The Effect of Learning Independence and the Ability to Understand Physics Concepts

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Abstract

The Effect of Learning Independence and Digital Literacy Skills on the Understanding of Physics Concepts. This study aims to determine: 1) The effect of learning independence and digital literacy skills together on the understanding of physics concepts among students at the Health Polytechnic in South Jakarta, 2) The effect of learning independence on the understanding of physics concepts among students at the Health Polytechnic in South Jakarta, 3) The effect of digital literacy skills on the understanding of physics concepts among students at the Health Polytechnic in South Jakarta. This research is a survey study conducted at the Health Polytechnic in South Jakarta. The total population is 739 students, and a sample of 88 students was randomly selected from four study programs at the Health Polytechnic in South Jakarta. Data collection was carried out using questionnaires and tests. Data analysis was performed using descriptive statistical methods, validity tests, reliability tests, and hypothesis testing with multiple linear regression analysis using SPSS software. The results of the study prove that learning independence and digital literacy skills contribute to the understanding of physics concepts.

Keywords: Learning Independence, Understanding of Physics Concepts

INTRODUCTION

Physics is a fundamental subject in science and technology education. Understanding the core concepts of physics is essential for students, especially in technical fields such as health sciences. However, many students face challenges in mastering physics concepts, often due to a lack of effective learning strategies. Two critical factors that can influence a student's understanding of physics are learning independence and digital literacy skills.Learning independence refers to the ability of students to manage their own learning process, including setting goals, finding resources, and evaluating their progress. Independent learners are often more motivated and capable of solving problems on their own, which is crucial for mastering complex subjects like physics. This study focuses on the impact of these two factors—learning independence and digital literacy skills—on the understanding of physics concepts among students at the Health Polytechnic in South Jakarta. It aims to investigate whether these factors, either individually or combined, contribute to the students' grasp of physics concepts. By examining these influences, the research seeks to provide insights into improving physics education and student outcomes in technical disciplines.

The purpose of this study is to investigate the combined effect of learning independence and digital literacy skills on physics concept understanding, examine the effect of learning independence alone on physics concept understanding, analyze the effect of digital literacy skills alone on physics concept understanding. In education, cognitive factors such as intelligence, memory, and reasoning abilities have long been the focus of research and instructional practices. However, non-cognitive factors—those that are not directly related to intellectual abilities—are gaining increasing recognition for their role in student learning outcomes. Non-cognitive factors encompass a range of psychological, emotional, and behavioral characteristics that can significantly influence students' academic performance, engagement, and motivation. In the context of physics education, non-cognitive factors such as learning independence, motivation, self-regulation, and digital literacy skills are particularly crucial for fostering a deeper understanding of complex subjects. Learning independence, a key non-cognitive factor, refers to a student's ability to manage their own learning process, including

setting goals, organizing study schedules, and seeking resources without constant guidance from instructors. Students with higher levels of learning independence tend to take more initiative in their studies, are more likely to engage in problem-solving, and demonstrate greater persistence when faced with academic challenges.

This independence is especially important in physics, a subject that often requires students to engage in self-directed exploration and critical thinking. Digital literacy also plays a significant role in modern education, particularly in disciplines such as physics, where technology and digital tools are increasingly integrated into teaching and learning. Digital literacy involves the ability to effectively access, evaluate, and use digital information, tools, and resources. In physics, this includes utilizing online simulations, conducting research through scientific databases, and using virtual labs to explore physical phenomena. A high level of digital literacy enhances students' ability to engage with the material, experiment, and visualize abstract concepts, thereby improving their overall understanding. This study focuses on the influence of non-cognitive factors, particularly learning independence and digital literacy skills, on students' understanding of physics concepts. By examining these factors, the research aims to understand how they contribute to or hinder students' mastery of physics, which is crucial for those pursuing careers in health and technical fields. Non-cognitive factors like motivation and self-regulation may play a complementary role in helping students effectively absorb and apply the concepts learned in the classroom.

The objectives of this research are as follows, to explore the combined effect of learning independence and digital literacy skills on the understanding of physics concepts. To investigate the influence of learning independence alone on students' physics understanding, the examine the role of digital literacy skills in enhancing students' comprehension of physics concepts. This study is important as it highlights how non-cognitive factors can shape the academic performance of students in a subject as challenging as physics, providing a more holistic view of the learning process. Understanding these influences can help educators develop targeted interventions to support students' growth in both cognitive and non-cognitive domains, ultimately leading to better educational outcomes.

