Relationship between External factors and Behavioral Intention of Virtual Reality Implementation among Vocational College Students

(Hubungan antara faktor luaran dan Niat Tingkah Laku Pelaksanaan Realiti Maya dalam Kalangan Pelajar Kolej Vokasional)

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ABSTRACT

Virtual reality (VR) technology has garnered increasing attention for its potential to improve learning outcomes in English learning in vocational colleges. Understanding the behavioral intention to use VR is essential for successful implementation. In practice, behavioral intention is shaped by external factors through multiple aspects, including previous experience, related training, policy, perceived cost and technicality. This study explored the relationship between external factors and behavioral intention to use VR in English learning, and provided insights into how these factors impact the acceptance of innovative educational tools. A quantitative research method was conducted and 520 vocational college students in Jilin Province, China involved in this study. The data were analyzed using Smart-PLS to assess the path coefficient results of the variables. The results showed that external factors were slightly positively correlated, but not statistically significant. Consequently, the hypothesis was rejected, indicating that external factors had no significant effect on behavioral intention to implement VR technology. These findings highlight the need to explore other factors that influence the adoption of VR in educational settings.

Key Words: Virtual Reality; Vocational College; English learning; External factors; Behavioral Intention

ABSTRAK

Teknologi realiti maya (VR) telah mendapat perhatian yang semakin meningkat kerana potensinya untuk meningkatkan hasil pembelajaran dalam pembelajaran Bahasa Inggeris di kolej vokasional. Memahami niat tingkah laku untuk menggunakan VR adalah penting untuk pelaksanaan yang berkesan. Dalam amalan, niat tingkah laku dibentuk oleh faktor luaran melalui pelbagai aspek, termasuk pengalaman terdahulu, latihan berkaitan, dasar, persepsi kos dan teknikal. Kajian ini meneroka hubungan antara faktor luaran dan niat tingkah laku untuk menggunakan VR dalam pembelajaran bahasa Inggeris, dan memberikan pandangan tentang cara faktor ini memberi kesan kepada penerimaan alat pendidikan yang inovatif. Kaedah kajian kuantitatif telah dijalankan dan 520 pelajar kolej vokasional di Wilayah Jilin, China terlibat dalam kajian ini. Data dianalisis menggunakan Smart-PLS untuk menilai hasil pekali laluan pembolehubah. Keputusan menunjukkan bahawa faktor luaran mempunyai korelasi positif sedikit, tetapi tidak signifikan secara statistik. Akibatnya, hipotesis telah ditolak, menunjukkan bahawa faktor luaran tidak mempunyai kesan yang signifikan terhadap niat tingkah-laku untuk melaksanakan teknologi VR. Penemuan ini menekankan keperluan untuk meneroka faktor lain yang mempengaruhi penggunaan VR dalam konteks pendidikan.

Kata Kunci: Realiti Maya; Kolej Vokasional; pembelajaran bahasa Inggeris; Faktor luaran; Niat Tingkah Laku

INTRODUCTION

Virtual reality (VR) technology garnered significant attention in education fields (Fitria 2023). In terms of students' English learning, VR also show its importance, since it can overcome the disadvantages of traditional teaching method by offering virtual and interactive learning environments (Raman, Hashim & Ismail 2023). Despite the growing interest in VR adoption for English learning in vocational colleges, its utilization swayed by various factors, like perceived ease of use, perceived usefulness and external factors (Yeh, Tseng & Heng 2022).

Previous studies highlighted the benefits of VR in educational settings and the significance of factors in the adoption of VR in education. However, less attention has been paid to external factors generally involved in VR implementation in the education field. For instance, (Almaiah, Al-Khasawneh & Althunibat 2020) demonstrated that policy frameworks that encourage the integration of digital tools into education have been shown to positively influence teachers' and students' intentions to use such technologies, but it only focused single aspect of external factors. In the context of technical and vocational education (TVET), understanding external factors becomes critical, as it focuses on equipping students with practical skills that are aligned with labour markets (Yeh, Tseng & Heng 2022). Moreover, the successful integration of VR requires coordinated support from external environment, including vocational education instructions, VR technology qualities, implementable policies, relevant trainings and time or money spent. To address this gap, this study seeks to extend the existing literature by focusing on the influence of external factors on the adoption of VR in English language education in vocational colleges. By exploring these external factors within vocational education context, this research aims to provide a deeper understanding of the broader contextual influences on technology acceptance, thereby informing more effective implementation strategies in vocational education settings.

This study ultimately seeks to contribute to the development of more contextually relevant and sustainable approaches to technology integration in education through addressing the research question and testing the hypothesis as following:

Research question: How do external factors impact students' behavioral intentions to adopt VR for English learning in vocational colleges?

Hypothesis: There is a significant relationship between external factors and behavioral intention in the implementation of VR technology in English learning in vocational colleges.

LITERATURE REVIEW

Virtual reality (VR) technology as one of innovative medium and a transformative tool for education. VR provides immersive environments that originated from real-world scenarios, which allow vocational students to engage in the virtual but experiential learning settings (Lege & Bonner 2020). VR not only stimulates students' motivation through immersive virtual environment but also provide real-time interaction and feedback. In detail, these features enable learners to practice language in meaningful contexts, like international business scenarios. Moreover, VR fosters experiential learning, allowing students to actively construct knowledge rather than passively receive it. Such characteristics of VR is corresponded with the educational objective of vocational colleges, which highlight the practical skills suitable for specific working areas. In this consideration, VR has great potential to promote vocational students' English learning through its contextualized learning environments (Ling & Mohammed 2023). Although the English is the lingua franca, the lack of language environments in China, especially the vocational education environments requires adoption of VR into English education to enhance students' language skills (Wang et al. 2021). Because the advantages of VR in language learning are the capabilities of stimulate students' learning motivation through virtual environments.

