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THE INFLUENCE OF SELF-EFFICACY AND SELF-REGULATION ON LEARNING MOTIVATION IN SIMULATION OF IMMERSIVE VIRTUAL REALITY-BASED LAPTOP ASSEMBLY PRACTICUM[1]

A INFLUÊNCIA DA AUTOEFICÁCIA E DA AUTORREGULAÇÃO NA MOTIVAÇÃO DA APRENDIZAGEM NA SIMULAÇÃO DA PRÁTICA DE MONTAGEM DE LAPTOPS BASEADA EM REALIDADE VIRTUAL IMERSIVA

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ABSTRACT

The purpose of this study was to determine the effect of self-efficacy on learning motivation, the effect of self-regulation on learning motivation, and the effect of self-efficacy and self-regulation on learning motivation in immersive virtual reality-based laptop assembly simulation. The population and sample of this study amounted to 68 students from the 2nd and 3rd year batches at the Department of Informatics Engineering, Faculty of Engineering and Vocational Education, Universitas Pendidikan Ganesha, Bali-Indonesia. This study uses a quantitative approach with a survey method to collect data. Data collection techniques in the form of instruments in the form of a questionnaire using a semantic differential scale. The data analysis technique used is multiple linear regression analysis, classical assumption test, t-test, F-test and the coefficient of determination. The results of the analysis show that self-efficacy has a positive and significant effect on learning motivation, the value of t-calculated> t-table (4.186>1998). While self-regulation has a positive and significant effect on learning motivation, the value of t-calculated> t-table (3.226>1998). The results of the analysis also show that there is a positive and significant influence between self-efficacy and self-regulation on learning motivation in the simulation of immersive VR-based laptop assembly practicum, where the value of F-calculated> F-table (16.453>3.150).

Keywords: Self-efficacy, Self-Regulation, Motivation to Learning, Laptop Assembly, Immersive Virtual Reality.

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RESUMO

O objetivo deste estudo foi determinar o efeito da autoeficácia na motivação para o aprendizado, o efeito da autorregulação na motivação para o aprendizado e o efeito da autoeficácia e da autorregulação na motivação para o aprendizado em uma simulação de montagem de laptop baseada em realidade virtual imersiva. A população e a amostra deste estudo foram 68 alunos do 2º e 3º anos do Departamento de Engenharia de Informática, Faculdade de Engenharia e Educação Profissional, Ganesha University of Education, Bali, Indonésia. Este estudo usa uma abordagem quantitativa com um método de pesquisa para coletar dados. A técnica de coleta de dados é um instrumento na forma de um questionário que usa uma escala de diferencial semântico. A técnica de análise de dados utilizada é a análise de regressão linear múltipla, o teste de suposição clássica, o teste t, o teste F e o coeficiente de determinação. Os resultados da análise mostram que a autoeficácia tem um efeito positivo e significativo na motivação para o aprendizado, o valor de t calculado > t de tabela (4,186>1998). Enquanto a autorregulação tem um efeito positivo e significativo sobre a motivação para o aprendizado, o valor de t-calculado > t-table (3,226>1998). Os resultados da análise também mostram que há uma influência positiva e significativa entre a autoeficácia e a autorregulação sobre a motivação para a aprendizagem na simulação de prática de montagem de laptop baseada em RV imersiva, em que o valor de F-calculado > F-table (16,453 > 3,150).

Palavras-chave: Autoeficácia. Autorregulação, Motivação para aprender, Montagem de laptops, Realidade virtual imersiva.

Introduction

Virtual reality (VR) based learning is gaining more and more attention in education due to its ability to create immersive and interactive learning environments (Shaikh Mohammed Shaukat, 2023; xiang et al., 2023). The use of VR technology allows students to experience realistic and immersive learning situations, which are difficult to achieve with conventional methods. (Kiegaldie; Shaw, 2023; Kim, 2020; Ma et al., 2022). In this context, two important psychological factors that influence learning success are self-efficacy and self-regulation. Self-efficacy refers to a person's belief in his or her ability to organize and execute the actions necessary to achieve a particular performance (Eidhof; De Ruyter, 2022; Wray; Sharma; Subban, 2022). According to Bandura's theory, self-efficacy has a significant impact on how individuals motivate themselves, face challenges, and persevere in adversity (Bandura, 1994). In VR-based learning, self-efficacy can determine the extent to which students feel capable of mastering the material delivered through this technology (Pendergast et al., 2022). Students with high levels of self-efficacy are more likely to actively participate, overcome technical

difficulties, and take full advantage of the VR learning environment (Gungor et al., 2022; Lee et al., 2022).

