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Exploring pre-service teachers' experience with virtual reality role-playing micro-teaching activities using Engage VR

*Thivilojana S. Perinpasingam
Faculty of Social Sciences and Leisure Management, Taylor's University, Malaysia
thivilojana.perinpasingam@taylors.edu.my

Faisal Athar bin Mohd Fadzil
VORTEX XR Lab, The Design School, Taylor's University, Malaysia

Shin Yen Tan
Faculty of Social Sciences and Leisure Management, Taylor's University, Malaysia

Carles Sharma Naidu a/l Achu Naidu
VORTEX XR Lab, The Design School, Taylor's University, Malaysia

ABSTRACT

This study aims to foster immersive learning experience among a group of undergraduate students from a private higher learning institution in Malaysia. Immersive learning, specifically virtual reality or VR, is a futuristic pedagogical innovation. Nonetheless, little attention has been given to pre-service teachers in how they experience and view their teaching practice with VR integration. Therefore, this study intends to provide opportunities to pre-service teachers to experience virtual reality role-playing micro-teaching activities, with a specific focus on improving their classroom management skills in a VR platform called Engage VR. This real-time immersive training experience enables virtual presence in virtual reality settings and allows for life-like responsive engagements as avatars. This study is about Design Development Research (DDR) that focuses on the evaluation process involved in the integration of Engage VR in a teacher education programme. A development research method based on ADDIE's model was selected, with three phases, namely needs analysis, design and development, and implementation and evaluation. The data for this study were collected from a survey that was carried out with pre-service teachers who completed a 5-week virtual simulated classroom programme to analyse their perception of using the Engage VR platform for the enhancement of their classroom management skills through micro-teaching activities. Findings from the study affirm that the integration of Engage VR can help boost pre-service teachers' confidence in exploring and overcoming potential shortfalls while managing their learners. Engage VR allows pre-service teachers to interact and create new content through various role-playing activities, as well as motivates them and allows them to develop problem-solving strategies. This study contributes to the area of digital education and communities, in line with the UN Strategic Development Goals (SDG 4) and in keeping abreast with the Fourth Industrial Revolution (4IR).

Keywords: ***Immersive learning, virtual reality, classroom management skills, virtual micro-teaching activities***

* Corresponding author

INTRODUCTION

Virtual reality or VR technologies refers to a specific section of technological applications that use computer programming, modelling, and design simulation to create an interactive virtual environment as close as possible to the real world or present-day reality, is engaging and supports deeper understanding with multi-sensory content (Muñoz-Saavedra et al., 2020; Yang & Abdul Latiff, 2022). While application software that exhibit simulations and environments have prevailed in numerous formats such as games, text-based decision-making stories, and the like, 3D environment representation, simulated real-world interaction, and immersive user interface define the typical VR platforms. The beginnings of VR technologies are hard to trace due to different considerations, varying primitive inceptions, prerequisite utilisation, and the possibly secretive military or governmental usage in the past. The initial occurrences of VR technology largely involved medical, military, flight, and operational training. Upon the advancement of technologies, various prototypes and commercial models have become available for public usage, primarily for gaming and tourism purposes (Williams & Hobson, 1995).

On the whole, commercially-available VR technologies consist of a headset gear that is equipped with stereoscopic 3D environments, simulations, and presentations with the potential addition of sound. Navigating the 3D environment may require using complex movement gear that translates live motions, but most set-ups use tactile hand controllers with buttons and sensors (Syamimi et al., 2020). However, the use of such gear and controllers may affect student perceptions and attitudes towards virtual learning environments. Aydin and Tasci (2021) conducted a case study of a Turkish university and revealed that while most students had a positive outlook towards virtual learning, some expressed concerns about the physical and technological demands of using the gadget.

With the new developments of VR and the creation of more new software, VR technology is finding applications and integration within various fields of research, studies, and the industry due to its immersive potentials and interactive training offerings. For this specific segment of the study, possible classroom integrations on the usability of VR technology will be explored (Jenkins, 2019).

