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The Effectiveness of Teaching Virtual Reality-Based Business Ethics: Is it Really Suitable for All Learning Styles?

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I. Introduction

Education must respond to the progress of information technology development by providing IT-based teaching methods to enhance the learning process. This is because the evolution of technology is changing student learning preferences from verbal to visual or even virtual (Proserpio and Gioia, 2007). Virtual reality (VR) is an IT-based learning media that creates a virtual environment which simulates the real world and provides concrete experiences, so students are able to actively explore their course material. VR technology is able to provide practical experiences without actually leaving home, so relevant for responding to the current situation due to the COVID 19th pandemic. Previous research examine the effectiveness of VR in various fields including engineering (Alhalabi, 2016), military (Webster, 2016), robotic surgery (Bric et al., 2016), Francis et al., 2020), firefighters (Çakiroglu & Gökoglu, 2019), negotiation training (Ding, Brinkman, & Neerincx, 2020), and health care training (Chow *et al.*, 2017), ethics education (Sholihin et al., 2020). However, empirical research examining learning styles on the effectiveness of using VR is still scarce. VR has different characteristics from other learning media, high immersiveness in a VR environment can create a sense of presence that improves learning outcomes, except for students with certain learning styles who experience cognitive overload when exploring virtual environments (Hsu et al., 2017). Therefore, it is necessary to investigate to what extent learning styles can influence the effectiveness of VR-based learning on business ethics. This is because the effectiveness of business ethics education is indispensable along with the increasing cases of fraud and financial companies (PwC's Global Economic Crime and Fraud, 2020).

Compared to traditional learning, VR is a more flexible learning method as it has no limitations on time, distance, and space (Yu *et al.*, 2007). The main characteristic of the VR is immersion, interaction and imagination (Zhang et al., 2017) that improve cognitive performance in engineering (Alhalabi, 2016), the military (Webster, 2016) and a surgical robot (Bric et al., 2016). VR-based learning can improve students' learning abilities compared to traditional teaching (Jena, 2016). VR has already proven its effectiveness in teaching business ethics (Sholihin et al., 2020) because VR has the ability to create a virtual world, without any impact

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from socially reprehensible acts. With VR, students are able to understand scenarios about ethical dilemmas that occur in business practices, observe the potential consequences and make decisions to solve concrete situations where ethical dilemmas require a response. VR allows students to simulate situations virtually and develop their long-term experience. This is crucial; because there is the possibility that in the near future our society will live in a mixed world (virtual and physical space).

However, technology's adoption may cause problems, including the effectiveness of technology for learning (Grasha, 1996) because the nature of instruction should accommodate individual differences in learning styles to improve the learning outcomes. Based on Aptitude-by-treatment interaction to improve the learning outcomes required the nature of the instruction that accommodates individual differences in ability, style or preference. Research on individual learnings style in the context of VR is indeed still in its infancy. (Lee et al., 2010; Pedram et al., 2020) found that in a virtual environment, differences in learning styles did not affect learning outcomes, whereas (Chen et al., 2005) argued that in the non-guided mode VR, the accommodator outperformed the assimilator learner.

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The virtual environment that is able to evoke a sense of presence refers to the intensity of emotional involvement. Sense of presence can actually improve leaning results, but if the user lacks the ability to explore game tasks it will cause cognitive overload that has a negative impact on learning outcomes (Huang et al., 2020; Hsu et al., 2017). Learning style preferences cause differences in cognitive load during the learning process using VR (Hsu et al., 2017). In a VR-based learning environment, students are required to explore the virtual environment, therefore without navigation, students with active experimental learning styles are superior to students with passive or observing learning styles (Chen et al, 2005).Therefore, it is necessary to understand the impact of adopting VR technology to improve students' performance by considering different learning styles.