Self-regulation refers to an individual's ability to control their thoughts, emotions, and actions in order to achieve specific goals (Loksa et al., 2022; Sáez-Delgado et al., 2022). Zimmerman suggests that self-regulation includes several components, including goal setting, self-monitoring, and self-reflection (George; Gallagher, 2022). In the context of VR learning, self-regulation is important to help students stay focused and engaged, manage time and resources effectively, and assess their progress on an ongoing basis (Reginald, 2023). Students who have good self-regulation skills are more able to utilize the interactive features of VR to deepen their understanding (Shen; Li, 2022). Learning motivation is one of the main determinants of educational success (Hasanah, 2022). In VR learning, learning motivation can be influenced by how much students feel their self-efficacy is high and are able to organize themselves well (Tsirulnikov et al., 2023). Students who are confident in their abilities and able to manage their learning process tend to be more motivated to participate in VR learning (Hsiao, 2021; Zatarain-Cabada et al., 2023). They tend to see challenges as learning opportunities and try harder to overcome obstacles.

Previous researchers have developed immersive VR application products for laptop assembly simulations. The results of this application development have been tested and implemented in the basic practicum course of computer systems. Researchers hope that this VR application can help students understand the laptop assembly process. The obstacles faced previously were the difficulty in obtaining laptop components separately, and the costs required were quite high to prepare laptop assembly practicum tools. Previous researchers have developed immersive VR application products for laptop assembly simulations. The results of this application development have been tested and implemented in the basic practicum course of computer systems. Researchers hope that this VR application can help students understand the laptop assembly process. The obstacles faced previously were the difficulty in obtaining laptop components separately, and the costs required were quite high to prepare laptop assembly practicum tools.

Previous research related to the application of immersive virtual reality in education found a theoretical framework called the Cognitive Affective Model of Immersive Learning (CAMIL) (Makransky; Petersen, 2021). Immersive virtual reality refers to a created reality that feels very similar to the original reality (Akgün; Atici, 2022). Further research is needed to test, develop and improve this model. CAMIL presents a theory of change that can help bring about learning outcomes through cognitive and affective factors. Presence and agency in an immersive VR environment influence 6 cognitive and affective factors consisting of Situational Interest, Motivation, Self-Efficacy, Embodiment, Cognitive Load, and Self-Regulation. More research is needed on these factors as Situational Interest, Motivation, Self-Efficacy, Embodiment, Cognitive Load, and Self-Regulation are complex theoretical frameworks that can be used to design immersive learning interventions that can facilitate learning. Therefore, this research will examine some cognitive and affective factors from this theoretical framework model namely from self-efficacy factor, self-regulation factor and motivation factor especially learning motivation.

Previous research conducted by Chen Y and Hsu C showed that there is a strong relationship between self-efficacy, self-regulation, and learning motivation (Chen; Hsu, 2020). For example, students with high self-efficacy usually have good self-regulation, which in turn increases their motivation to learn. In VR environments, which demand active engagement and adaptation to new technologies, this relationship becomes even more important. Self-efficacy and self-regulation are key factors influencing learning motivation in VR-based learning (Estoque Loñez; Errabo, 2022). Students' confidence in their own abilities and their ability to organize their learning process largely determine how well they can utilize VR technology to achieve their learning goals. Therefore, it is important for educators to pay attention to and develop these two aspects to maximize the effectiveness of VR learning.

This study aims to examine and analyze the influence of self-efficacy and self-regulation on learning motivation in the context of Virtual Reality (VR) based learning. Specifically, the purpose of this study is to identify the level of self-efficacy and self-regulation of students, analyze the effect of self-efficacy on learning

motivation, analyze the effect of self-regulation on learning motivation, and examine the interaction between self-efficacy and self-regulation in influencing learning motivation. By achieving these objectives, this research is expected to make a significant contribution to the understanding of how self-efficacy and self-regulation affect learning motivation in VR-based learning. The results of this study are also expected to provide a strong empirical basis for the development of more effective educational strategies in utilizing VR technology to achieve optimal learning outcomes.

