirian belajar, dan pengaruh kemandirian belajar siswa terhadap pemahaman konseptual siswa pada topik gerak lurus dalam blended learning. Sampel dalam penelitian ini ialah 22 orang siswa kelas X. Metode dalam penelitian ini adalah pre-experimental design dengan one-group pretest-posttest group design. Instrumen yang digunakan dalam pengumpulan data adalah tes. Data dianalisis dengan menggunakan uji non-parametrik Wilcoxon test dan uji one sample T-test. Hasil penelitian menunjukkan bahwa pembelajaran blended dapat meningkatkan kemampuan pemahaman konsep siswa dan kemandirian belajar siswa secara signifikan pada materi gerak lurus. Hal ini dikarenakan siswa mampu belajar secara mandiri saat proses pembelajaran, sehingga siswa lebih aktif, kreatif, dan mandiri dalam memahami suatu konsep. Pembelajaran dengan blended learning memiliki pengaruh terhadap pemahaman konsep, dan pemahaman konsep mempengaruhi self-directed learning peserta didik.

ABSTRACT

Learning physics requires understanding the concept so that students can analyze the relationship between concepts to explain a natural phenomenon. However, students need clarification and help to understand and analyze physics concepts. So to train to understand, students need self-directed learning. This study aims to analyze students' conceptual understanding, learning independence, and the effect of student learning independence on students' conceptual understanding of straight motion in blended learning. The sample in this study was 22 students of class X. The method in this study was a pre-experimental design with a one-group pretest-posttest group design. The instrument used in data collection is a test. Data were analyzed using the non-parametric Wilcoxon test and the one-sample T-test. The study results show that blended learning can significantly improve students' conceptual comprehension abilities and learning independence in straight-motion material. It is because students can learn independently during the learning process, so they are more active, creative, and independent in understanding a concept. Learning with blended learning influences understanding concepts, and understanding concepts affects students' self-directed learning.

1. INTRODUCTION

The current COVID-19 pandemic has disrupted activities, including educational activities. Various policies have been issued by the government. one of which is the restriction of activities outside the home, including activities in the school environment. As a result, online learning activities are carried out, so learning media are needed that are easily accessible to students. Online learning is a challenge in the modern era as a result of information technology (Wisanti, Ambawati, Putri, Rahayu, & Khaleyla, 2021). The development of technology in education is growing rapidly. The development of this technology can help in the learning process. E-learning or online learning is an important part of this evolution and it has become a key element of today's education for students to become more technology literate (Sivakumar & Selvakumar, 2019). Innovation in the field of learning needs to be carried out and adapted to the demands of learning (Herayanti. Widodo, Susantini, & Gunawan, 2020) The innovation needed in learning is to integrate conventional models through face-to-face and online learning so students can learn independently through the internet (Herayanti et al., 2020). The learning model used must lead to the use of digital technology (Kesuma, Diani, Hasanah, & Fujiani 2020). The

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combination of face-to-face learning and technology-mediated online learning is a characteristic of blended learning (Krasnova & Shurygin, 2020). The teaching and learning process in the classroom, sometimes the topic cannot be received optimally by students due to limited face-to-face time (Ardianti, Sulisworo, Pramudya, & Raharjo 2020). Blended learning has the potential to create a variety of learning styles, broaden the learning experience, and improve topic consistency and learning quality (Oktavianti, Handayanto, Wartono, & Saniso, 2018; Sivakumar et al., 2019). Students still have the opportunity to interact socially directly and get guidance from the teacher in blended learning (Suma, Suwindra, & Sujanem, 2020). The blended learning strategy is expected to be able to minimize deficiencies in the learning process that is not only mastery of the topic but also how to deliver topic using ICT that is appropriate for the condition of students (Wintarti, Masriyah, Ekawati, & Fiangga, 2019). The application of blended learning can stimulate students to be more active, creative, and independent in exploring the information needed to study independently and understand concepts (Suana, Maharta, Nyeneng, & Wahyuni, 2017). The use of blended learning shows better learning outcomes than students who study with traditional learning methods (Sivakumar et al., 2019) and can increase students' understanding of concepts in static fluid concepts (Maulida, Suparwoto, Pramudya, & Sulsworo, 2020). Meanwhile, survey showed that during blended learning students experienced difficulties in internet networks and how to access materials due to lack of experience in learning using technology. In blended learning students have difficulty in understanding the material and often neglect the assigned tasks, and not all students can attend on time while studying online (Marisda & Ma'Ruf, 2021).