In Indonesia, the shift from offline learning to e-learning has created new academic pressures for some students (Pajarianto *et al.*, 2020). The main challenge for educators is how to improve students' learning outcomes and overcome the problem of using e- learning technology. Looking at the scarcity of research into the effectiveness of VR for teaching business ethics during the COVID pandemic. This study fills the gap by extends on the work of Sholihin et al. (2020) in that we establish the connection between user perception of the use of VR and learning style on the effectiveness of VR. Therefore, the research question for this study could be as follows:

RQ1: Is the effectiveness of VR-based learning media ethics influenced by the interaction between the user perception of VR and learning styles?

II. Research model and hypotheses

VR technology creates virtual environments capable of breaking the boundaries of traditional educational systems. For example, VR can create a virtual environment for athletic education (Wang & Hu, 2017) and surgical training for surgeons (Francis, Bernard, Nowak, Daniel, & Bernard, 2020). VR is an interactive technology that provides visualization and real-time interaction in a virtual world that resembles the real world. VR has three main characteristics that emphasize immersion, interaction, and imagination (Zhang *et al.*, 2017). VR provides a highly interactive experience or virtual experience, which is the psychological and emotional state of the user when interacting with a product in a 3D environment. Virtual experiences create a sense of presence that describes the user's emotional interactions. Sense of presence is a predictor of user perceptions related to satisfaction, quality, motivation, positive attitude, or positive performance in VR-based learning environments (Weibel & Wissmath, 2011; Yoon et al., 2015).

VR features are the antecedents of technological quality and technological accessibility (Salzman*et al.*, 1999; Zhang *et al.*, 2017). The quality of the technology is the extent to which users believe that certain technologies are relevant and useful for accomplishing work, and improving their performance. That is, if a user feels that the technology is useful to complete the work and improve their performance, they will assume it is a high-quality technology. Technological accessibility is the extent to which users believe that using a particular technology is comfortable, controllable and easy to use. Therefore, we predict that VR features have an effect on the perception of the technology's quality and accessibility.

H1: VR as determinant of technology's quality

H2: VR as determinant of technology's accessibility

The theory of the interactive media effect implies that media characteristics have an effect on affective, cognitive and behavioral responses (Sundar *et al.*, 2015). Several previous studies have tested the use of VR on undergraduate students and found that VR-based learning can improve the learning outcomes for educational environment (Su, 2018), biology (Makransky *et al.*, 2016), health care (Chow*et al*., 2017) and fire safety skills (Çakiroglu and Gökoglu, 2019). Previous research has found empirical evidence that VR features can facilitate learning (Yusoff *et al.*, 2011), experience (Chow *et al*., 2017; Yusoff *et al*., 2011), and provide feedback (Chittaro and Zangrando, 2010; Chow *et al*., 2017). These three components are the antecedents of self-efficacy (Gist and Mitchell, 1992). Several previous studies have found that VR-based learning can increase self-efficacy in various fields: the art of negotiating (Ding *et al*., 2020), athletics (Wang and Hu, 2017), and surgery (Francis *et al*., 2020).

However, it is important to note that virtual learning environments will not necessarily facilitate students' performance (Dalgarno*et al.*, 2002). The Aptitude-by-treatment interaction (ATI) study examined the effect of students' aptitudes and traits on learning outcomes of various forms of instruction (Cronbach & Snow, 1969). The main assumption underlying the ATI research is that the nature of instruction is desirable to accommodate individual differences in abilities, or learning styles to improve learning outcomes.

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A learning style is a process that students use to gather and process information (Cano *et al.*, 1992). A learning style is a general tendency to process information differently (Jonassen and Grabowski, 1993). Kolb (1984) defined a learning style as the preferred way for students to understand and process information and divide it into four types of learning styles are: Accommodator, assimilator, Converger, and diverger. Accommodators have a dominant learning ability from real experiences and active experiments. They are classified as actors and touchers. On the contrary, assimilators have a dominant ability in abstract conceptualization and reflective observation. Assimilators are classified as observers and thinkers. Convergers have a dominant ability for abstract understanding and transforming through action, most appropriate learning occurs through abstract conceptualization and active experimentation. Convergers are both thinkers and doers. On the other hand, divergers have dominant abilities through concrete experiences and reflective observation. A diverger is a toucher and an observer.