Literature review

There are several previous studies that examine the impact of self-efficacy, self-regulation, and learning motivation in the use of VR. Lan Ma and Long She's research (Ma; She, 2024) discusses the importance of self-regulation in online learning and how self-regulation ability affects academic success. Research shows that students who have good self-regulation skills tend to be more successful in managing their learning process, including in VR-based learning environments. This study by Nuh Yavuzalp and Eralp Bahcivan (Yavuzalp; Bahcivan, 2021) explores the relationship between e-learning readiness, self-regulation skills, satisfaction, and academic achievement. The results suggest that self-regulation skills play an important role in academic success and student satisfaction in online learning, which can be applied to the VR context. Estoque Loñez and H. Errabo analyzed self-motivation, self-efficacy, and self-regulation in the cognitive learning process and virtual laboratories as information (Estoque Loñez; Errabo, 2022). This study shows that there is a significant difference between the levels of motivation, self-efficacy and self-regulation. It further shows that there is a high correlation coefficient between the levels of motivation and self-regulation, motivation and self-efficacy as well as self-efficacy and self-regulation. This research emphasizes the importance of self-confidence and the ability to regulate motivation in achieving learning goals, especially in the context of educational technology such as VR.

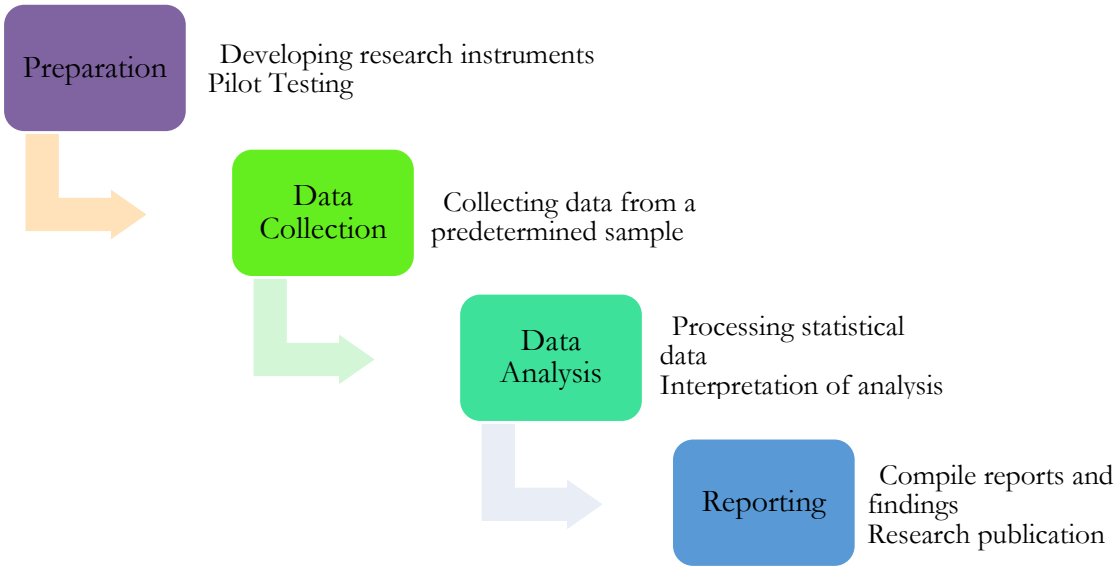
Considering previous research conducted on motivation and learning, the CAMIL theoretical framework developed by Makransky and Petersen identifies specific affordances of learning in immersive virtual environments (Makransky; Petersen, 2021). CAMIL adalah singkatan dari Cognitive Affective Model of Immersive Learning. Presence and agency are common capabilities of learning in IVR and these are applied to CAMIL's theoretical framework. Presence is the feeling of "being there" and agency is the feeling of "generating and controlling actions". Presence and agency influence 6 Affective and Cognitive Factors consisting of interest, motivation, self-efficacy, embodiment, cognitive load, and self-regulation. This study focuses on examining 3 affective and cognitive factors, namely self-efficacy factors, self-regulation and motivational factors, especially learning motivation. Muhterem Akgun and Bünyamin Atıcı conducted a meta-analysis on the relationship between self-efficacy and academic performance in VR learning environments (Akgün; Atici, 2022). The results show that high self-efficacy is positively correlated with better academic achievement in VR learning contexts. These studies provide deep insights into how self-efficacy, self-regulation, and learning motivation interact in learning contexts that use VR technology. Although research on the influence of self-efficacy, self-regulation, and learning motivation in the use of VR has shown positive results, there are various gaps that need to be addressed to improve the understanding and application of this technology in education. The results of this study are expected to make a significant contribution to the development of more effective and inclusive immersive VR-based educational practices.

