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The Effect of Virtual Reality Learning on Students' Motivation, Interest, and Competence in Meeting the Needs of the Modern World of Work

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ABSTRACT
The purpose of this study is to determine the potential of virtual reality (VR) learning to prepare students with the competencies and knowledge needed by the industry. By using VR technology, students can learn realistically and interactively in a simulated environment, which allows them to develop practical skills and knowledge relevant to industry needs. Data was collected from 100 respondents. Data were analysed quantitatively using the Partial Least Squares−Structural Equation Modelling (PLS-SEM) technique, SmartPLS 3. The aspects that significantly affect the competence of students were examined. The results of the study show that learning with virtual reality has a positive and significant effect on student competence.

Keywords: *Virtual Reality, Motivation, Interest, Competency.*

1. INTRODUCTION

Today's industry is increasingly relying on innovation and creativity in the development of new products and services [1]. Learning with VR technology can help students develop their creativity and innovation and prepare them to work in a creative and innovative work environment [2]. Several industries such as technology, health, manufacturing, and architecture have started to integrate VR technology in the employee training and development process [3][4]. For example, VR can be used to train employees in the use of new equipment, simulate emergency situations, and train in workplace safety [5]. In the world of education, it is hoped that VR technology can also help students learn about manufacturing processes, product development, and the latest technology in certain industries [6].

By leveraging VR learning, educational institutions can better prepare students to enter the industry with the skills and knowledge needed[7]. Educational institutions can adapt curricula and teaching methods taking into account industry needs and integrate VR technology into learning [8]. This is in line with the independent or independent learning campus launched by the Ministry of Education, Culture, Research and Technology (Kemendikbudristek) which aims to improve the quality of education in tertiary institutions in Indonesia by focusing on improving skills, developing skills and mastering technology [9][10][11].

In the long term, the use of VR technology in learning can help reduce the gap between the skills required by the industry and the skills possessed by graduates [12][13]. Thus, the use of VR learning can have a positive impact on students, educational institutions, and industry, by preparing students to better enter the world of work and meet the growing needs of the industry [14].

2. LITERATURE REVIEW

In recent years, many researchers have conducted research into the use of VR, where the use of VR has increased significantly in learning [15][16][17]. However, there are shortcomings in previous research studies where the research only aimed to find out the benefits of learning using VR. Meanwhile, this study aims to measure the relationship or correlation between several variables that can affect virtual reality (VR) learning with industrial needs.

Some of the variables that affect virtual reality learning with industrial needs that are used as a reference in this study are, VR technology, learning content, learning methods, teaching skills and learning objectives.

The following are some of the variables that can affect the relationship between independent learning and industrial needs, Interests and talents of students, curriculum and learning, facilities and infrastructure, teacher competence and industrial needs.

The following are some of the variables that may affect the relationship between virtual reality learning, independent learning campuses, and industry needs, Technology and innovation, Quality of human resources, Industrial needs, and Collaboration between campuses and industry.

Independent learning is an educational concept that gives freedom to students to choose and manage their own learning path [18]. This concept promotes students as learning subjects who are active and responsible for their learning process [19]. While the needs of the industry is the need for workers who have the skills and abilities in accordance with the demands and needs of the world of work [20].

There is a close relationship between independent learning and industrial needs. Freedom of learning provides opportunities for students to develop broader skills and knowledge, as well as hone critical thinking skills, creativity and innovation. This is very much needed in the industrial world which continues to grow and is increasingly complex [21].

In the context of industrial needs, independent learning can help students become better prepared to face challenges and competition in the world of work [22]. By developing skills and abilities that are in line with industrial needs, students can more easily adapt to changes in the work environment, so that they can become productive and innovative workers. Therefore, independent learning can be an effective educational strategy to prepare students to face the demands and needs of the industry in the future [23].

This research method uses a correlation survey where one of the research methods is used to determine the correlation between two or more variables. This method is usually used to examine the relationship between quantitative variables. The SmartPLS application version 3 is software used to analyze research data using the Partial Least Squares (PLS) Path Modeling technique [24].

Partial Least Squares (PLS) Path Modeling is one of the multivariate analysis techniques used to examine the relationship between variables in a model. This technique is one of the most popular methods for analyzing structural models because it has several advantages, such as the ability to handle highly correlated variables, abnormal data, and small sample sizes.[25].

