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Effective Online Learning of Interest and Impact on Self-Directed Students in Mechanical Education

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A R T I C L E I N F O

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A B S T R A C T

The internet network greatly supports the smooth conduct of online learning. If the network is inadequate, online learning will be difficult to carry out, thus hampering the learning process and making it ineffective. The high cost of internet packages for large data quotas is also a problem faced by students when accessing services such as Zoom meetings, YouTube, and Google Meet, which require a significant amount of data. Additionally, some areas in Indonesia still have poor internet access or are difficult to connect to the network. Interest in learning is a strong desire within a person that can generate a response, enthusiasm, and motivation, stimulating the brain to command the body to take action. This stimulation leads to engagement in learning activities with the aim of gaining knowledge from the subject being studied. High learning interest among students is expected to foster self-directed learning, enhancing their creativity in seeking various learning resources that can be used as references in the online teaching and learning process, especially during the pandemic era.

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INTRODUCTION

Indonesia was one of the countries that implemented a lockdown in 2020 due to the increasing number of COVID-19 infection cases, which resulted in many fatalities. The government issued regulations to enforce physical distancing, advising the limitation of face-to-face activities (Wang, Xia, et al., 2023)(Adedoyin & Soykan, 2020). This led to the disruption of activities as everything had to be done from home. Schools and universities were also affected by the government's physical distancing measures, requiring teachers and lecturers to find ways to continue the teaching and learning process to ensure students' right to education was upheld (Fathonah et al., 2023)(Yasyfi et al., 2024).

WFH, an abbreviation for "work from home," means working from home. This policy is outlined in the Circular Letter of the Minister of Administrative and Bureaucratic Reform (PAN & RB) No. 50/2020, which is a second amendment to Circular Letter No. 19/2020 regarding the Adjustment of the Work System of State Civil Apparatus in Preventing the Spread of COVID-19 within Government Agencies. As civil servants, teachers are required to conduct the learning process online (Makarim, 2020).

Online learning utilizes various online applications such as WhatsApp Group, Telegram Group, Zoom Meeting, Google Classroom, Google Meet, classroom and YouTube (Batdı et al., 2021)(Wang, Pan, et al., 2023). These applications were widely used during the pandemic. However, despite the advancements in technology, not all challenges in the learning process can be addressed. This is based on several general statements known to be true. The goal of online learning is to provide quality learning services that are massive and open, reaching a wider audience (Romadin, 2023; Yoto et al., 2024). Blended learning combines face-to-face and online methods, preparing a system that involves direct interaction between students and lecturers. In blended learning, the process is not limited by space and time, allowing students to learn outside the classroom without rigid regulations (Aljedaani et al., 2023)(Jiang et al., 2023). The advantages of online learning include independent learning, high interactivity, improved memory retention, and richer learning experiences through text, audio, video, and animations (Derakhshan & Fathi, 2023). It also facilitates easy content delivery and updates, as well as downloading capabilities. Students can email peers, post comments in discussion forums, use chat rooms, and participate in video conferences to communicate directly (Sanan et al., 2022)(Wiratmaja & Widayana, 2022).

One factor supporting online learning is interest, defined as a strong inclination or desire towards something. In the Indonesian Dictionary, interest is described as a high inclination of the heart towards something; passion, desire (Purnamawati & Yahya, 2019; Romadin, 2021). Interest drives behavior with energy, direction, and persistence. In learning activities, motivation is the overall driving force within a learner that initiates learning activities, ensures their continuation, and directs them towards achieving learning goals (Billett, 2020).