Research Design and Methods

This research uses a quantitative approach with a survey method to collect data. The quantitative approach was chosen to allow objective measurement and statistical analysis of the variables studied. The population in this study were students involved in the simulation of immersive virtual reality-based laptop assembly practicum at the Department of Informatics Engineering, Faculty of

Engineering and Vocational Education Universitas Pendidikan Ganesha, Bali-Indonesia. The sample was selected using simple random sampling technique with a total of 68 students from the 2nd and 3rd year batches. The data analysis technique uses multiple linear regression analysis with the help of the SPSS 27 application. The stages of data analysis consist of descriptive analysis to describe the demographic characteristics of respondents as well as the distribution of self-efficacy, self-regulation, and learning motivation. Furthermore, classical assumption test analysis, feasibility test and interpretation of results were carried out. The Flowchart of this research procedure is presented in Figure 1.

Figure 1 – Flowchart of Research Procedure



Based on the Flowchart of research procedures in Figure 1, this research process starts from instrument development. The Research Instrument consists of a Self-Efficacy Questionnaire using a scale developed by Bandura and modified and tested with adjustments for the VR context (Bandura, 1994). The Self-Regulation Questionnaire uses a scale developed by Zimmerman and made modifications that have been tested for validity and reliability (Ebadi; Shakoorzadeh, 2015). Motivation to Learn Questionnaire Using the Motivated Strategies for Learning Questionnaire (MSLQ) scale modified for the VR context (Hsu; Lin; Lin, 2017). The VR tool is implemented using Oculus Quest 2. Students from the 2nd and 3rd year

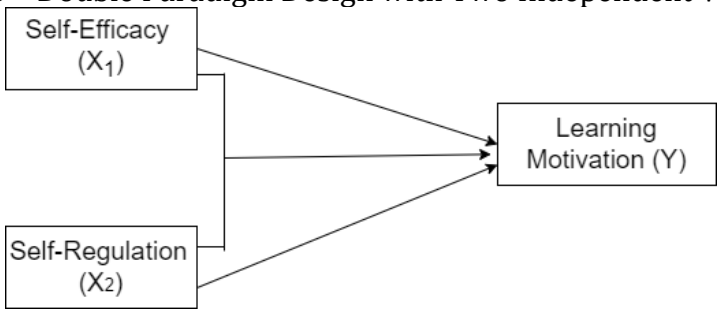
batches during the basic computer system lecture process are given the use of VR tools containing laptop assembly practicum simulation applications in turn. Figure 2 below is the data collection process and the display of the immersive VR environment of the laptop assembly application.

Figure 2 – Practicum process using VR (a) Students practicing laptop assembly (b) Display of laptop assembly practicum in VR environment

(a) (b)

Researchers made observations during the process of using VR activities and after completing students using VR were given questionnaires online. Data collection techniques in the form of instruments in the form of questionnaires using a semantic differential scale and distributed to students online using Google Form. In this study, the influence between the three variables, namely self-efficacy as variable X_1, self-regulation as variable X_2 and learning motivation as variable Y. For the constellation of influences between variables is presented in Figure 3 as follows.

Figure 3 – Double Paradigm Design with Two Independent Variables



Based on Figure 3. Double paradigm design with two independent variables, the hypothesis that can be proposed to examine the effect of self-efficacy and self-regulation on learning motivation in Virtual Reality (VR) based learning as follows.