Some researchers support that learning outcomes will improve if subject matter is presented in a way that is consistent with students' learning styles (Slavin, 2000; Woolfolk, 1998). However the field of learning styles has been repeatedly criticized for confusing and overlapping definitions and terminology, imprecise measurements and lack of independent evaluation (Peterson et al., 2009; Wilingham et al., 2015). However, research on learning styles in VR learning needs to be explored. VR has high interaction and immersive characteristics, giving rise to a sense of presence which refers to a sense of spatial immersion in a virtual environment (Weibel & Wissmath, 2011) and the intensity of emotional involvement. A sense of presence can improve learning outcomes if users are not overwhelmed by the virtual environment (Bachen, Hernandez-Ramos, Raphael, and Waldron (2016).

In the context of VR, the user explores a virtual environment that involves navigating within it. Navigation is the process of determining the path to be traversed by any object through any environment. However, the process of navigating in a virtual environment is difficult (Stankiewicz, McCabe, Kelly, Tara, & Legge, 2003; Smith & Marsh, 2004). One of the causes is the problem of disorientation or getting lost (Marsh & Smith, 2001). Some VR users have problems retaining knowledge of location and orientation while moving in a virtual environment (Darken & Sibert; 1993). The ability to retain this knowledge is related to the ability of the user's spatial orientation which differs between individuals. If the user does not have the ability to explore the virtual environment effectively and complete game tasks, it will cause a cognitive load that has negative impact on learning (Hsu, Wang, & Zhang, 2017). Chen *et al*. (2016) examined the effects of interactions on VR-based learning with three modes (non-guided, guided, and non-VR) and a learning style, on performance. In non-guided VR mode, the accommodator learner outperforms the assimilator learner. Under conditions of lack of guidance or navigation, learners with active experimental learning styles have more ability to explore virtual environments than passive learners, so that cognitive overload in the active type is lower than the passive type.

To improve learning outcomes it is necessary to accommodate the differences in learning styles or individual preferences. VR has the characteristics that allow students to actively explore virtual environtment. Students who are active learner types (accommodators and convergers) are

Commented [RS5]: Masuk yang cognitive overload able to outperform passive learners (assimilators, divergers) because the use of VR also requires active involvement in exploring the virtual environment to solve the learning problems it raises. In addition, passive learners will have a tendency to experience higher cognitive overload in exploring virtual environments than active learners. Therefore, we predict that the learning style moderates the relationship between technology's quality and technology's accessibility on learning effectiveness, as measured by self-efficacy.

H3: The learning style moderates the relationship between technology's quality and self-efficacy.

H4: The learning style moderates the relationship between technology's accessibility and self-efficacy.

3. Methodology

This application was built using the waterfall or the classic life cycle models. The system development life cycle (SDLC) is a process for developing software that emphasizes needs, followed by structured steps to improve the product's quality, based on best practices or well-tested methods (Pressman, 2005; Radack, 2009; Raval and Rathod, 2013). The waterfall development model is shown in Figure 1. This model is systematic, the steps that must be followed to develop the software start with the requirements' definition, the system's and software's design, implementation and testing, integration and system testing, and maintenance (Sommerville, 2011).

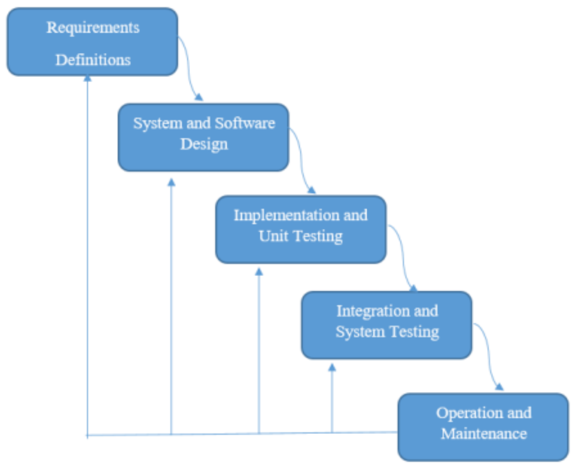

Figure 1. The Waterfall Model (Sommerville, 2011)