Online learning can be defined as distance learning using internet-based applications, aiming to provide honesty and independence for students to learn from home (Wiratmaja & Widayana, 2022)(Tarazanny et al., 2024). This allows students to seek additional theories on the subjects taught and develop them, thereby enhancing their knowledge through self-directed learning via online media. Interest in learning is a strong internal desire that generates a response, enthusiasm, and passion, stimulating the brain to command the body to engage in learning activities willingly and voluntarily to achieve the goal of gaining knowledge from the subject studied. Self-directed learning refers to learning activities conducted by students without relying on help from others, including friends or teachers, to master the material or knowledge independently. Students can apply their knowledge to solve everyday problems (Miguel-Alonso et al., 2023)(Turan & Koç, 2018). High learning interest in students is expected to foster self-directed learning, enhancing their creativity in seeking various learning resources that can be used as references in the online teaching and learning process during the pandemic. Self-directed learning is a desire arising from within a person, aimed at changing one's mindset and behavior to achieve specific goals or targets (Khiat, 2015). Achieving these goals requires a process that relies on oneself without depending on others' assistance to complete tasks.

THEORITICAL REVIEW

The transition from traditional classroom settings to online learning environments has been a significant trend in higher education, particularly within technical fields such as mechanical engineering. This review explores the effectiveness of online learning, focusing on its impact on student interest and self-directed learning among mechanical engineering students.

Online Learning in Mechanical Education

Online learning has emerged as a critical pedagogical approach, especially in the context of mechanical engineering education. The shift towards online platforms has been driven by the need for flexible learning environments that accommodate diverse student needs and learning preferences. However, this transition raises questions about its effectiveness compared to traditional face-to-face instruction.

Research indicates that online learning can enhance student satisfaction, performance, and self-confidence, particularly when students are actively engaged in their learning process. A study involving mechanical engineering students found that those who utilized online learning resources reported higher satisfaction levels and improved performance in complex tasks compared to their peers who relied solely on traditional methods.

Factors Influencing Online Learning Effectiveness

Several factors contribute to the effectiveness of online learning, including student self-efficacy, motivation, and the design of the learning

environment. Self-directed learning is particularly important in online settings, where students must take greater responsibility for their educational outcomes.

1. Self-Efficacy : Students' confidence in their ability to succeed in online learning environments significantly affects their engagement and motivation. Higher self-efficacy is associated with better learning outcomes and increased persistence in challenging tasks.
2. Motivation : Intrinsic and extrinsic motivations play crucial roles in online learning. Studies show that students with a strong intrinsic motivation tend to engage more deeply with course materials and demonstrate higher levels of academic achievement. Conversely, a lack of motivation can lead to disengagement and lower performance.
3. Learning Environment Design : The structure and interactivity of online courses can significantly impact student interest and motivation. Effective online learning environments often incorporate interactive elements, such as discussion forums and collaborative projects, which can enhance student engagement and foster a sense of community.

Impact on Self-Directed Learning

Self-directed learning is a key component of successful online education. In mechanical engineering, where practical skills and conceptual understanding are essential, fostering self-directed learning can enhance students' ability to navigate complex problems independently. Research indicates that online learning can promote self-directedness by allowing students to choose their learning paths, access resources at their convenience, and engage with materials that align with their interests and career goals.

Challenges and Considerations

Despite the advantages of online learning, challenges remain. Not all students are equally prepared for this mode of education, and issues such as lack of access to technology, inadequate internet connectivity, and varying levels of digital literacy can hinder the effectiveness of online learning initiatives. Additionally, critics argue that online learning may not be suitable for all technical subjects, suggesting that hands-on experiences are essential in fields like mechanical engineering.

METHODOLOGY

The research uses a quantitative approach. The quantitative approach is used to reveal the influence between the scientific approach applied by teachers and reasoning abilities on student competence. This study aims to determine the extent of the influence and contribution of exogenous variables on endogenous variables. The exogenous variable in this research is the implementation of online learning (X). The endogenous variable in this research is self-directed learning (Z), while the intervening or mediating variable is interest in learning (Y). The relationship between the exogenous and endogenous variables.