1. RESULT AND DISCUSSION

This study aims to determine whether there is a relationship (correlation) between the factors that influence competence in today's modern world of work, by using virtual reality learning. Preliminary assumptions are that there is a correlation between several factors. The potential for virtual reality learning in motivating and increasing students' interest and competence in meeting the demands of the world of work. In the correlation survey research method, researchers collect data from respondents using questionnaires or interviews. The data obtained were then analyzed using statistical techniques to determine whether there was a relationship between the variables studied [26].

Initial assumptions (hypotheses) in this study are:

H1	:	There is a correlation between virtual reality learning and competence
H2	:	There is a correlation between motivation and competence
H3	:	There is a correlation between interest in competence
H4	:	There is a correlation between virtual reality learning through motivation to competence
H5	:	There is a correlation between virtual reality learning through interest in competence

In this study the data used to collect this primary data through the questionnaire method. The technical arrangement of questions or statements is related to VR learning, motivation and interest in the competence of students [27]. The measurement of this study uses a Likert scale of 1-5 which is used to measure responses from respondents, namely scale 1 (strongly disagree), scale 2 (disagree), scale 3 (neutral), scale 4 (agree), scale 5 (strongly agree). The research subjects were students of informatics engineering education at Padang State University.

4. RESULT AND DISCUSSION

The results of the study show how the relationship or correlation occurs between factors related to virtual reality learning between, the Independent Learning Campus, and industrial needs. The effectiveness of the correlation can be seen from the students' statements based on the answers to the questionnaire where the existing question indicators are important factors in influencing motivation and interest which result in good quality learning so that it will improve academic abilities which will be directly proportional to the competencies students acquire in learning using VR media [28].

The initial model of correlation or relationship between variables based on indicators in each question in the questionnaire can be seen in Figure 1.

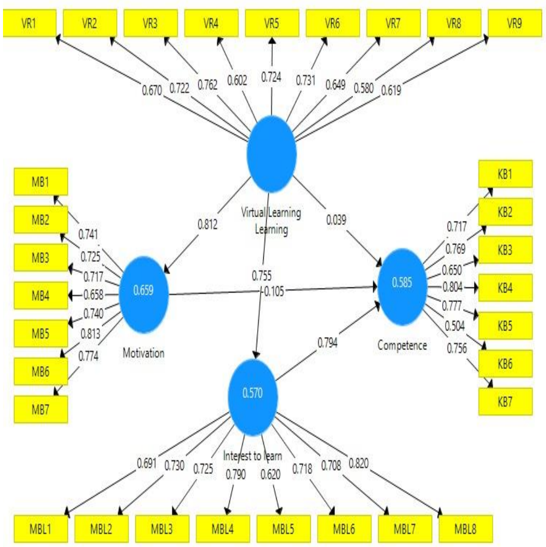

Figure 1 Initial model between variables

Model evaluation (Outer model) was carried out by convergent and discriminant validity tests. The validity test will be valid if the loading factor (λ) ≥ 0.7. An indicator with a loading value below or <0.7 indicates that the indicator does not work in the measurement model and this indicator must be discarded. Table 1 states the value of the loading factor (λ).

Table 1 shows that some indicator values have a loading factor value (λ) $\geqslant$ 0.7, which means that the indicator is declared invalid (convergent validity). Invalid values will be eliminated or discarded to get a loading factor value (λ) $\geqslant$ 0.7[29].

Before eliminating these values, further testing is carried out, namely determining discriminant validity by analyzing the Average Variance Extracted (AVE) value with the aim of whether convergently invalid indicators are discarded or maintained.

Table 2 Initial model AVE values

Rated aspect	**AVE**
Virtual learning	0.457
Interest	0.529
Motivation	0.547
Competence	0.515

Table 1 Initial loading factor (λ).