1. There is a positive and significant influence between self-efficacy on learning motivation in the simulation of immersive virtual reality-based laptop assembly practicum
2. There is a positive and significant influence between the influence of self-regulation on learning motivation in the simulation of immersive virtual reality-based laptop assembly practicum
3. There is a positive and significant influence between the influence of self-efficacy and self-regulation on learning motivation in the simulation of immersive virtual reality-based laptop assembly practicum

In this study to test the research hypothesis using multiple linear regression analysis, namely seeing the effect of independent variables on the dependent variable, using a mathematical equation, namely multiple linear regression analysis with the following formula.

$$Y = a + B_1X_1 + B_2X_2 + \varepsilon$$

Description: Y =Variabel Dependent; a = Constant; B = Coefficient of Determination; X = Independent Variable; ε = Error term

Multiple linear regression analysis includes the Coefficient of Determination test which aims to see the effective contribution of variable X_1; X_2; d n explaining variable Y, F-test aims to see the simultaneous influence of variable X_1; X_2 on variable Y and t-test to see the partial influence of each variable X_1; X_2 on variable Y.

Results

Based on the results of distributing questionnaires used in this study totaling 68 students at the Department of Informatics Engineering, Faculty of Engineering and Vocational Education Universitas Pendidikan Ganesha, Bali-Indonesia, the following are details of the characteristics of respondents presented in Table 1.

Table 1 – Distribution of respondent data

Gender	Amount
Male	29
Female	39
Total	68

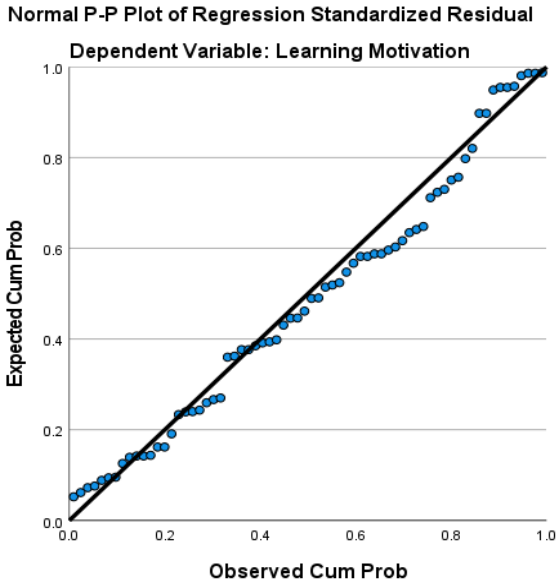
The following is presented the results of descriptive statistics consisting of mean and standard deviation in Table 2 as follows.

Table 2 – Descriptive statistic results

Descriptive Statistics			
	Mean	Std. Deviation	N
Learning Motivation	59.97	4.548	68
Self-Efficacy	43.91	4.606	68
self-regulation	59.62	4.804	68

Based on Table 2, it can be seen that the dependent variable learning motivation has a mean of 59.97 and a standard deviation of 4.548. Furthermore, the independent variable self-efficacy has a mean of 43.91 and a standard deviation of 4.606, and the independent variable self-regulation has a mean of 59.62 and a standard deviation of 4.804 and the number of respondents (N) is 68 students. Furthermore, this study conducted a classic assumption test consisting of Normality Test, Heteroscedasticity Test, Multicollinearity test, and Autocorrelation test.

Figure 4 – Normality Test Results



Based on the Figure 4. above, the results of the normal probability plot graph above can be seen that the plot points follow the diagonal line. It can be concluded that the data is normally distributed or meets the classical assumptions of normality.

Table 3 – Heteroscedasticity Test Results

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients		
		B	Std. Error	Beta	t	Sig.
1	(Constant)	9.149	3.718		2.461	.337
	Self-Efficacy	.229	.056	.458	4.104	.245
	Self-Regulation	.064	.054	.133	1.188	.239

The value of heteroscedasticity is greater than 0.05, so there are no symptoms of Heteroscedasticity. The classical assumption of heteroscedasticity in this model is met, which is free from heteroscedasticity.