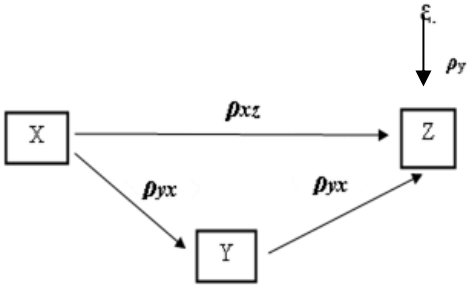

Fig. 1. Path Analysis

$$n = \frac{N}{N.d^2 + 1} = \frac{202}{(202).(0{,}05^2) + 1} = \frac{202}{1{,}50} = 134{,}09 = 135$$

The population of this research is 202 students from the Mechanical Engineering Department at the Faculty of Engineering, State University of Makassar (UNM) the sampling technique was done randomly, and the sample was obtained through calculations using the above formula, resulting in a sample of 135 students from the Mechanical Engineering Department at the Faculty of Engineering, State University of Makassar (UNM).

The research results were analyzed using descriptive quantitative techniques and path analysis. Descriptive quantitative analysis was used to describe the data obtained from the research process. Numerical data were processed and presented in descriptive statistical calculations, including frequency tables and percentages of the research results. Path analysis is a statistical analysis method that allows for quantitative interpretation of a number of variables within the analytical model. The influence between independent and dependent variables was tested through direct and indirect influence analysis among the variables. The researcher used SPSS 25 software for data analysis with a significance level of 5% to determine the contribution of independent variables to the dependent variable.

RESULTS

Frequency Distribution of Online Learning Implementation

Table 1. Classification Criteria for the Score of the Online Learning Implementation Variable Daring

No	Kategory	Interval	Frequency	Percentage
1	Strongly Disagree	< 53	1	0.74
2	Disagree	54 - 79	48	35.56
3	Agree	80 - 104	85	62.96
4	Strongly Agree	> 104	1	0.74
Total			135	100.00

In general, it can be concluded from the classification criteria in Table 1 that PTM students perceive the implementation of online learning to be in the

'Agree' category. A total of 0.74% of students perceive the implementation of online learning to be in the 'Strongly Disagree' category, 35.56% in the 'Disagree' category, 62.96% in the 'Agree' category, and 0.74% in the 'Strongly Agree' category.

Frequency Distribution of Learning Interest

Table 2. Classification Criteria for the Score of Learning Interest Variable

No	Kategory	Interval	Frequency	Percentage
1	Rendah	< 40	0	0.00
2	Sedang	41 - 57	3	22.22
3	Tinggi	58 - 74	78	57.78
4	Sangat Tinggi	> 74	54	40.00
Total			135	100.00

The classification in Table 2 suggests that, in general, PTM students perceive their learning interest to be high. A total of 0.00% of students perceive their learning interest to be low, 22.22% perceive it to be moderate, 57.78% perceive it to be high, and 40.00% perceive it to be very high.

Frequency Distribution of Mechanical Technology Competency Mastery

Table 3. Classification Criteria for the Score of Mechanical Technology Competency Mastery Variable

No	Kategory	Interval	Frequency	Percentage
1	Strongly Disagree	< 40	0	0.00
2	Disagree	41 - 57	6	4.44
3	Agree	58 - 73	102	75.56
4	Strongly Agree	> 73	37	20.00
Total			135	100.00

The classification in Table 3, can be concluded that, in general, PTM students perceive learning independence to be in the high category. A total of 0.00% of students have learning independence in the low category, 0.00% in the medium category, and 8.57% in the high category, while 91.53% are in the very high category.

Testing with Path Analysis

To determine the contribution of the implementation of the scientific approach to reasoning ability mastery, refer to the model summary table below, especially the R-squared valuUntuk mengetahui kontribusi implementasi pendekatan saintifik terhadap penguasaan kemampuan penalaran, dapat dilihat pada tabel model summary berikut, khususnya nilai R square.