Linear motion is one of the materials in physics, where students are expected to be able to understand the concept of observed natural phenomena or phenomena. In studying physics, students' understanding is needed so that they can develop their initial concepts to find new concepts (Bukifan & Yuliati, 2021). Understanding the concept is one of the problems that often occur in science learning (Maskur, Latifah, Pricilia, Walid, & Ravanis, 2019). Learning physics involves interrelationships between concepts to explain natural phenomena and problem solving. However, sometimes students have difficulty in developing their conceptual understanding (Bouchée, Thurlings, De Putter, Smits, & Pepin, 2021). Students experience misconceptions and difficulties in understanding and analyzing physics concepts (Affriyenni, Swalaganata, Kurniawan, & Taqwa, 2021). For example, students argue that if an object is moving in a straight line and another object is moving in a straight line, it changes uniformly, and one object precedes the other, then the two objects will never have the same speed (Fadllan, Prawira, Arsini, & Hartono, 2019). Another misconception that often occurs is that students do not understand the relationship between distance and displacement, the relationship between speed or velocity and acceleration, the position-time graph shows the motion of objects, and the position-time graph, if the curve is up or down then the acceleration is positive or negative (Pujayanto, Budiharti, Adhitama, Nuraini, & Putri, 2018) The inability of students to distinguish the concepts of position, velocity, and acceleration can lead to misconceptions (Wells, Henderson, Traxler, Miller, & Stewart, 2020). The ability of students to master and understand the material must be trained by students and teachers through the learning process (Dewantara, Misbah, & Wati, 2020).

In addition to understanding concepts, another thing that requires special attention in learning physics is the independence of students' learning (Arista & Kuswanto, 2018; Eveline, Jumadi, Wilujeng, & Kuswanto 2019). Independence can help students to develop knowledge to increase competence and improve results (Cahyana, Supatmi, Erdawati, & Rahmawati, 2019). Students who want to be independent in the learning process must be creative in developing their ideas without depending on the teacher or their friends. Students need to have control over the material that has been given by the teacher by completing it themselves so that their thoughts on the material are recognized and integrated (Maduretno, 2017). Based on the description above, this research was conducted to determine the understanding of students' concepts in the material of straight motion during blended learning. Blended learning is carried out using handouts based on android and practice questions uploaded in Google Classroom. The difference with previous research is the use of application-based handouts on Android. The purpose of this study is to analyze students' conceptual understanding, learning independence, and the influence of student learning independence on students' conceptual understanding on the topic of straight motion in blended learning.

2. METHOD

The method used in this study is a pre-experimental design with a one-group pretest-posttest group design as shown in Figure 1. This research was conducted at one of the senior high schools in Ngabang for tenth graders. The sample in this study were students of class X Mathematics and Natural Sciences with 22 students. Data collection techniques use saturated sampling techniques where all members of the population are used as samples. This study aims to analyze conceptual understanding, self-directed learning, and the effect of self-directed learning on students' conceptual understanding of linear motion. O_1 is pre-test, O_2 is posttest, and X is implementation of blended learning. The instrument used in data collection is a test of students' understanding

of the concept in the form of multiple-choice reasoned and a questionnaire of students' learning independence. The aspects of conceptual understanding terdiri dari translasi, interpretasi, dan extrapolasi showed in Table 1 (Bloom, Engelhart, & Hill, 1956) and the test's indicators and Table 2 shown the indicator of self-directed learning.