The most prevalent use of a VR environment in an educational institution is as a visual learning aid. In most classes, regardless of any subject including English, VR technology is used as a visualisation aid similar to images to help represent particular concepts and create visual cues or familiarity to develop learning further. VR technology allows for creating and imaging immersive 3D objects and environments that may show details or actions not seen in typical visual aids. Furthermore, due to the interactive presentation made by the simulated reality of VR, learners can artificially observe a particular occurrence, object, or being as present within the premises of their space, further adding motivational development to learning (Ardiny & Khanmirza, 2018).

In more advanced scenarios of learning implementation, interactive activities that utilise tactic controls and developed simulations are implemented within VR. Similar to regular classroom activities, VR learning tasks introduce and teach concepts beyond the traditional discussion setting. Frequently, it presents creative and interactional set-ups and functions that stimulate and motivate learners better by appealing to other senses like role-playing task scenarios. Due to the capabilities of VR, these environments open various avenues for creative exploration and learning tasks that may not be possible within the confines of traditional learning environments. Enhanced games, virtual field trips, classroom related scenarios may become integrated within the learning environment through VR as mentioned by Park et al. (2019).

With VR being increasingly acknowledged as an important instructional tool, more empirical attention in this area is needed. Nonetheless, little attention has been given especially to pre-service teachers in how they experience and view their teaching practice with VR integration. This study aims to foster immersive learning experience among pre-service teachers and contribute to the research literature from the perspective of the pre-service teachers in how they view the potential integration of VR technology into their teaching practice, specifically with a focus on classroom management skills such as dealing with an agitated learner or controlling a disruptive classroom as part of their teacher training. The research question addressed in this study is:

What are the opinions of pre-service teachers at a higher learning institution in Malaysia on the integration of Engage VR to enhance classroom management skills?

LITERATURE REVIEW

Most methods of class integration suggest only VR supplementation of lessons. VR segments are treated as additional learning aids. However, proposals and prototypical set-ups that attempt to utilise VR as its facilitating medium continue to be established and experimented on by various researchers and educators. Complete VR set-ups use the simulated environment as classrooms to fully immerse learners within similar but highly malleable realities (Cochrane, 2016). Studies have also examined the effects of implementing VR on student motivation and engagement. For example, Hamid et al. (2022) found that playing games in VR can have positive effects on both student engagement and motivation. Similarly, Al-Ansi et al. (2023) found that using a virtual learning environment in a large college course can increase student engagement. Aydin and Tasci (2021) conducted a case study on Turkish university students' perceptions of VR learning environments and found that they had a generally positive attitude towards its use.

Another study found that VR role-playing activities can improve social communication skills in children with attention-deficit/hyperactivity disorder (ADHD) (Bote, 2021). By using a virtual environment to simulate social situations, children were able to practise and develop their communication skills in a safe and controlled setting. This highlights the potential of virtual environments as a tool for enhancing skills through role-playing activities. Furthermore, Ma et al. (2014) conducted a meta-analysis of intelligent tutoring systems (ITS), which can be regarded as a precursor to VR technology in education. The study found that ITS can have a positive impact on student learning outcomes. This suggests that the use of immersive and interactive technologies like VR could potentially have even greater effects on learning outcomes. In a 2019 study by Thompson et al., pre-service teachers used a digital simulation called "Teacher Moments" to engage in role-playing activities and practise approximating parent-teacher conversations. The simulation took place in a virtual environment, allowing for repeated practice without the need for real-life scenarios. The study found that the simulation led to an improvement in the pre-service teachers' communication skills and increased their confidence in dealing with parent-teacher interactions.

It is worth noting, however, that the effectiveness of VR in education may depend on various factors, including the quality of the VR content, the pedagogical design, and the learners' prior experience with VR as highlighted by Cavanaugh et al. (2020). Therefore, more research is needed to fully understand the potential of VR technology in education and how best to integrate it into the classroom. In the context of this study, this is done with a focus on pre-service teachers' classroom management skills, a crucial component of teaching and learning, in virtual micro-teaching activities.