The requirements' definition stage comprises of several aspects including the requirements for the software's functionality, the system's service, and constraints. At this stage, it was expected that all the software's requirements would have been met, including the specification's requirements which included the specifications for the device to be used. The device used to run this application was an Android-based smartphone with a minimal version of lollipop and is supported by a VR box. The second stage was the software's design. This software was modeled with the Unified Modeling Language (UML), a standard language that is widely used in the industrial world to define requirements, undertake an analysis or design, and describe architecture in object-oriented programming (Booch, 2005; Viswanathan and Samuel, 2016). UML modeling consists of nine diagrams of models which are grouped into three categories, but in this study, only two types of diagrams were used, namely use case diagrams and sequence diagrams. Use case diagrams are used to briefly describe who uses the system and what they can do. Sequence diagrams describe the behavior of objects in the use cases by describing the lifetime of objects and the messages sent and received between the objects (Brunel *et al.*, 2016; Siau and Cao, 2001).

After the software model had been successfully created using UML, the next stage was implementation and testing. Software that had been designed using UML modeling was built with the Unity 3D development software, Vuforia SDK, Mono Develop and Java SDK. Meanwhile, 3D design, virtual environment, user interface and related designs used Adobe Photoshop CS6, Adobe Premiere CS6, Corel Draw X5, Blender 3D, AutoCAD and Format Factory 2.2 applications. After the implementation was completed, testing was carried out to determine the performance of the software. The results of the application's functionality and compatibility tests showed that all the application's functions ran well and could be used in a variety of different Android devices. The last stage was maintenance; this was carried out when bugs or errors were found in the application, or periodically every quarter.

Hypothesis testing using partial least squares structural equation modeling (PLS-SEM) to analyze the data. This study used WarpPLS as the software for the PLS-SEM. Differing from the covariance-based structural equation model (CB-SEM) which uses software such as LISREL or Amos, PLS-SEM does not assume the normality of the distribution of the samples and can carry out statistical analyses with relatively smaller sized samples, which are oriented more toward predictive orientation (Hair *et al.*, 2017). PLS-SEM is primarily intended for causal predictive analyses in situations of high complexity but with limited theoretical information. Therefore, using PLS-SEM is more suitable for exploratory studies like this research than for rigorous and confirmatory studies.

Measurement of the self-efficacy was adapted from Fischbach (2015), self-efficacy shows confidence in one's ability to control one's motivation, behavior, and the social environment. While perceived as features of VR, technology's accessibility and quality measures were adapted from Dalgarno *et al.* (2002). The learning style used a modified version of a learning style inventory (LSI) (adapted from Kolb (1984) and McCarthy (1996)).

VR non-guided mode was implemented for accounting students at the Faculty of Economics, Yogyakarta State University, who were taking online business ethics courses during the COVID-19 pandemic. We offered all the students in the class the opportunity to participate as the respondents in this research. The participant of this study was 123 students. Table 1 below shows the descriptive statistics of the respondents.

Table 1. Descriptive Statistic

Variable	N	Minimum	Maximum	Mean	Std. Deviation
Age	123	20.00	22.00	20.53	0.81
GPA	123	3.00	4.00	3.87	0.34
Work experience	123	0.00	1.00	0.18	0.39

The average age of the respondents was 20.53 years, their GPA was 3.87 and their average work experience was less than 1 year.

IV. Result

a. Business Ethics Learning Media based on Virtual Reality

Ethics learning media, based on a VR application, has been successfully developed through a series of software engineering processes, from defining the requirements to its operation and maintenance. This application provided a simulation of a real situation in terms of ethical decision making. Given a variety of cases or situations in the virtual world, the users could experience the dilemma of making a decision when faced with a fairly complex bribery case. This application provided a variety of decision scenarios that focused on auditors' ethical dilemmas.