Table 4. Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics				
					R Square Change	F Change	df1	df2	Sig. F Change
1	.365[a]	.133	.120	6.531	.133	10.137	2	132	.000

a. Predictors: (Constant), Y, X

b. Dependent Variable: Z

Based on the above model summary table, it is known that the value of R-squared (R2) is 0.133. This indicates that the influence of online learning and learning interest on self-directed learning simultaneously is 13.3%. Meanwhile, the remaining 86.7% is influenced by other factors

TABEL 5. Anova

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	864.779	2	432.390	10.137	.000[b]
	Residual	5630.658	132	42.656		
	Total	6495.437	134			

a. Predictors: (Constant), Pembelajaran Daring, Minat Belajar

b. Dependent Variable: Kemandirian Belajar

The significance test results in the ANOVA table show a Sig. value of 0.004. This value indicates that 0.05 ≥ Sig. value 0.000, thus rejecting H0 and accepting H1, meaning that the regression coefficient is significant. Based on this, it can be concluded that the implementation of online learning and learning interest simultaneously and significantly influences self-directed learning.

To determine the individual contribution of online learning implementation to self-directed learning, refer to the following model summary table, especially the R-squared value.

Table 6. Coefficients

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	39.215	6.752		5.808	.000
	Pembelajaran daring	.116	.062	.164	1.867	.004
	Minat Belajar	.287	.095	.267	3.036	.003

a. Dependent Variable: Kemandirian Belajar

The critical t-value is observed at a significance level of 0.05 where df = sample size - number of variables = 135 - 3 = 132. Therefore, the critical t-value at df = 132 is 1.645. Meanwhile, the calculated t-value obtained from the coefficients table is 3.036. This indicates that the calculated t-value > critical t-value (3.036 > 1.645), thus rejecting H0 and accepting Ha. It is concluded that the implementation of online learning individually influences self-directed learning.

Next, to test the significance level of the constant, refer to the following ANOVA table. Based on the coefficient table, it is found that the implementation of online learning has a Sig. value of 0.004. When compared to

α = 0.05, the Sig. value is smaller than α (0.004 < 0.05). This means that H0 is rejected and H1 is accepted, thus concluding a significant influence.

Similarly, the critical t-value is observed at a significance level of 0.05 where df = sample size - number of variables = 135 - 3 = 132. Therefore, the critical t-value at df = 132 is 1.645. Meanwhile, the calculated t-value obtained from the coefficients table is 1.867. This indicates that the calculated t-value > critical t-value (1.867 > 1.645), thus rejecting H0 and accepting Ha. It is concluded that learning interest individually influences self-directed learning.

Based on the coefficient table, it is found that learning interest has a Sig. value of 0.003. When compared to α = 0.05, the Sig. value is smaller than α (0.003 < 0.05). This means that H0 is rejected and H1 is accepted, thus concluding a significant influence.

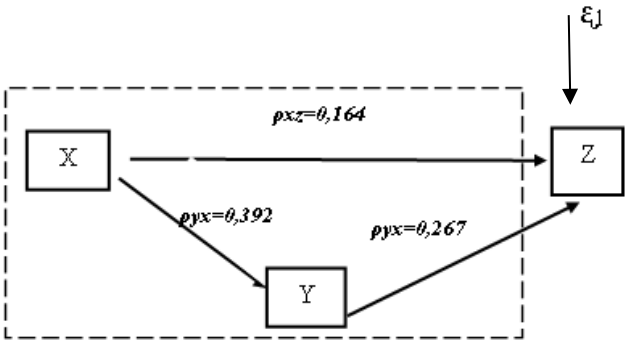

Fig.2 Path Diagram of Empirical Causal Relationship X Through Y to Z in the Structural Mode

TABEL 7. Coefficients

Model		Unstandardized Coefficients B	Unstandardized Coefficients Std. Error	Standardized Coefficients Beta	t	Sig.
1	(Constant)	51.138	4.321		11.834	.000
	Implementasi pembelajaran daring	.258	.052	.392	4.921	.000

a. Dependent Variable: minat belajar

The critical t-value is observed at a significance level of 0.05 where df = sample size - number of variables = 135 - 3 = 132. Therefore, the critical t-value at df = 132 is 1.645. Meanwhile, the calculated t-value obtained from the coefficients table is 1.867. This indicates that the calculated t-value > critical t-value (1.867 > 1.645), thus rejecting H0 and accepting Ha. It is concluded that the implementation of online learning individually influences learning interest.