METHODOLOGY

This study is about Design Development Research (DDR) that focuses on the evaluation process involved in the integration of Engage VR in a teacher education programme as cited by Perinpasingam (2018). First, a development research method based on ADDIE's model was selected. This model can be divided into three phases, namely needs analysis, design and development, and implementation and evaluation. Next, data were collected from the third phase, which is known as the implementation and evaluation phase. Data were collected through a survey administered to pre-service teachers to analyse their perception of using the Engage VR platform in their education programme for the enhancement of their classroom management skills through micro-teaching activities. The purpose of the evaluation process was to examine the participants' point of view on the effectiveness of integrating Engage VR as an instructional tool to improve learner engagement and interactivity in a simulated virtual classroom environment. Data collection took place after the completion of the virtual simulated classroom session which was conducted for 5 weeks. The data gathered will be used for the enhancement of the micro-teaching related activities in a simulated environment.

To understand the effectiveness of Engage VR, a quantitative method was adopted. A validated closed-end data collection tool was used after the exposure of Engage VR to quantify responses on learner engagement and interactivity. A principal component factor analysis was computed to determine the factor structure among 22 items related to perception of pre-service teachers on usage of Engage VR as an effective classroom management tool. The 22 questionnaire items were extracted into five factors or domains. The first factor or domain was about shortcomings of interaction with technology, the second was about effectiveness of using Engage VR to enhance classroom management skills, the third about an engaging tool for virtual role-playing activities, the fourth was perception of an effectual micro-teaching tool and the fifth factor was about perception of pre-service teachers' enthusiasm in using Engage VR.

The data were analysed using SPSS software. The descriptive analysis of each domain was reported as frequency and percentage, as well as the strength of the pre-service teachers' perception, was reported in mean and standard deviation. The distribution across the pre-service teachers' characteristics was tested using one-way ANOVA to assess the difference in mean for each domain. The relationship between the domains was tested using a Pearson correlation and confounding variables were adjusted in partial correlation.

FINDINGS

Pre-service teachers' perception of the level of engagement and interactivity in using Engage VR for role-playing activities

The questionnaire was adapted from a published PhD thesis (Perinpasingam, 2018). The author had developed a 22-item questionnaire which was further extracted into five domains, explaining 55.1% of total variance in students' perception. Pre-service teachers' perception on role-playing activity with Engage VR was assessed based on five main domains: 1) overcoming shortcomings (eigen value = 4.693), 2) effectiveness (eigen value = 2.812), 3) engaging (eigen value = 1.706), 4) effectual communication (eigen value = 1.214), and 5) enthusiasm (eigen value = 1.145).

The scores for items in Domain 1 show that the pre-service teachers have a neutral perception in terms of overcoming shortcomings by using Engage VR. A good perception was reported for enjoying the classroom instruction (mean = 3.15 ± 0.91) and being motivated with the frequent usage of Engage VR (mean = 3.00 ± 0.83). The scores for items in Domain 2 show that the pre-service teachers have a good perception in terms of effectiveness of using Engage VR for role-playing activities. A good perception was reported with the highest score for believing that it is important to be able to use technologies such as the computer and Engage VR and other VR-related tools (mean = 3.36 ± 0.74). This is followed by believing that if more pre-service teachers used Engage VR, they would be able to handle and manage their classrooms/learners better (mean = 3.27 ± 0.63).

The scores for items in Domain 3 show that the pre-service teachers have a good perception for engaging role-playing activities with Engage VR. A good perception was reported with the highest score for the perception that using Engage VR does not scare the user (mean = 3.39 ± 0.56). This is followed by the perception that using Engage VR does not make users nervous (mean = 3.36 ± 0.65). The scores for items in Domain 4 show that the pre-service teachers' perception in terms of an effective communication tool with Engage VR ranged from 2.76 to 3.30. A good perception was reported with the highest score for the statement that the participant enjoys working with Engage VR and appearing as avatars (mean =3.30 ± 0.64). The participants reported a neutral perception that they can learn more from books and the internet about classroom management skills, rather than exploring it in the Engage VR platform (mean= 2.76 ± 0.97).