Table 1. The Indicators of Conceptual Understanding

Aspects of Concept Understanding	Indicators Test
Translation	Identifying a velocity-to-time graph in regular straight motion based on the presented phenomenon
	Identifying the largest acceleration based on a speed-to-time graph
	Identifying positive acceleration based on a speed-to-time graph
	Identifying negative accelerations based on speed-to-time graphs
Interpretation	Interpreting the farthest displacement through a scale whose results are displayed graph
	Summing up the farthest mileage through a scale whose results are displayed graph
	Interprets the most travel speed through the scale on which the results are displayed graph
	Summing up the most travel speed through the scale on which the result is displayed graph
Extrapolation	Assess the acceleration chart against the right time based on the presented phenomenon
	Predicting a distance-to-time chart showing the phenomenon presented

(Bloom et al., 1956)

Table 2. Modified Self-Directed Learning Indicators

Indicator	Indicator Panel Component
Self-confidence	a) Student learns independently
	b) Student believes within themselves
Discipline	a) Student does utmost while studying
	b) Student does not procrastinate towards theassignments that given
Initiate	a) Student has willingness in study
	b) Student never postpone the task that given.
	c) Student initiate to find another learning sources
Responsible	a) Student wittingly study
	b) Student actively in study

(Morris, 2019)

The data obtained were analyzed by the Wilcoxon test, descriptive statistical analysis, and the one-sample t-test. The data from validity instrument test of conceptual understanding were analyzed using Aikens' Coefficient validity.

3. RESULT AND DISCUSSION

Result

In this study, students were given a pretest before treatment, then students were given a posttest to determine the increase in understanding of the concept after the implementation of treatment with blended learning. These results were then compared with the results of the students' conceptual understanding pretest. The data obtained were then analyzed using the Wilcoxon test as shown in Table 3.

Table 3. Wilcoxon Test Results

Statistic	Pretest - Posttest
Z.Sign (2-tailed)	0.00
Negative Ranks	0.00
Positive Ranks	22.00
Minimum	37.50
Maximum	75.00
mean	56.30

Table 3 shows that there is a significant difference between the pretest and posttest scores. In addition, Table 3 shows that all students experienced an increase in concept understanding. It shows that there are no

students who experience a decrease in concept understanding after being given treatment in the form of blended learning which is equipped with handouts. An increase in students' understanding of the concept of straight motion material, this is indicated by an increase in the pretest value after being given treatment to students showed in Figure 3. Before being given treatment the average value of the pretest was 26.82, then the average value of the posttest increased to 67.27. This increase represents that blended learning influences in helping students understand concepts in straight motion material.

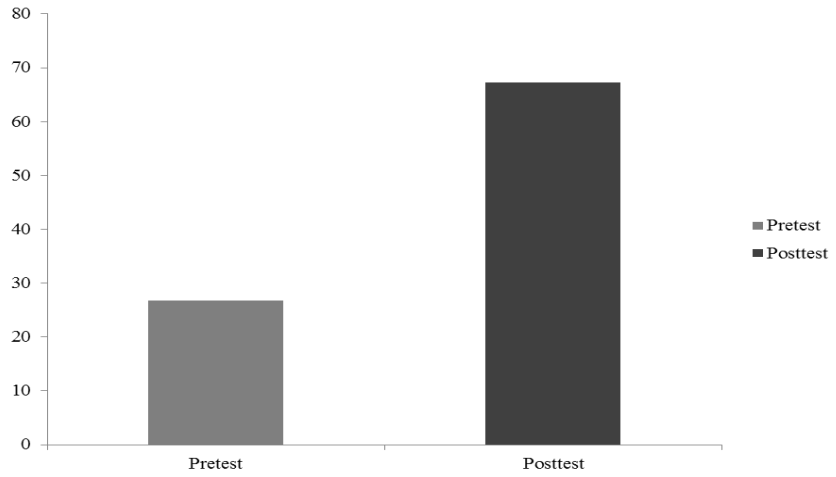

Figure 1. Graph of the average understanding of students' concepts

Based on Figure 1, shows that there is an increase in the average value of students' understanding of the concept of linear motion topic. Increasing understanding of student concepts can be influenced by several factors, one of which is blended learning which is presented more interestingly using application-based handouts on Android. In learning students are often given questions as exercises to understand concepts. The increase in the understanding of each student can be seen as shown in Figure 2.