Physics is known as a natural science that studies natural phenomena. It is fundamental in nature and serves as the foundation for the development and advancement of other scientific disciplines. Physics significantly supports both pure and applied research, including in the field of health. Many laboratory and hospital devices utilize physics concepts in their operation. Therefore, students in Health Polytechnic institutions must be able to understand physics concepts to effectively utilize and apply physics knowledge, especially in the healthcare sector.

The study of physics aims to provide a comprehensive understanding of the subject. This holistic perspective can be achieved through the process of analyzing fundamental principles, discussing their limitations, and outlining their implications. Physics is often perceived as a collection of separate sciences, interconnected yet lacking a truly unified perspective. As a quantitative science, physics relies on mathematics to express its ideas and concepts clearly.

Understanding can be expressed verbally, non-verbally, or in the form of a framework of thought. It serves as the foundation for developing insights, as understanding involves the mental process of transforming and adapting knowledge (Gardner, 1999, as cited in Puspitasari and Febrinita, 2020).

Understanding holds a strategic and crucial position in the learning process. Students who memorize a theory do not necessarily comprehend it. On the other hand, if students truly understand a theory, they will automatically remember it. Therefore, in the process of learning physics, students need to develop a proper and accurate understanding of physics concepts to achieve the learning objectives. Lecturers must be aware of the

indicators that signify students have attained a good understanding of physics concepts
Understanding physics concepts refers to Anderson's taxonomy, a revised version of Bloom's taxonomy. This taxonomy includes seven cognitive processes that constitute the ability to understand. These cognitive processes are interpreting, exemplifying, classifying, summarizing, inferring, comparing, and explaining (Krathwohl, 2002)

Several dimensions of individual differences can influence the learning process. According to Slameto (2010), besides differences in levels of intelligence, creative thinking ability, and problem-solving skills, individuals may also differ in how they process knowledge and establish connections between one experience and another..

Non cognitive style refers to the characteristic way in which an individual forms attitudes and beliefs about their surroundings. It is the method or approach by which a person processes the information they receive and reacts to it. Each individual has distinct characteristics, which means that the way they think, evaluate, and behave will vary too.

The learning experience of an individual can be observed through their perception, as perception is a process related to the reception of stimuli and information in the human brain. Information is received through the senses and then processed by the brain to form a conclusion about something (Goh et al., 2017, as cited in Puspitasari and Febrinita, 2020).

Information about students' perceptions of their cognitive styles will help lecturers understand their thinking patterns in comprehending specific concepts, including physics concepts. Lecturers must know whether students have accurately understood the physics concepts being taught, as one of the goals of education is to provide students with the means to understand knowledge (Simanjuntak, 2012). This includes understanding physics concepts

Research Methodology

This study will be conducted at the Health Polytechnic in South Jakarta. The research will take place during the academic year 2021/2022, from October 2021 to January 2022. The type of research is quantitative, using a survey research method. The purpose of this study is to examine the effect of learning independence and digital literacy skills on the understanding of physics concepts.

The population for this study consists of all students from four study programs at the Health Polytechnic of the Ministry of Health, South Jakarta, totaling 739 students. The sample size is 88 respondents, who are first-year students in the 2021/2022 academic year. The research variables include independent variables (X_1) learning independence, independent variables (X_2) digital literacy skills, and the dependent variable (Y) physics concept understanding. The data sources are questionnaires and tests provided to the students.

The variable of physics concept understanding refers to students' ability to truly understand the learning material concepts. The indicators include students' ability to interpret, exemplify, classify, summarize, conclude, compare, and explain a concept based on their own knowledge construction, not merely memorization.
The variable of learning independence is a learning process in which each individual takes the initiative, with or without the help of others, in determining their learning activities.

The indicators of learning independence used are learning engagement, self-confidence, persistence in learning activities, learning direction, and learning creativity. The research instruments consist of questionnaires with four Likert scale options, containing 25 to 30 statements, and multiple-choice tests consisting of 35 questions. Before being used for data collection, the questionnaire was piloted with 36 students to assess the validity and reliability of the instrument. After the validation requirements were met, the data were analyzed using regression analysis with the help of SPSS software.