The scores for items in Domain 5 show that the pre-service teachers have a good perception with regard to student enthusiasm using Engage VR. Furthermore, a good perception was reported with the highest score for statement that Engage VR has helped users see a new dimension in classroom management skills (mean = 3.42 ± 0.66). This is followed by the perception that Engage VR gives more opportunities to learn new knowledge, in particular managing diverse learners in a virtual environment (mean = 3.30 ± 0.59) (Table 1).

Table 1. Overall scores across five domains of participants' perception in using Engage VR

Domains	Overall score across domain
1	2.86 ± 0.60
2	3.24 ± 0.58
3	3.31 ± 0.46
4	3.03 ± 0.52
5	3.29 ± 0.55

Therefore, these pre-service teachers perceived that Engage VR is best for increasing their enthusiasm level (domain 5: 3.29 ± 0.55) followed by an increase in the level of engagement through role-playing activities (domain 3: 3.31 ± 0.46), increase in level of effectiveness on classroom management skills with role-playing activities (domain 2: 3.24 ± 0.58) and as effective communication tool (domain 4: 3.03 ± 0.52). Additionally, these teachers perceived a moderate level towards overcoming shortcomings (domain 1: 2.86 ± 0.60) (Table 2).

Table 2. Descriptive analysis of five domains in using Engage VR

Domain	Items	SDA	DA	AG	SAG	Mean + SD
Domain 1: Overcoming shortcomings with Engage VR	1. I enjoy classroom instruction using Engage VR	2 (6.1)	5 (15.2)	12(36.4)	14(42.4)	3.15 ± 0.91
	2. I am tired of technology use in the classroom	8(24.2)	13(39.4)	8(24.2)	4(12.1)	2.24 ± 0.97
	3. I will be able to get a good job if I know how to use Engage VR	2(6.1)	6(18.2)	17(51.5)	8(24.2)	2.94 ± 0.83
	4. I can concentrate better during the Engage VR session	2(6.1)	6(18.2)	16(48.5)	9(27.3)	2.97 ± 0.85
	5. I would be more motivated if Engage VR was used more often	2(6.1)	5(15.2)	17(51.5)	9(27.3)	3.00 ± 0.83
Domain 2: Effectiveness of using Engage VR for role-playing activities	6. I enjoy the interactive tools available in the Engage VR app	1(3.0)	4(12.1)	17(51.5)	11(33.3)	3.15 ± 0.76
	7. I enjoy the virtual role-playing micro teaching activities better when Engage VR is used	0	5(15.2)	16(48.5)	12(36.4)	3.21 ± 0.70
	8. I believe that if more pre-service teachers used Engage VR, they would be able to handle and manage their classrooms/ learners better.	0	3(9.1)	18(54.5)	12(36.4)	3.27 ± 0.63
	9. I believe that it is important for me to be able to use technologies such as the computer and Engage VR and other VR-related tools	1(3.0)	2(6.1)	14(42.4)	16(48.5)	3.36 ± 0.74
	10. I feel comfortable using Engage VR	0	4(12.1)	19(57.6)	10(30.3)	3.18 ± 0.64
Domain 3: Engaging role-playing activities with Engage VR	11. I think the VR role-playing activities takes a longer time when using Engage VR	1(3.0)	3(9.1)	17(51.5)	12(36.4)	3.21 ± 0.74
	12. Using Engage VR does not scare me	0	1(3.0)	18(54.5)	14(42.4)	3.39 ± 0.56

Table 2. (con't)