The application was tested in terms of its compatibility and functionality so that the application can run on various types of Android devices, ranging from the Lolipop to Marshmallow versions, with various screen resolutions, and all the functions were found to run well. This VR application offers high levels of interactivity and accessibility within its various scenarios. After successfully downloading and installing the application on an Android device, the user just needs to put the Android smartphone on the VR box and activate the Bluetooth remote control.

A view of the virtual world is displayed according to the use case diagram's design scenario. The application's users act as auditors and have to perform audit simulations. The users see an opening video describing their client's company, which is a construction company (Figure 2). Then the auditor meets the board of directors to sign the audit engagement paperwork. After accepting the engagement, the auditor performs the audit work. First, the auditor reviews the project and assesses the level of completion of the building (Appendix figure a). Second, after reviewing the project, the auditor enters the accounting department and audits the financial statements, including determining the costs charged, based on the level of the building's completion (appendix figure b). During the audit, the auditor experiences pressure from the client to approve the client's earnings manipulation actions. The auditor is faced with an ethical dilemma: the client offers a bribe so that the auditor would agree to the client's profit manipulation actions, or the audit gets canceled so the auditor loses the client (appendix figure c). The user, as the auditor, must make a decision after facing the ethical dilemma.

Figure 2. Screenshot of the VR condition describing their client's company

b. Result of Hypotheses Testing

At this stage, a confirmatory factor analysis was used to evaluate the validity and reliability of the constructs. PLS algorithm was used to assess the reliability and validity of the constructs. Reliability shows the internal consistency of the measurement. (1) Cronbach's alpha should exceed 0.7. and (2) Composite reliability should exceed 0.7. From Table 2, all the Cronbach's alphas are greater than 0.7. The minimum for composite reliability also exceeds 0.7. Therefore, the items used to represent the constructs were reliable.

Convergent validity shows the degree to which a measure/indicator is positively correlated with an alternative measure/indicator for the same construct. Therefore, items that are indicators of a reflective construct should have a high convergence, or divide the variance. Convergent validity was tested using the average variance extracted (AVE), which should be greater than 0.5 for convergent validity to be confirmed (Hair et al., 2017). The AVE value was greater than 0.5 for all of the constructs, indicating good convergent validity. Thus, sufficient reliability and convergent validity were demonstrated, as shown in Table 2.

Table2. Result of measurement model, reliability and validity

Constructs	*Factor loadings*	α	CR	AVE
Learning Effectiveness	0.976	0.973	0.982	0.948
	0.980			
	0.966			
Self-efficacy	0.976	0.828	0.887	0.665
	0.693			
	0.768			
	0.800			
Technology's Accessibility	0.928	0.836	0.902	0.754
	0.810			
	0.863			
Technology's Quality	0.833	0.796	0.867	0.621
	0.666			
	0.812			
	0.831			
Virtual Reality	0.878	0.915	0.934	0.673
	0.886			
	0.865			
	0.849			
	0.881			
	0.752			
	0.586			

Note: VR = Virtual reality, LE = Learning Effectiveness, SE = Self-efficacy, TA = Technological Accessibility, TQ = Technology's Quality, α = Cronbach's alpha, CR = *composite reliability*, AVE = *average variance extracted*

Discriminant validity shows the degree to which a latent variable or construct is completely different from other constructs, as shown by the results of the empirical research. Sufficient discriminant validity implies that a construct is truly unique and can capture phenomena that are not represented by other constructs in the model. Table 3 shows the discriminant validity's result. The discriminant validity of all the latent constructs was confirmed by comparing the square roots of the AVE to the correlation coefficients of the other variables, as shown in Table 3. The result shows that the square roots of the AVE in the diagonal column are higher than the correlation coefficient between the variables in the same column. The test results show that the criteria for discriminant validity have been fulfilled. Overall, the results of the measurement model test show that the criteria for reliability, convergent validity, and discriminant validity have been met.

Table 3. Discriminant validity

Construct	Learning Effectiveness	Self-efficacy	Technology's Accessibility	Technology's Quality	Virtual Reality
Learning Effectiveness	**0.974**				
Self-efficacy	0.958***	**0.816**			
Technology's Accessibility	0.626***	0.616***	**0.868**		
Technology's Quality	0.504***	0.452***	0.663***	**0.788**	
Virtual Reality	0.568***	0.598***	0.799***	0.666***	**0.82**

Note: the diagonal line (bold) is the square root of AVE of each construct. ***The correlations among constructs are smaller than the square root of AVE of each construct.