No	Indicator	loading factor (λ)	validity
1.	VR1	0.670	Invalid
2.	VR2	0.722	valid
3.	VR3	0.762	valid
4.	VR4	0.602	Invalid
5.	VR5	0.724	valid
6.	VR6	0.731	valid
7.	VR7	0.649	Invalid
8.	VR8	0.580	Invalid
9.	VR9	0.619	Invalid
10.	MB1	0.741	valid
11.	MB2	0.725	valid
12.	MB3	0.717	valid
13.	MB4	0.658	Invalid
14.	MB5	0.740	valid
15.	MB6	0.813	valid
16.	MB7	0.774	valid
17.	MBL1	0691	Invalid
18.	MBL2	0.730	valid
19.	MBL3	0.725	valid
20.	MBL4	0.790	valid
21.	MBL5	0.620	Invalid
22.	MBL6	0.718	valid
23.	MBL7	0.708	valid
24.	MBL8	0.820	valid
25.	KB1	0.717	valid
26.	KB2	0.769	valid
27.	KB3	0.650	Invalid
28.	KB4	0.804	valid
29.	KB5	0.777	valid
30.	KB6	0.504	Invalid
31.	KB7	0.756	valid

From table 2 it can be seen that the Average Variance Extracted (AVE) value shows that the variables X2 (interest), X3 (motivation) and Y (competence) have shown numbers above 0.5, this indicates that this indicator is discriminately valid. For the Average Variance Extracted (AVE) value below 0.5, it indicates discriminately invalid. Based on the consideration of the Average Variance Extracted (AVE) value that has been obtained, a further test is carried out by creating a new model by removing indicators that cause invalidity both convergently and discriminately.

Table 3 Initial model Composite Reliability values

Rated aspect	Cronbach's Alpha	Composite Reliability
Virtual learning	0.840	0879
Interest	0.872	0.899
Motivation	0.863	0.894
Competence	0.851	0.883

It can be seen from table 3, the Composite Reliability indicator value is above 0.7, so this criterion meets the reliable criteria. But because this model does not meet its validity element, further testing is still carried out by creating a new model so that the assumptions of validity are met.

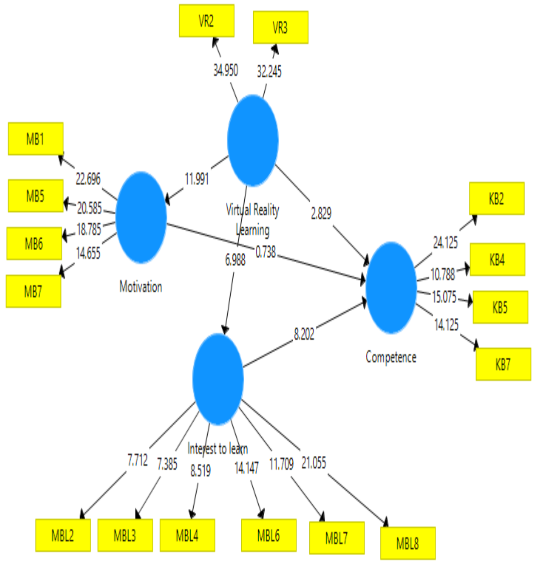

Figure 2 PLS final model algorithm

After further testing, the loading factor (λ) data is obtained as follows table 4.

No	Indicator	Loading Factor (λ)	Validity
1.	VR2	0.904	Valid
2.	VR3	0.902	Valid
3.	MB1	0.809	Valid
4.	MB5	0.803	Valid
5.	MB6	0.818	Valid
6.	MB7	0.799	Valid
7.	MBL2	0.753	valid
8.	MBL 3	0.750	Valid
9.	MBL4	0.709	Valid
10.	MBL6	0.767	Valid
11.	MBL7	0.732	Valid
12.	MBL8	0.845	Valid
13.	KB2	0.815	Valid
14.	KB4	0.771	Valid
15.	KB5	0.832	Valid
16.	KB7	0.831	Valid

Table 4 contains data on the loading factor (λ) ≥ 0.7, which indicates convergent validity. It can be seen that after eliminating several indicators, the results obtained for all indicators are convergently valid.

Table 5 Final model AVE values

Rated aspect	AVE
Virtual learning	0.815
Interest	0.578
Motivation	0.652
Competence	0.660

From table 5, it can be seen that the Average Variance Extracted (AVE) values of all indicators show that they have shown numbers above 0.5, so they are said to be discriminately valid.