Domain	Items	SDA	DA	AG	SAG	Mean + SD
	13. Using Engage VR does not make me nervous	0	3(9.1)	15(45.5)	15(45.5)	3.36 ± 0.65
	14. Using Engage VR is able to help me to practice classroom scenarios better	0	4(12.1)	16(48.5)	13(39.4)	3.27 ± 0.67
Domain 4: Perception of effective communication tool with Engage VR	15. I can learn more from books and the internet about classroom management skills rather than exploring it in the Engage VR platform	3(9.1)	11(33.3)	10(30.3)	9(27.3)	2.76 ± 0.97
	16. I enjoy working with Engage VR and appearing as avatars	0	3(9.1)	17(51.5)	13(39.4)	3.30 ± 0.64
	17. I work very well on my virtual micro-teaching task with Engage VR	0	6(18.2)	20(60.6)	7(21.2)	3.03 ± 0.64
Domain 5: Perception of student enthusiasm using Engage VR	18. The Engage VR app is user-friendly	0	7(21.2)	12(36.4)	14(42.4)	3.21 ± 0.78
	19. I paid attention during the Engage VR familiarisation session	0	3(9.1)	20(60.6)	10(30.3)	3.21 ± 0.60
	20. I would recommend Engage VR app to my other course mates	0	4(12.1)	15(45.5)	14(42.4)	3.30 ± 0.68
	21. I know that Engage VR gives me more opportunities to learn new knowledge	0	2(6.1)	19(57.6)	12(36.4)	3.30 ± 0.59
	22. The Engage VR has helped me see a new dimension in classroom management skills	0	3(9.1)	13(39.4)	17(51.5)	3.42 ± 0.66

Note: SDA= Strongly Disagree, DA = Disagree, AG =Agree, and SAG = Strongly Agree

The questionnaire was administered to a total of 33 pre-service teachers. All the variables in this study were normally distributed. The majority of the participants in this study were female (81.8%) and aged 21–30 years (66.7%). Next, the majority of the participants from this study were Chinese (75.8%), followed by Indian (15.2%) while three participants were from other ethnicities. A total of 36.4% participants had excellent spoken English fluency while 27.3% of the participants had excellent written English proficiency. There is a significant difference in the mean score of domain 2 (effectiveness) and domain 3

(engaging) across the ethnicity variable. Chinese participants reported a significant lowest score in effectiveness of using Engage VR for role-playing activity (F=3.559, p = 0.014) as well as in engaging role-playing activities with Engage VR (F = 3.562, p = 0.014). Other characteristics of study participants showed no significant differences in the scores of all domains (Table 3).

Table 3. Mean difference in scores of domains across participants' characteristics

		Frequency (percentage)	Domain 1	Domain 2	Domain 3	Domain 4	Domain 5
Overall Score			**Mean ± SD**	**Mean ± SD**	**Mean ± SD**	**Mean ± SD**	**Mean ± SD**
			2.86 ± 0.60	3.24 ± 0.58	3.31 ± 0.46	3.03 ± 0.52	3.29 ± 0.55
Gender	Male	6 (18.2)	2.87 ± 0.67	3.23 ± 0.59	3.50 ± 0.35	3.00 ± 0.60	3.23 ± 0.60
	Female	27(81.8)	2.86 ± 0.59	3.23 ± 0.58	3.27 ± 0.47	3.04 ± 0.52	3.30 ± 0.54
	t-test		0.027	–0.014	1.132	–0.155	–0.282
	p-value		0.979	0.989	0.266	0.878	0.780
Age (years)	18–20	11 (33.3)	2.84 ± 0.70	3.29 ± 0.55	3.30 ± 0.38	3.10 ± 0.47	3.38 ± 0.54
	21–30	22(66.7)	2.87 ± 0.56	3.21 ± 0.60	3.32 ± 0.50	3.00 ± 0.55	3.25 ± 0.56
	t-test		–0.162	0.380	–0.133	0.465	0.671
	p-value		0.872	0.707	0.895	0.645	0.507
Ethnicity	Chinese	25 (75.8)	2.75 ± 0.55	3.10 ± 0.55	3.23 ± 0.46	3.00 ± 0.52	3.18 ± 0.55
	Indian	5 (15.2)	3.16 ± 0.61	3.68 ± 0.46	3.35 ± 0.22	3.00 ± 0.58	3.68 ± 0.41
	Others	3 (9.1)	3.27 ± 0.81	3.67 ± 0.42	3.92 ± 0.14	3.33 ± 0.58	3.60 ± 0.35
	One way ANOVA, F		1.827	3.559	3.562	0.538	2.527
	p-value		0.178	0.014*	0.014*	0.589	0.097
English Course	Yes	8 (24.2)	3.15 ± 0.68	3.40 ± 0.60	3.44 ± 0.61	3.29 ± 0.68	3.40 ± 0.69
	No	25(75.8)	2.77 ± 0.55	3.18 ± 0.57	3.27 ± 0.40	2.95 ± 0.45	3.26 ± 0.50
	t-test		1.615	0.922	0.903	1.669	0.644
	p-value		0.116	0.364	0.373	0.105	0.524
Medium of Instruction at School	Bahasa Melayu	2 (6.1)	3.20 ± 0.28	3.60 ± 0.28	3.63 ± 0.53	3.17 ± 0.24	3.50 ± 0.14
	Chinese	6 (18.2)	2.60 ± 0.82	3.07 ± 0.72	3.13 ± 0.44	3.00 ± 0.52	3.37 ± 0.50
	English	25 (75.8)	2.90 ± 0.55	3.25 ± 0.56	3.33 ± 0.45	3.03 ± 0.55	3.26 ± 0.58
	One way ANOVA, F		0.936	0.651	0.999	0.074	0.244
	p-value		0.404	0.529	0.380	0.929	0.785
Spoken English Fluency	Weak/ Fair	4 (12.1)	2.80 ± 0.85	3.00 ± 0.91	3.13 ± 0.60	2.92 ± 0.50	3.25 ± 0.50
	Good	17 (51.5)	2.74 ± 0.54	3.21 ± 0.36	3.26 ± 0.36	2.96 ± 0.45	3.26 ± 0.52
	Excellent	12 (36.4)	3.05 ± 0.60	3.35 ± 0.71	3.44 ± 0.53	3.17 ± 0.63	3.35 ± 0.63
	One way ANOVA, F		0.963	0.571	0.879	0.638	0.105
	p-value		0.393	0.571	0.426	0.535	0.901