Table 4 – Multicollinearity Test Results

Model		Collinearity Statistics	
		Tolerance	VIF
1	(Constant)		
	Self-Efficacy	.976	1.025
	Self-Regulation	.976	1.025

The VIF values for the Self-Efficacy and self-regulation variables are both 1.025, while the Tolerance is 0.976. If the Tolerance value > 0.100 and the VIF value < 10.00, then there are no symptoms of multicollinearity. Based on the Tolerance value obtained which is greater than 0.100 and the VIF value is smaller than 10.00, it can be said that there is no multicollinearity in the two independent variables. Based on the classical assumption requirements of linear regression using the Ordinary Least Squares (OLS) approach, a good linear regression model is free from multicollinearity. Thus, the above model is free from multicollinearity.

The data used to estimate the linear regression model is time series data, so it is necessary to test the assumption of freedom from autocorrelation. The results of the autocorrelation test can be seen in the Durbin-Watson column Model Summary[b] table.

Table 5 – Autocorrelation test results

Model	Std. Error of the Estimate	Durbin-Watson
1	3.762	2.170

The Durbin-Watson value listed on the SPSS output is called the DW count. This figure will be compared with the acceptance or rejection criteria that will be made with the d_L and d_U values determined based on the number of independent variables in the regression model (k) and the number of samples (N). The d_U value is sought in the Durbin-Watson distribution table based on k (2) and N (68) with a significance level of (error) 5% (α = 0.05).

$$d_U\ (1.668) < \text{Durbin-Watson}\ (2.170) < 4\text{-}d_U\ (2.332)$$

Based on the calculation results, the Durbin-Watson value (2.170) is greater than the d_U value (1.668) based on the Durbin-Watson table and smaller than the 4-d_U calculation results (4 - 1668= 2.332). So it can be concluded that there is no autocorrelation in the linear regression model.

Furthermore, the t-test in multiple linear regression is intended to test whether the parameters (regression coefficients and constants) estimated to estimate the multiple linear regression equation/model are the right parameters or not. The right meaning here is that the parameter is able to explain the behavior of the independent variable in influencing the dependent variable. The parameters estimated in linear regression include constants and coefficients in the linear equation. In this section, the t-test is focused on the slope parameter (regression coefficient) only. So the t-test in question is the regression coefficient test. The test results can be seen in the Coefficients[a] table as in Table 6 below.

Table 6 – T-test Results

Model		Unstandardized Coefficients		Standardized Coefficients		
		B	Std. Error	Beta	t	Sig.
1	(Constant)	22.774	6.730		3.384	.001
	Self-Efficacy	.423	.101	.428	4.186	.000
	Self-Regulation	.312	.097	.330	3.226	.002

If the t-calculated probability value (SPSS output shown in the sig. column) is smaller than the error rate (alpha) 0.05 (which has been determined), it can be said that the independent variable (from the t-calculated) has a significant effect on the dependent variable, while if the t-calculated probability value is greater than the error rate of 0.05, it can be said that the independent variable does not have a significant effect on the dependent variable.

The Effect of Self-Efficacy on Learning Motivation in Laptop Assembly Practicum Simulation Based on Immersive Virtual Reality

Based on the distribution of the t-table value, namely (0.025; 65) = 1998 and the t-calculated value based on Table 6. self-efficacy variable of 4.186, it is known that the t-calculated value> t-table (4.186>1998). So it is decided that the regression coefficient is significant or H0 is rejected and accepts the hypothesis in this study, namely the self-efficacy variable partially has a positive and significant effect on learning motivation in the simulation of immersive VR-based laptop assembly practicum. This can also be evidenced from the probability value of the independent variable, namely self-efficacy (Sig.) of 0.000 which is smaller than 0.05 or P < 0.05, which means that the regression coefficient of the self-efficacy variable is partially significant at the 95% confidence level (α : 0.05).

The Effect of Self-Regulation on Learning Motivation in Laptop Assembly Practicum Simulation Based on Immersive Virtual Reality

Based on the distribution of the t-table value which is (0.025;65) = 1998 and the t-calculated value based on Table 6 of the self-regulation variable of 3.226, it is known that the t-calculated value> t-table (3.226>1998). So it is decided that the regression coefficient is significant or H0 is rejected and accepts the hypothesis in this study, namely the self-regulation variable partially has a positive and significant effect on learning motivation in the simulation of immersive VR-based laptop assembly practicum. This can also be evidenced from the probability value of the independent variable, namely self-regulation (Sig.) of 0.002 which is smaller than 0.05 or P < 0.05, meaning that the regression coefficient of the self-regulation variable is partially significant at the 95% confidence level (α : 0.05).