RESULTS AND DISCUSSION

Results

Table 1. Calculation Results of the Multiple Correlation Coefficient between Variables X_1 and X_2 on Variable Y

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	0.522	0.273	0.256	9.702

a. Predictors: (Constant), Digital Literacy Skills, Learning Independence

Table 2. Summary of the Significance Testing of Regression for the Effect of Variables X_1 and X_2 on Variable Y

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	3000.566	2	1500.283	15.940	.000[b]
	Residual	8000.332	85	94.122		
	Total	11000.898	87			

a. Dependent Variable: Understanding of Physics Concepts
b. Predictors: (Constant), Learning Independence.

Interpretation of Results:

Model Summary (Table 1), The R value is 0.522, which indicates a moderate positive correlation between the independent variables (learning independence and digital literacy skills) and the dependent variable (understanding of physics concepts). The **R Square** value of 0.273 means that approximately 27.3% of the variability in the understanding of physics concepts can be explained by the combination of learning independence and digital literacy skills. The Adjusted R Square value of 0.256 accounts for the number of predictors and suggests a slightly smaller proportion of explained variance when adjusting for the number of predictors.The Standard Error of the Estimate is 9.702, which represents the average deviation of the observed values from the predicted values.

ANOVA (Table 2), the Regression Sum of Squares is 3000.566, and the Residual Sum of Squares is 8000.332. The total sum of squares is 11000.898.The F value of 15.940 indicates that the regression model significantly fits the data.The Sig. value of 0.000 (which is less than the significance level of 0.05) suggests that the regression model is statistically significant, meaning that the independent variables (learning independence and digital literacy skills) have a significant effect on the understanding of physics concepts.

Table 3. Summary of the Regression Line Equation Calculation Results

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	22.099	8.283		2.668	0.009
	Understanding of Physics Concepts	0.296	0.148	0.229	2.005	0.048
	Learning Independence	0.366	0.118	0.353	3.089	0.003

a. Dependent Variable: Understanding of Physics Concepts

RESULTS AND DISCUSSION

This study highlights the influence of learning independence and digital literacy skills on the understanding of physics concepts among students at the State Health Polytechnic in South Jakarta. The key findings are summarized as follows, the Joint Effect of Learning Independence and Digital Literacy on the Understanding of Physics Concepts , The multiple correlation coefficient (R) of 0.522 indicates a moderate and positive relationship between the independent variables (learning independence and digital literacy) and the dependent variable (understanding of physics concepts).The coefficient of determination (R^2) of 0.273 suggests that 27.3% of the variation in the understanding of physics concepts is explained by learning independence and digital literacy, while the remaining is influenced by other factors.The resulting regression equation is $Y = 22.099 + 0.296X_1 + 0.366X_2$, meaning. A one-unit increase in learning independence (X_1) contributes to a 0.296-unit increase in the understanding of physics concepts (Y), assuming other factors are constant.

A one-unit increase in digital literacy skills (X_2) contributes to a 0.366-unit increase in the understanding of physics concepts (Y). With a significance value of 0.000 < 0.05 and F-statistic of 15.940, it can be concluded that the combined influence of the two independent variables on the understanding of physics concepts is statistically significant.The Effect of Learning Independence on the Understanding of Physics Concepts . A t-statistic of 2.005 and a significance value of 0.048 < 0.05 indicate a significant effect. Students with high learning independence can explore information, determine effective learning methods, and complete tasks well. They are capable of understanding physics concepts independently without relying solely on instructor guidance.

The Effect of Digital Literacy Skills on the Understanding of Physics Concepts A t-statistic of 3.089 and a significance value of 0.003 < 0.05 also indicate a significant effect. Digital literacy enables students to search for relevant information, evaluate content, organize knowledge, and share information. These skills are crucial in online learning, particularly during the pandemic when access to digital resources is essential. Research Implications This study offers several practical implications:The importance of enhancing learning independence through teaching methods that promote student activity, persistence, creativity, and initiative in understanding physics concepts. Developing digital literacy skills should be an integral part of the educational process, including training on skills such as online content evaluation, knowledge organization, and the use of technology for learning.Educators and educational institutions should create a

learning ecosystem that supports independence and digital literacy, enabling students to master concepts effectively and utilize available resources optimally.