Table 3. (con't)

		Frequency (percentage)	Domain 1	Domain 2	Domain 3	Domain 4	Domain 5
Written English Proficiency	Weak/ Fair	5 (15.1)	2.64 ± 0.65	2.80 ± 0.57	2.90 ± 0.14	2.73 ± 0.15	3.00 ± 0.01
	Good	19 (57.6)	2.81 ± 0.54	3.31 ± 0.44	3.36 ± 0.40	3.05 ± 0.51	3.39 ± 0.56
	Excellent	9 (27.3)	3.09 ± 0.69	3.33 ± 0.77	3.44 ± 0.57	3.15 ± 0.65	3.24 ± 0.65
	One way ANOVA, F		1.072	1.785	2.798	1.056	1.057
	p-value		0.355	0.185	0.077	0.360	0.360

D1: Shortcomings, D2: Effectiveness, D3: Engaging, D4: Effectual communication, and D5: Enthusiasm

*$p < 0.05$

Relationship between domains of pre-service teachers' perception of role-playing activity with Engage VR

The Pearson correlation test result showed that all domains are significantly correlated positively to each other. Strong positive and significant correlations were observed between D1–shortcoming and D2–effectiveness (r = 0.783, $p < 0.001$), between effectiveness and engaging (r = 0.719, $p < 0.001$) as well as with enthusiasm (r = 0.853, $p < 0.001$) (Table 4).

Table 4. Pearson correlation analysis between the domains of pre-service teachers' perception of role-playing activity with Engage VR

		D1	D2	D3	D4	D5
D1	r	1				
	p-value					
D2	r	0.783	1			
	p-value	<0.001*				
D3	r	0.538	0.719	1		
	p-value	0.001*	<0.001			
D4	r	0.615	0.585	0.649	1	
	p-value	<0.001*	<0.001*	<0.001*		
D5	r	0.570	0.853	0.663	0.545	1
	p-value	0.001*	<0.001*	<0.001*	0.001*	

Correlation is significant at the $p < 0.05$ (2-tailed).