Table 6 Composite Reliability value of the final model

Rated aspect	Cronbach's Alpha	*Composite Reliability*
Virtual learning	0.774	0898
Interest	0.854	0891
Motivation	0.825	0.882
Competence	0.833	0.886

It can be seen from table 6, the Composite Reliability value for all indicators is above 0.7, so this criterion meets the reliable criteria. This is also reinforced by value Cronbach's Alpha > 0.6. After testing the model which is considered valid and reliable, the next step is to test the inner model or evaluate the final model. In this evaluation, the results of the path coefficient test, goodness-of-fit test and hypothesis testing are seen. The path coefficient test has a function to see the magnitude of the influence of the independent variables on the dependent variable.

Table 7 Value path coefficient

Rated aspect	Original sample	Sample mean	Standard deviation (STDEV)	T Statistic (O/STDEV)
Virtual learning to Motivation	0.679	0.681	0.056	12.603
Virtual learning to Interests	0.713	0.712	0.101	7.087
Competency virtual learning	-0.346	-0.321	0.124	2.783
Competency to Motivation	0.094	0.128	0.127	0.737
Competency to Interest	0.954	0.909	0.117	8.159

Based on table 7. It can be seen that the valuepath coefficient the highest is shown by VR learning on motivation of 12,063. the lowest value is 0.737, namely the effect of motivation on competence. The greater the value of the path coefficient, the stronger the influence of the independent variables on the dependent variable.

Further testing of the structural model is carried out by looking at the results of the Goodness of fit test based on the coefficient of determination R2, the following is the R square value obtained from the output of Smart PLS 3.0.

Table 8 Value of R Square

Rated aspect	R *Square*
Competence	0.630
Interest	0.509
Motivation	0.462

Based on table 8 it is known that the R2 value for variable Y (competence) is 0.630. Means that all independent indicators affect competence by 63.0% and the remaining 37% is influenced by other factors. Furthermore, the R2 value for the X2 variable (interest) is 0.509 or 50.9% and the R2 value for the X3 variable (motivation) is 0.462 or 46%. The Q Square value is 0.351, by looking at this value, this research has a good observation value because the Q Square value > 0 is 0.351. The higher the Q Square value, the better or more fit the data.

Table 9 Statistical T Value and P-Value

Hypothesis	Rated aspect	T Statistic (O/STDEV)	P Value	Decision
H1	Competency to Interest	7.575	0.000	accepted
H2	Competency to Motivation	0.692	0.489	Rejected
H3	Virtual learning to Competency	2.638	0.009	accepted
H4	Virtual learning to Interests	6.874	0.000	accepted
H5	Virtual learning to Motivation	12.664	0.000	accepted

Based on table 9. Shows that the relationship between interest and competence has a significant value with a t-statistic of 7,575 (> 1.96), thus the H1 hypothesis in this study which states that "interest in learning affects competence" is accepted.

Furthermore, for the H2 hypothesis with a t-statistic value of 0.692 (<1.96) in this study stating that "learning motivation has an influence on competence" is rejected. For the H3 hypothesis with a t-statistic value of 2.638 (> 1.96), this study states that "VR learning has an influence on competence" is accepted. In the H4 hypothesis with a t-statistic value of 6.874 (> 1.96), this study states that "VR learning has an effect on learning interest" is accepted. As for the last hypothesis or H5 with a t-statistic value of 12,664 (> 1.96), this study states that "VR learning has an influence on learning motivation" is accepted.

5. CONCLUSION

This research was conducted to analyse the effect of VR learning which aims to improve student competence in accordance with the current needs of the industrial world. From the results of the analysis, it can be seen that based on the t-statistic value below 1.96 it causes the hypothesis to be rejected, this shows that several independent indicators (X1, X2, X3) which are suspected of having influence and correlation with competence turn out that after being analysed they do not have a direct influence on competence or the effect is very small.

Virtual reality (VR) learning has advantages and the importance of which is, it can increase the interest and motivation of students where interactive and fun learning experiences can increase students' interest in learning and encourage them to participate more.

Overall, virtual reality learning is very important in improving the quality of learning and providing a more interactive, effective and efficient learning experience for students.

AUTHORS' CONTRIBUTIONS

Khairi Budayawan: Lead author, designed research, collected and analyzed data, wrote and edited manuscripts, submitted manuscripts to journals.

Delvi Asmara: Assisted in data collection, provided input in data analysis, assisted in writing and editing manuscripts.

Each author has an equal contribution to the study, although their role may vary at each stage of the research. The primary author is usually responsible for research and manuscripts, while other authors provide support and contributions at various stages.

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