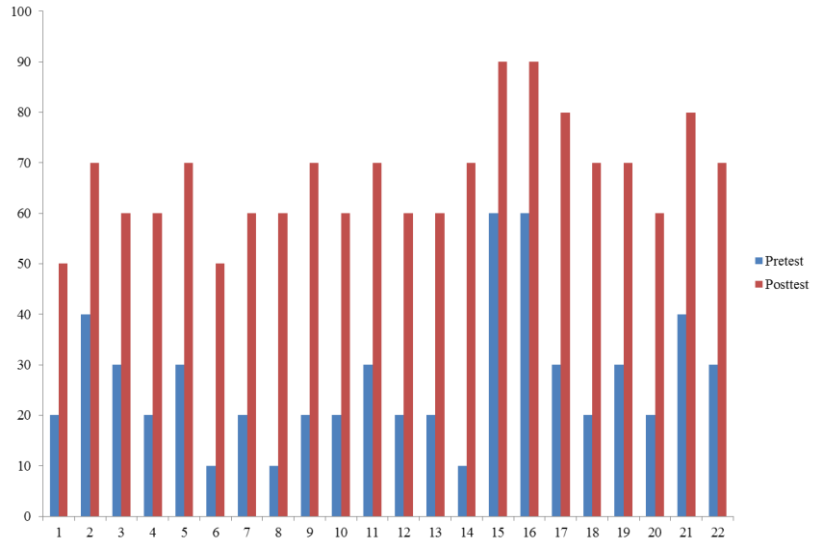

Figure 2. Graph of Student Conceptual Understanding

Based on Figure 2, it can be seen that each student experienced an increase in the score of conceptual understanding after blended learning. This indicates that blended learning can help students to understand the concept of linear motion and improve student learning outcomes. In the learning process sometimes students ask the material that has not yet been understood through WhatsApp to the teacher and will be explained through WhatsApp and described again at the time of face-to-face learning. Students are often given practice questions to train and know the extent to which students' understanding

The data from the learning independence questionnaire obtained were analyzed using a one-sample t-test to determine the difference in the average value of the population used as a comparison with the average of a

sample. Before the one-sample t-test was carried out, a normality test was first carried out so that it was found that the data obtained were normally distributed with a significance value of 0.018. Then proceed with the one-sample t-test as shown in Table 2.

Table 2. Test Results One Sample t Test

Sign. (2-tailed)	0.895
mean	70.18

Based on Table 2 shows the results that the significance value obtained is 0.895 which indicates that it is greater than 0.05. This indicates that the average value of the learning independence of students is equal to the value of 70. The data on learning independence obtained is shown in Figure 3.

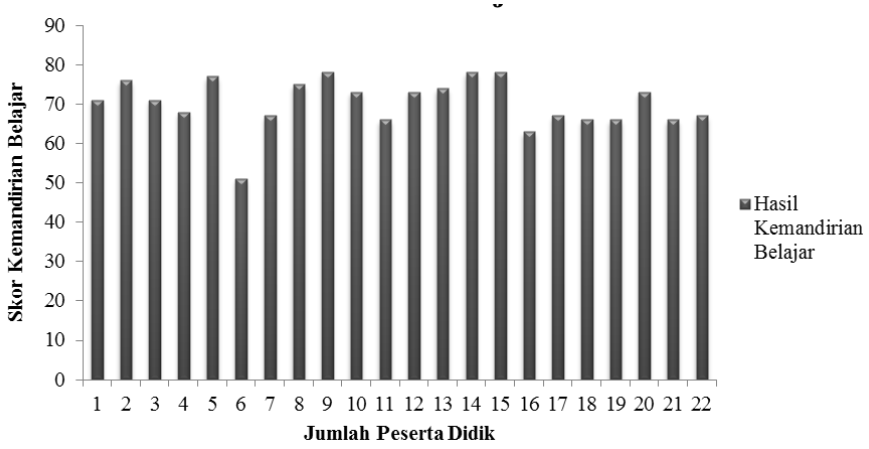

Figure 3. The Results of Students' Self-Directed Learning

Based on Figure 3, information is obtained that several students have scored less than the average value. This can be caused by the interest and motivation of students towards physics lessons. Students who have high learning independence can manage their learning activities independently at the preparation, implementation, and evaluation stages(Aulia, Susilo, & Subali, 2019). Independent learning of students needs to be trained in a relatively long time, so that students can get used to learning independently to obtain additional information related to learning materials. This can make students directly involved in getting learning experiences from learning activities. Learning independence must be possessed by students in learning physics so that learning can take place more effectively. Pearson correlation test results between learning independence and understanding of concepts showed in Table 3.