Based on the coefficient table, it is found that learning interest has a Sig. value of 0.000. When compared to α = 0.05, the Sig. value is smaller than α (0.000 < 0.05). This means that H0 is rejected and H1 is accepted, thus concluding a significant influence.

Table 8. Summary of decomposition of path coefficients, direct and indirect effects

Pengaruh variabel	Pengaruh kausal		Sisa ε_1 dan ε_2	Total
	tidak langsungsung			
	Langsung beta	Melalui Y		
X terhadap Z	0,164			0,164
		0,164 + (0,392 x 0,267)		0,268
X melalui Y terhadap Z	0,113		0,887	1,00
X terhadap Y	0,392			0,392

DISCUSSION

Based on the model summary table above, it is known that the value of R-squared (R2) is 0.133. This value indicates that the combined influence of online learning and learning interest on self-directed learning is 13.3%. Meanwhile, the remaining 86.7% is influenced by other factors. The Beta value shows the path coefficient of online learning implementation on reasoning ability to be 0.164. To determine the percentage of the influence of the scientific approach on self-directed learning, the sum of 0.164^2 is calculated, resulting in a 2.67% influence of online learning implementation on self-directed learning, while the remaining 97.33% is influenced by other factors not examined. This aligns (Aljedaani et al., 2023; Batdı et al., 2021) that one of the advantages of online learning is increased interaction between students and teachers, flexibility in time and place of learning, reaching a wide range of participants globally, and facilitating content updating and storage.

The Beta value shows the path coefficient of learning interest on reasoning ability to be 0.267. To determine the percentage of the influence of learning interest on self-directed learning, the sum of 0.267^2 is calculated, resulting in an 8.00% influence of learning interest on self-directed learning, while the remaining 92.00% is influenced by other factors not examined. According to (Bozkurt & Sharma, 2023; Tubagus & Syarifuddin, 2023) based on the understanding of interest, it can be concluded that interest is a feeling that drives someone to engage in an activity or a motivation that underlies someone's actions. Therefore, it is concluded that learning interest is the drive that someone has to engage in learning activities.

The Beta value shows the path coefficient of online learning implementation on reasoning ability to be 0.392. To determine the percentage of the influence of the scientific approach on reasoning ability, the sum of 0.392^2 is calculated, resulting in a 15.64% influence of online learning implementation on reasoning ability, while the remaining 84.36% is influenced by other factors not examined. Self-regulated behavior is characterized by an individual's ability to face obstacles and problems, have self-confidence, and be able to do everything independently without the help of others. Meanwhile, self-regulated learning (self-directed learning) is the ability of an individual to have effective learning strategies and know how and when to use that knowledge so that students can regulate themselves in learning (Khiat, 2015; Sanova et al., 2022;

Turan & Koç, 2018).It is important to be mastered by vocational high school (SMK) students majoring in machining.

CONCLUSIONS

Based on the discussion of the research results regarding the contribution of online learning implementation to learning interest and its impact on self-directed learning, the following conclusions can be drawn:

1. Online learning implementation and learning interest simultaneously influence the self-directed learning of PTM FT UNM students.
2. The implementation of the scientific approach significantly influences the self-directed learning of PTM FT UNM students.
3. Learning interest significantly influences the self-directed learning of PTM FT UNM students.
4. Online learning implementation significantly influences the learning interest of PTM FT UNM students.

FUTURE STUDY

Future research could explore other factors that might influence self-directed learning, such as technological proficiency, student motivation, and external support systems. Understanding these factors could provide a more comprehensive view of what influences self-directed learning in an online environment.

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