The Effect of Self-Efficacy and Self-Regulation on Learning Motivation in Laptop Assembly Practicum Simulation Based on Immersive Virtual Reality

The coefficient of determination explains the variation in the influence of the independent variables on the dependent variable. In calculating the coefficient of determination, the authors use Adjusted R-Square because the independent

variable is more than one. The results of the coefficient of determination can be seen in Table 7 as follows.

Table 7 – Results of the coefficient on determination

Model	R	R Square	Adjusted R Square
1	.780[a]	.636	.616

Based on the results of the coefficient of determination, it can be explained that the Adjusted R-Square value is 0.616 which shows the proportion of the influence of the independent variable, namely self-efficacy and self-regulation on the dependent variable learning motivation of 61.6%. This means that based on the interpretation table of the coefficient of determination, the independent variables, namely Self-Efficacy and self-regulation, have a "Strong" influence on the dependent variable learning motivation. While the remaining 38.4% is influenced by other variables that are not in the linear regression model.

Multiple Linear Regression Analysis Results

Multiple linear regression analysis is used to estimate the effect of self-efficacy and self-regulation on learning motivation in immersive VR-based laptop assembly practicum simulation. Based on Table 6 above, the multiple linear regression equation is as follows.

$$Y = 22.774 + 0.423X_1 + 0.312X_2 + \varepsilon$$

The multiple linear regression equation can be explained as follows.

1. The constant value is 22.774, this states that if self-efficacy and self-regulation are ignored, the value of student learning motivation is 22.774
2. The regression coefficient for the self-efficacy variable is 0.423, this shows that every 1% increase in the self-efficacy factor, student learning motivation will increase by 4.23%.

3. The regression coefficient for the self-efficacy variable is 0.423, this shows that every 1% increase in the self-efficacy factor, student learning motivation tends to increase by 3.12%.

Furthermore, the model feasibility test or more popularly referred to as the F-test is the initial stage of identifying whether the estimated regression model is feasible or not. If the F-calculated (SPSS output shown in the sig. column) is smaller than the predetermined error level (alpha) 0.05, it can be said that the estimated regression model is feasible, while if the F-calculated probability value is greater than the error level of 0.05, it can be said that the estimated regression model is not feasible. The results of the F-calculated can be seen in Table 8 ANOVA[a] below. The F-calculated probability value is shown in the last column (sig.)

Table 8 – F-calculated Test Results

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	465.803	2	232.901	16.453	.000[b]
	Residual	920.138	65	14.156		
	Total	1385.941	67			

The value of prob. F-calculated (sig.) in the table above is 0.000 less than the significance level of 0.05 (Sig.<0.05), meaning that self-efficacy and self-regulation simultaneously affect learning motivation in the simulation of immersive VR-based laptop assembly practicum. Based on the comparison of the F-calculated and F-Table values, where the F-table has a confidence level of 95% (α = 0.05), the F-table value = 3.150. So from the results of the calculation of the significant test, it can be seen that the F-calculated> F-table value is 16.453> 3.150, so the research hypothesis can simultaneously be proven, namely that there is a positive and significant influence between self-efficacy and self-regulation on learning motivation in the simulation of immersive VR-based laptop assembly practicum.

Discussion

The results of this study prove that self-efficacy has a positive and significant influence on learning motivation in simulating immersive VR-based laptop assembly practicum. Students with high levels of self-efficacy will show higher learning motivation in Virtual Reality-based learning than students with low levels of self-efficacy. Students who believe in their ability to understand and master the material in a VR environment will be more motivated to actively participate and engage in the learning process. These beliefs help them overcome obstacles and make optimal use of VR technology. Self-efficacy refers to a person's perceived ability to learn or perform an action. Several empirical studies investigating the effects of virtual reality immersive-based lessons on self-efficacy have also identified positive effects. According to Xie T.Li Y.Tang Y. the application of Immersive Virtual Reality mediated learning produces more positive learning outcomes for students who have high self-efficacy (Xie; Li; Tang, 2023). It is the key factor in determining the success of learning using virtual reality. The results of this study are consistent with the results of research conducted by Binhajib et al that students' beliefs in their ability to operate VR technology, understand the material, and overcome challenges in a VR environment affect their motivation, engagement, and learning outcomes (Binhajib; Mckinney; Eike, 2023). Therefore, it is important for educators to develop effective strategies to increase students' self-efficacy in VR-based learning, including training, support, constructive feedback, and the use of models or mentors. With high self-efficacy, students can fully utilize the potential of VR learning to achieve their learning goals.