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Structural model consists of testing the relationships between the constructs and the model's predictive capabilities. Validating the structural model can help researchers to consider systematically whether the hypotheses expressed by the structural model are supported by the data (Hair et al., 2017). The results of the PLS-SEM test of the structural model are shown in Figure 6.

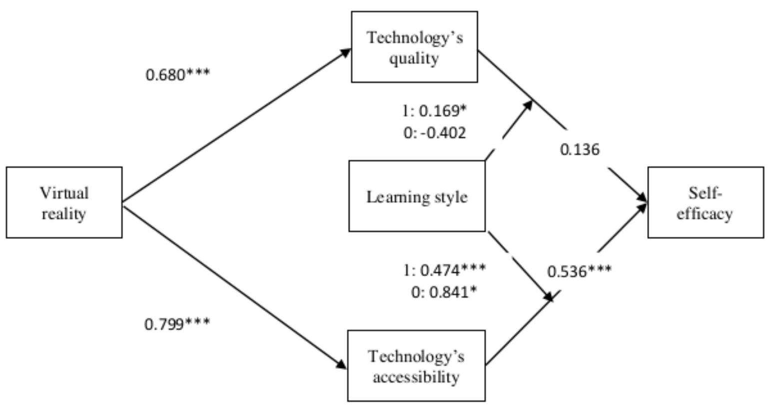

Figure 6. Moderating effects of learning style
Note: *** p <0.01 , ** p <0.05. *p<0.1, 0 = passive learning style, 1 = active learning style

8

VR technology positively affected the technology's quality ($\beta = 0.680$, $p < 0.01$) and the technology's accessibility ($\beta = 0.799$, $p < 0.01$). This supports H1 and H2.

Table 5. Model Comparison Test for Multigroup Structural Model

Structural Path to-	*β and p-value* (LS-Passive)	*β and p-value* (LS-Active)
Technology's Quality ->Self-efficacy	-0.402	0.169*
Technology's Accessibility ->Self-efficacy	0.841	0.474***

Note: Significance of estimation; *** p <0.01, ** p <0.05. * p < 0.1

In this study, we only classified two types of learning styles: the active learning style (accommodators and convergers) and the passive learning style (diverged and assimilators) because there were a few students with divergent and assimilator learning styles. The learning style moderates the relationship between technology's quality and self-efficacy because of the differences in the effect of the technology's quality on self-efficacy in the active and passive learning style group (Table 5). In the active learning style group, the effect of technology's quality on self-efficacy was marginally positive significant, while in the passive learning style group the effect was insignificant. The same results were also found on the effect of technology accessibility on self-efficacy, in the active learning style group, there was a significant effect of technology's accessibility on self-efficacy, while in the passive learning group there was no influence. Therefore, H3 and H4 were supported.

V. Discussion

An effective learning experience is characterized as an active student experience, providing immediate feedback and a high level of engagement. VR technology has the ability to create an "experience" as in real life. The main characteristic of VR is Immersion which allows the user's presence in the VR environment. Sense of presence encourages users to "Engaged" and actively interact in a virtual environment.

Sense of presence is a major predictor of user perception (eg satisfaction, motivation or positive performance) in VR technology-based learning (Weibel & Wissmath, 2011; Yoon et al., 2015). As predicted in the Technology Acceptance Model (TAM) and Task-Technology Fit (TTF) that the technology should be Easy to use, Useful and Fit the task so that users can enjoy the interaction and experience of using technology to achieve the expected results. Conversely, if the student is overwhelmed with excessive difficulty using the technology, it will affect negatively on their learning process.