D1: Shortcomings, D2: Effectiveness, D3: Engaging, D4: Effective communication, and D5: Enthusiasm

The partial correlation analysis demonstrated that all domains remain significantly correlated positively to each other after adjusted for ethnicity. Ethnicity was controlled in this analysis as there are significant differences in the mean scores across ethnicity. Strong positive and significant correlations were observed between shortcomings (D1) and effectiveness (D2) (r = 0.755, $p < 0.001$) and between effectiveness (D2) and enthusiasm (D5) (r = 0.832, $p < 0.001$) after adjusting for ethnicity. Other variables were correlated at a moderate level to each other (Table 5).

Table 5. Partial correlation analysis between the domains of pre-service teachers' perception of role-playing activity with Engage VR, adjusted for ethnicity

Control Variables			D1	D2	D3	D4	D5
Ethnicity	D1	r	1				
		p-value					
	D2	r	0.755	1			
		p-value	<0.001*				
	D3	r	0.472	0.664	1		
		p-value	0.006*	<0.001*			
	D4	r	0.604	0.578	0.649	1	
		p-value	<0.001*	0.001*	<0.001*		
	D5	r	0.518	0.832	0.611	0.530	1
		p-value	0.002*	<0.001*	<0.001*	0.002*	

Correlation is significant at the $p < 0.05$ (2-tailed).
D1: Overcoming shortcomings, D2: Effectiveness, D3: Engaging, D4: Effectual communication, and D5: Enthusiasm

DISCUSSION

In the evaluation phase, the implementation and evaluation of the perception of pre-service teachers on the usage of Engage VR was carried out. The participants consisted of 33 pre-service teachers from an undergraduate programme offered at a private higher learning institution in Malaysia. Data were collected from a survey that was administered after participants attended a five-week exploration programme of using Engage VR to manage diverse learners in a virtual classroom environment.

Five main domains were identified in this study regarding the usage of Engage VR to enhance classroom management skills among pre-service teachers. The first domain highlighted ways to reduce shortcomings through the use of Engage VR. In this regard, most of the pre-service teachers reported that they enjoyed the classroom instructions, followed by enhanced motivation as well as concentration. This finding is supported by Ardiny & Khanmirza (2018). The authors highlighted that exposure to a virtual learning environment supports an alternative approach to learning and increases the motivation level among the learners. Cochrane (2016) further concurred that the usage of VR technology in the classroom is well accepted due to the benefits of this immersive platform.

The second domain emphasised the effectiveness of using Engage VR for role-playing activities. After being introduced to Engage VR, the pre-service teachers agreed on its effectiveness compared to conventional approaches. The effectiveness focused more on the pre-service teachers' ability to use technology to improve classroom management skills. According to Muñoz-Saavedra et al. (2020), virtual learning platforms support and may enhance instructional programmes and visual presentations to explore a particular content. Furthermore, according to Jenkins (2019), the usage of immersive learning environments has enhanced interactive teaching and learning, particularly in higher learning institutions; however, this is relatively new in the Malaysian classroom.

The third domain highlighted the aspects of engaging role-playing activities with Engage VR. The study found that after the usage of Engage VR, the pre-service teachers were able to enhance their self-esteem without feeling scared or nervous while engaging in role-playing activities. The finding aligns with Park et al. (2019) who contended that the usage of Engage VR is collaborative, learner-centred, and inquiry-based learning and hence improves users' understanding of scenario-based learning.

The fourth domain highlighted the perception of effective communication using Engage VR to support classroom management skills among pre-service teachers. The study found that the pre-service teachers' perception that Engage VR can be used as an effective communication platform improved significantly, thus supporting the need for early exposure to various classroom related management skills in a virtual environment. This is evident as the pre-service teachers perceived the effectiveness in communication, especially through the usage of avatars and specific characters. Further, they believed classroom scenarios in the role-playing task supports ease of communication. This finding concurs with Nissim and Weissblueth (2017), highlighting that Engage VR provides a platform for trainee teachers to increase their efficacy level, and interest and become creative teachers as they explore various scenarios in a simulated learning environment.