Self-regulation variables have a positive and significant effect on learning motivation in simulating immersive VR-based laptop assembly practicum. The results of Liu Z.et al's research, students with good self-regulation skills will show higher learning motivation in Virtual Reality-based learning than students with low self-regulation skills (Liu et al., 2023). The ability to set goals, monitor progress, and manage time and resources effectively helps students stay focused and motivated in VR learning environments that may demand more intensive adaptation and self-

management. In VR learning environments, self-regulation becomes particularly important as this technology offers immersive and interactive learning experiences that require good self-control to utilize the full potential of the learning experience. The results of this study are consistent with Igarzabal's research (Igarzábal et al., 2021) has shown that good self-regulation contributes significantly to success in technology-based learning, including VR. Students' ability to set goals, plan, monitor progress, manage time, and adapt their learning strategies determines how effectively they can utilize VR technology to achieve their learning goals.

The combination of high self-efficacy and self-regulation will have a stronger influence on learning motivation in the simulation of immersive VR-based laptop assembly practicum than the influence of each variable separately. The combination of high self-efficacy and good self-regulation in this study proved to have a synergistic effect on learning motivation in the simulation of immersive VR-based laptop assembly practicum. The results of this study are consistent with Guillen et al.'s research, learners who are confident in their abilities and able to regulate themselves will be better able to overcome challenges and take full advantage of VR learning potential (Guillén; Ortiz Colón; Moreno, 2023). The proposed hypotheses reflect the assumption that self-efficacy and self-regulation are important factors influencing learning motivation in immersive VR-based laptop assembly practicum simulation. Testing this hypothesis through empirical research can provide deeper insights into how these two variables interact and influence the learning process in the context of advanced educational technology. Future research needs to examine other factors related to the 6 Affective and Cognitive Factors consisting of interest, virtual embodiment, and cognitive load. The gap in this research which still focuses on students in the field of Engineering, in the future research subjects are needed to various disciplines and different levels of education. The results of this study have not explicitly differentiated between different types of VR technologies (e.g., full immersive VR vs. non-immersive VR) and how each type of technology affects self-efficacy, self-regulation, and motivation to learn. Future studies comparing the effects of different types of VR technology may provide insight into which type of

technology is most effective for improving self-efficacy, self-regulation, and motivation to learn.

Conclusion

This study aims to examine and analyze the influence of self-efficacy and self-regulation on learning motivation in the context of Virtual Reality (VR) based learning. This research activity utilizes an immersive virtual reality-based laptop assembly practicum simulation application. Although this laptop assembly VR can help students understand the laptop assembly process better, several challenges arise related to self-efficacy, self-regulation and learning motivation. In the process of observing practicum activities, researchers need to examine whether there is an effect of self-efficacy and self-regulation on learning motivation in the simulation of immersive virtual reality-based laptop assembly practicum. This study uses a quantitative approach with a survey method to collect data. The data collection technique is an instrument in the form of a questionnaire using a semantic differential scale. Data analysis techniques used in this study are multiple linear regression analysis, classical assumption test, t-test, F-test and the coefficient of determination. The analysis shows that self-efficacy partially has a positive and significant effect on learning motivation, the value of t-calculated > t-table (4.186>1998). While self-regulation partially has a positive and significant effect on learning motivation, the value of t-calculated >t-table (3.226>1998). The results of the analysis also show that there is a positive and significant influence between self-efficacy and self-regulation on learning motivation in the simulation of immersive VR-based laptop assembly practicum, where the value of F-calculated>F-table (16.453>3.150). This research is expected to contribute significantly to the understanding of how self-efficacy and self-regulation affect learning motivation in VR-based learning. The results of this study are also expected to provide a strong empirical basis for the development of more effective educational strategies in utilizing VR technology to achieve optimal learning outcomes.

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