Likewise in the use of VR, a sense of presence can improve learning outcomes only if users are not overwhelmed in exploring VR-based game tasks (Bachen, Hernandez-Ramos, Raphael, and Waldron, 2016). Learners construct new knowledge with a limited working memory. If the learner does not have the ability to explore learning tasks in VR it will cause an increase in cognitive load, which in turn has a negative impact on learning (Hsu, Wang, & Zhang, 2017).

This study uses non-guided VR mode, so that users would most likely run into problems disorientation or getting lost. Efforts to stay oriented in a virtual environment take up mental resources which will reduce the amount of mental resources available for understanding knowledge. At the time of the internal cognitive load (to understand the knowledge) high and external cognitive load (to explore the virtual environment) high, then the total cognitive load will exceed mental resources that will ultimately have a negative impact on learning (Cooper, 1998).

According to the result of this study, the use of VR has a positive effect on user perception about technological quality and technological accessibility. Virtual experience able to bring a sense of precense (Yoon, Choi, & Oh, 2015) that is a sense of immersion to describe the intensity of emotional involvement. The sense of presence that arises is an important predictor of user perception in a VR-based learning environment (Weibel & Wissmath, 2011; Yoon et al., 2015). The ability of VR in presenting a sense of presence is an important predictor of the various positive responses of users, including the perception of technology's quality and technology's accessibility.

However, the exploration of the virtual environment will cause disorientation or getting lost. The ability to retain knowledge related to location and orientation is related to user spatial orientation which is different for each student. Learners must explore the virtual environment in completing learning tasks so that it imposes extraneous cognitive load. If the intrinsic and extraneous cognitive load is high, it will reduce the mental resources available to understand the concept of knowledge which causes the possibility of learning failure.

This study also found empirical evidence that the effect of technology's quality and technology's accessibility on self-efficacy was different in active and passive learning style groups. In active learning style, perceptions of technology's quality and technology's accessibility have a positive effect on learning outcomes, while in passive learning style it does not. This study supports Chen et al (2005) that active experimental learners outperformed reflective observation in non-guided VR-based learning. The absence of navigational aids is beneficial for active experimental learners (accommodators) to actively explore the virtual environment in order to solve the learning problems that arise. On the other hand, for reflective observation type learning (assimilator) it will be difficult to explore the virtual environment, thereby increasing the extraneous cognitive load, which in turn will have a negative impact on learning outcomes (Hsu et al, 2017).

The results of this study provide practical implications. The practical implication is that VR is a potential learning technology that can be used in the pandemic era. This is a significant finding because the majority of previous studies focused on online course modules or video streaming as a form of distance learning media. Compared to traditional media, the use of VR makes learning more flexible without the constraints of time, distance and space (Yu *et al*., 2007). VR is able to present a virtual environment so that it is able to provide practical experiences for students without them leaving their homes. Based on these findings, a well-designed VR has a great deal of potential for use as a distance learning medium, by considering the students' learning styles.Tthe Learning process that adapts to students' learning styles and preferences is a critical success factor of learning (Thompson, 2013).

VI. Conclusion

This study found that the interactivity feature of VR is an antecedent of technology's quality and technology's accessibility supports research by Zhang *et al*., (2017). VR creates high interaction experience, giving rise to a sense of presence refers to the user's emotional interaction. Sense of presence is a predictor of user response including technology quality and technology accessibility. The findings of this study also support the interactive media effect theory that states the media's interactivity feature will affect the learning outcome (Sundar *et al*., 2015).

In addition, this study also support Aptitude-by-treatment interaction (ATI) research. For active learners, the technology quality increases self-efficacy, while for passive learners it does not. Likewise, technology accessibility has a significant positive effect on self-efficacy on active learners, but not on passive learners.

The limitation of the research sample is the weakness of this study. Data were taken during the pandemic. Actually, VR is a technology that is adaptive to pandemic conditions, but the problem is that not all students have VR box tools in their homes to operate this media. In addition, this study could not compare the effectiveness of VR on the four learning styles because there were only a few students with the characteristics of assimilators and divergers. Future research can be conducted by examining the differences between guided and non-guided VR modes on learning outcomes due to differences in VR mode can allegedly lead to discrepancies cognitive load.

Appendix

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