The final domain emphasised the perception of pre-service teachers about their enthusiasm for using Engage VR. The results demonstrate that using Engage VR in the classroom has opened up new dimensions, more opportunities, and new knowledge to explore as well as encourages the pre-service teachers to recommend the usage of Engage VR among their peers. This implies that after the introduction of Engage VR in the classroom, more pre-service teachers have significantly improved and they could understand classroom management skills better and manage diverse learners with higher levels of confidence. Similarly, Huang et al. (2016) mentioned that VR has the potential to bring about a new learning concept that can transform the way a learner relates to the content as it necessitates interface and collaboration which supports active involvement among learners in the virtual environment.

The results of this study also reveal that pre-service teachers of Indian and other ethnicities perceived the effectiveness of Engage VR significantly better compared to the Chinese pre-service teachers. This suggests that ethnicity can influence and is susceptible to the consequences of the technology divide, especially in the education system (Mihelj et al., 2019). Ethnicity was used as the confounding variable in testing the correlation within the domains.

Strong positive and significant correlations were observed between effectiveness in role-playing and overcoming shortcomings ($r = 0.755$, $p < 0.001$) and enthusiasm ($r = 0.832$, $p < 0.001$). This suggests that the role-playing tasks for classroom which were integrated using Engage VR can give pre-service teachers the confidence they need to explore and overcome potential shortfalls while managing their learners. Engage VR also allows pre-service teachers to interact and create new content through various role-playing activities, which offers several benefits such as motivation, fun, commitment, and enthusiasm, as well as improvements in computational thinking and computational practices (Almeida & Simoes, 2019). In addition, scenario-based activities can motivate pre-service teachers and facilitate the development of their problem-solving strategies.

CONCLUSION

In conclusion, the overall study demonstrates that the use of VR technology in teacher education can provide an innovative and engaging way for pre-service teachers to practise their teaching skills, particularly classroom management skills. In exploring the use of the Engage VR platform for role-playing micro-teaching activities, the study found that participants had positive experiences and perceived the technology as beneficial for their learning. While there are limitations and challenges to consider, the potential of VR technology in teacher education cannot be ignored as we continue our journey forward in the era of the 4th Industrial Revolution. This is especially so considering that learning using technology applications and collaborating with other students in teams can improve

leadership skills and are important for 21st century learning (Bidin, Shahidan & Sahid, 2021). The outcomes of this study suggest that further research is needed to explore the long-term impact of this technology on pre-service teachers' teaching efficacy, student outcomes as well as examine the instructional design aspects of VR based pedagogy which in turn would open more doors of opportunity to explore immersive approaches for the future of teaching and learning.

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Thivilojana S. Perinpasingam (Dr)

is a senior lecturer at the School of Education, Taylor's University, Malaysia. Her interest includes the integration of technology in language classrooms and showcasing these instructional innovations at national and international competitions. In addition to that, module development is another area of research that she works on.

Faisal Athar bin Mohd Fadzil

is an XR Specialist at Vortex XR Lab, Taylor's University. He is passionate about XR and other emerging technologies and has a background in teaching and working in the XR industry. Faisal is dedicated to creating immersive experiences and pushing the boundaries of what is possible in XR.

Shin Yen Tan (Dr)

is an academic at the School of Education, Taylor's University, Malaysia. She received her PhD in Education from University of Malaya and her research interests include teacher education, English education, as well as classroom discourse and interaction. Her recent publications include "Re-thinking monologicality: multi-voiced, mono-perspectival classroom discourses" *(The Asia-Pacific Education Researcher)* and "Reflective learning? Understanding the student perspective in higher education" *(Educational Research)*.

Charles Sharma Naidu (Ts. Dr)

is the Director of VORTEX XR Lab, Taylor's University. He is also a senior lecturer with The Design School, Faculty of Innovation and Technology. With a PhD in Education and a focus on instructional design and educational technology, he has demonstrated a keen interest in the potential of immersive technologies such as virtual and augmented reality to enhance learning experiences. As the Director of VORTEX XR Lab, Dr. Charles and his team has been actively involved in development efforts and research; centered around leveraging Extended Reality technologies as solutions to impact the teaching and learning community and expand its application as a collaborative effort with the industry.