Table 3. Pearson Correlation Test Results Between Learning Independence and Understanding of Concepts

Sign. (2-tailed)	**0.000**
N	22.00
Pearson Correlation	0.84

Based on Table 3 shows that there is a correlation between learning independence and understanding of students' concepts with a significance value of 0.000. Students with independent learning can dig up information on linear motion topic, so that it can help students understand concepts. Blended learning can make students learn independently because of the limited time during face-to-face learning. With the independence of learning from students, they can learn anywhere and anytime outside of learning activities at school.

Discussion

One of the characteristics of the development of the 21st century is the development of science and technology, especially in the field of science (Alsalhi, 2020). This requires the development of learning in the world of education by utilizing technology. The development of technology can help teachers in providing media and teaching materials that are more accessible to students. The development of tenology in Era 4.0 provides an opportunity for us to learn even though it is separated by place and time and there is no face-to-face. There are many methods that can be used, for example, Google meet, Google zoom, or with the existence of social media such as whatsapp. One of the learning methods applied is blended learning (Rahmat, 2020). The application of

blended learning can develop students' skills and knowledge, and can be an opportunity to integrate innovative developments and technologies through online education (Jani, Muszali, Nathan, & Abdullah 2018). Blended learning with technology can design and develop dynamic and effective blended learning (Bazelais & Doleck, 2018). Based on the results of the research obtained, it shows that the conceptual understanding of students has increased significantly. This explains that blended learning and the role of the teacher in learning is very important in helping students during the learning process. This increase is in line with blended learning which can improve students' critical thinking skills and they are happy with blended learning because of the flexible time and easy access to materials (Suana, Ningsih, Maharta, and Putri, 2020). The application of blended learning can reduce students' misconceptions because it can help students understand the theory factually, and students can freely ask the teacher in face-to-face classes (Kesuma, Diani, Hasanah, & Fujiani, 2020). Learning by combining online and face-to-face learning can improve students' conceptual understanding skills. Self-directed learning is significant for higher education levels, particularly in online learning, because it helps studens to learn actively (Muhtadi, Ismaniati, Haryanto, Miyarso, & J. Dwi, 2022). Learning is carried out using blended learning techniques so that students can find additional information related to linear motion material. In blended learning, students are given deepening of material and learning videos to help students understand the cconcept of linear motion. In many developed countries, blended learning has become the most preferred learning model (Gaol & Hutagalung, 2020).

Students' self-directed learning in this case has an average score equal to 70. This shows that students' learning independence is quite good when learning is blended. Learning independence needs to be trained continuously so that students can become more active, creative, and independent in understanding concepts and solving problems in learning. Students are required to be more active and independent in learning, this is due to the limited time in face-to-face learning during the Covid-19 pandemic. Blended learning can help students learn more actively because in this model students can explore additional information related to learning materials. Blended learning-based learning is the best learning model for teaching and learning, so that in physics learning it can overcome the limited time needed by the teacher in learning (Zain & Jumadi, 2018). Students who learn through blended learning strategies get higher scores in academic achievement than students who learn through lecture learning methods (Sivakumar et al., 2019). Blended learning is carried out by giving handouts to students before the learning activities take place, so that they are expected to have an initial understanding of the linear motion topic. When learning activities take place face-to-face, the teacher guides students if there is material that has not been understood. The ability of students to understand concepts needs to be trained, so it takes a relatively longer time. In blended learning, students get the opportunity to take advantage of their abilities in the field of technology and be actively involved in expressing new ideas or ideas they get. This research shows that blended learning is not always an obstacle in material explanation, but it is able to become a medium and exercise for teachers and students in facing technological advances in the field of education.

The results of this study show that blended learning can be used in learning if it is supported by the use of learning media and teacher guidance as a facilitator. In blended learning, the teacher as a facilitator is not only limited to providing material and questions, but also providing learning guidance when students have difficulty understanding concepts. Blended learning in this case utilizes android-based learning media in the form of applications on smartphones that can be used offline which are equipped with animations and learning videos. In this study, there are still some limitations so that for the next research, you can conduct research using a wider sample, more effective and efficient learning time, and can improve other cognitive abilities so that it can help students in improving physics learning outcomes.

4. CONCLUSION

The implementation of blended learning can stimulate students to be actively involved, creative, and independent in obtaining the information needed to understand the concept. The results of this study indicate that students have an increased students' conceptual understanding and self directed learning in linear motion material through blended learning.

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