CONCLUSION

1. There is a significant influence of learning independence and digital literacy skills jointly on the understanding of physics concepts among students at the State Health Polytechnic in South Jakarta.This is evidenced by a significance value of 0.000 < 0.05 and an F-statistic of 15.940.
2. There is a significant influence of learning independence on the understanding of physics concepts among students at the State Health Polytechnic in South Jakarta. This is evidenced by a significance value of 0.048 < 0.05 and a t-statistic of 2.005.
3. There is a significant influence of digital literacy skills on the understanding of physics concepts among students at the State Health Polytechnic in South Jakarta. This is evidenced by a significance value of **0.003 < 0.05** and a t-statistic of **3.089**.

SUGGESTION

For future research, it is recommended to use the **Rasch Model** in data analysis

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REFERENSI

1. Akbar, M., & Anggraini, F. (2017). Teknologi dalam Pendidikan Literasi Digital dan Self Directed Learning pada MahasiswaSkripsi. Indigeneus, 2(1), 28-38.
2. Gilster, P. (2016). Digital Literacy. International Journal of Digital Literacy and Digital Competence,7(3),1-12.
3. Mudjiman, H. (2007). Belajar Mandiri (Self - Motivated Learning). Surakarta: LPP UNS dan UNS Press.
4. Krathwohl, D. R. (2002). A Revision of Bloom's Taxonomy: An Overview. *Theory Into Practice*, 41(4), 212-218.
5. Puspitasari, W. D., & Febrinita, F. (2020). Persepsi Mahasiswa tentang Pemahaman Konsep Kinematika Gerak ditinjau dari Kemampuan Berpikir Kritis. *UPEJ Unnes P*Rais, H., & Ferinaldi. (2019). Pengaruh Minat Belajar terhadap Pemahaman Konsep Matematis pada Mata Kuliah Teori Bilangan Mahasiswa Pendidikan Matematika . *Mat-Edukasia*, 4(1), 71-77.
6. Simanjuntak, M. P. (2012). Peningkatan Pemahaman Konsep Fisika Mahasiswa melalui Pendekatan Pembelajaran Pemecahan Masalah Berbasis Video. *Jurnal Pendidikan Fisika*, 1(2), 55-60.
7. Slameto. (2010). *Belajar dan Faktor yang Mempengaruhinya*. Jakarta: Rineka Cipta.
8. Suhendri, H., & Mardalena, T. (2013). Pengaruh Metode Pembelajaran Problem Solving terhadap Hasil Belajar Matematika Ditinjau dari Kemandirian Belajar. Jurnal Formatif, 3(2), 105-114.
9. Pusdiklat Kementerian Pendidikan dan Kebudayaan Republik Indonesia. (2017). Evaluasi Pembelajaran Fisika di Sekolah**.** Jakarta: Pusdiklat.
10. Krathwohl, D. R. (2002). A Revision of Bloom's Taxonomy: An Overview. *Theory Into Practice*, 41(4), 212-218.
11. Slameto. (2010). *Belajar dan Faktor yang Mempengaruhinya*. Jakarta: Rineka Cipta.
12. Suharyat, Y. (2009). Hubungan antara Sikap, Minat dan Perilaku Manusia. *Jurnal Region*, 1(3), 1-19.
13. Puspitasari, W. D., & Febrinita, F. (2020). Persepsi Mahasiswa tentang Pemahaman Konsep Kinematika Gerak ditinjau dari Kemampuan Berpikir Kritis. *UPEJ Unnes P*Rais, H., & Ferinaldi. (2019). Pengaruh Minat Belajar terhadap Pemahaman Konsep Matematis pada Mata Kuliah Teori Bilangan Mahasiswa Pendidikan Matematika . *Mat-Edukasia*, 4(1), 71-77.
14. Suharyat, Y. (2009). Hubungan antara Sikap, Minat dan Perilaku Manusia. *Jurnal Region*, 1(3), 1-19.
15. Vivi, U., Ahmad, F., & Rosha, M. (2012).

Peningkatan Kemampuan Pemahaman Konsep Melalui Pendekatan PMR dalam Pokok Bahasan Prisma dan Limas. Jurnal Pendidikan Matematika, 1(1), 33-38.

16. Wiguna, D. G. E. S., Marhaeni, M. P. A. N., & Suastra, M. P. P. I. W. (2014). Kontribusi Gaya Kognitif dan Konsep Diri terhadap Pemahaman Konsep IPA Mahasiswa Jurusan S1 PGSD Undiksha." *Jurnal Pendidikan Dasar Ganesha*, 4(1), 1-10.