As for vocational colleges students who learn English for work purpose with specific subjects or directions, like tourism, engineering and hospitality (Lertchalermtipakoon, Wongsubun & Kawinkoonlasate 2021). VR can largely satisfy the requirements of language learning and bridge the gap between communication demands and lacking of language environments with the contextualized learning method, which can promote learning outcomes and improve the confidence of interaction (Manoharan, Ashtikar & Kumar 2024). Furthermore, VR assisted learning method is different from the conventional method that mainly rely on lectures and textbooks and incorporates visual and auditory components, which make English learning process more engaged (AlGerafi et al. 2023). Vocational students might experience virtual English-speaking environments and solve challenges related to their working demands in an enjoyable manner. In addition, VR provides environments to help solving challenges in language education. For instance, the personalized learning design helps to track individual characteristics and to refine students' language abilities (Sardi et al. 2022). Meanwhile, VR also enhance the students' learning outcomes and make English learning more effective and targeted (Zarafshani et al. 2020).

Although the VR assisted learning method has various benefits, the integration of VR in English learning in vocational colleges still confronts obstacles. VR device was

less employed language education, thus, the technology wasn't fully align with the English education requirements (Barbara 2022). Bano, Yang and Alam (2022) figured out the skills to implement VR in English learning is needed, since the VR supported learning should not only control the technology but also learn language simultaneously. Thus, the training should be mentioned as the factor affecting VR adoption in English learning. During the VR adoption procedure, teachers and students play a significant role, yet remain unpleasant using experience that hinder the further adoption (Mystakidis & Christopoulos 2022). The positive using experience promote VR utilization, but negative using experience would hinder the adoption, thus, the experience also regarded as a factor influencing VR adoption in English learning. In real situation, the trend or policy issued by institutions also sway students' using VR in their learning (Peng & Peng 2022). Additionally, the cost of technology and efforts when using VR are defined as perceived cost affecting VR adoption in English learning (Korlat et al. 2021). Studies like (Ali Abdulkareem et al. 2023) show that insufficient skills, lack of using experience, heavy workloads lead people prefer traditional methods than VR assisted learning method. Consequently, the VR still in its infancy in language education settings, especially in vocational colleges in China.

The mainly used theoretical foundation in this study are Technology Acceptance Model (TAM) proposed by (Davis, Bagozzi & Warshaw 1989), which explains how users come to use technology. TAM not only posits the two factors, perceived ease of use and perceived usefulness, directly influence users' behavioral intentions to adopt technology, but also emphasize the role of external factors, while TAM has been instrumental in understanding technology adoption (Lu et al. 2021). Sukendro et al. (2020) successfully explained factors predicting the use of e-learning and the relationships between facilitating condition and perceived ease of use and perceived usefulness, by doing research to understand students' use of e-learning. Manis & Choi (2019) extended TAM to VR adoption, identifying that age, curiosity, past use, and price as key antecedents. There are also some scholars proceed their research based on TAM. External factors refer to the contextual elements that can influence the adoption process, including elements such as technological infrastructure, policy support, training, prior experience and access to resources (Alshurideh et al. 2024). Chahal and Rani (2022) holds that external factors such as self-efficiency, social factors, and personal innovativeness have influence on attitude and behavior intention in their study of exploring adoption of E-learning among higher education students through TAM, while they also suggest the usefulness of TAM in the analyzing process. These external determinants are particularly relevant in educational settings where the

implementation of new technologies, such as virtual reality (VR), may be constrained by infrastructure, funding, or policy regulations. According to recent studies, these external factors play a crucial role in determining not only the initial acceptance but also the sustained use of VR in educational contexts (AL-Oudat & Altamimi 2022). TAM is useful to explore influencing factors of technology acceptance and helpful to promote integrating technical method into education field. Although educational institutions increasingly acknowledge the value of technological integration, the adoption of emerging tools such as VR continues to face systemic barriers (Sukendro et al. 2020). Thus, this study adopts TAM as the research model to explain the influencing factors affecting students' acceptance of VR, aiming to support broader diffusion of VR among vocational colleges.

METHODOLOGY

RESEARCH DESIGN

A quantitative research design was conducted to examine the relationship between external factors, including previous experience, related training, policy, perceived cost and technicality, and behavioral intentions to VR adoption for English learning in vocational colleges. Meanwhile, the systematic data collection and analysis of data to test hypotheses and draw conclusions about phenomena. The information from population was gathered through survey design to achieve the research objectives.

RESEARCH PARTICIPANTS

The target population involved students in vocational colleges in Jilin Province, China. Jilin province was selected as its consistent development of economic and vocational institutions. In total, there are 28 vocational colleges in Jilin Province and around 202,570 students. Since the larger number of populations, the stratified sampling method was conducted to narrow down the number as it can make future results more reasonable (Mahmud et al. 2020). The population was stratified based on two criteria: majors and grade levels. This stratification ensured that students from different disciplines and grades were proportionally represented in the sample. Then the respondents are selected from each stratum based on certain percentage within the overall population. To determine the minimum required sample size, the Krejcie and Morgan's (1970) formula was used in this study, which suggests the sample size should be added around suggested 30% sample size. Thus, 520 students were chosen to participate in the research. These students were randomly chosen from the stratified groups, ensuring that each student had an equal chance of being included. This approach corresponded with the study and

ensured the validity of the findings regarding VR adoption in English learning in vocational education context.

DATA COLLECTION METHOD

The structured questionnaire was usually regarded as useful data collection tool that designed with targeted questions (Goodman 1997). Thus, questionnaire was used as research instruments in this study. The questionnaire was designed to gather data across two sections, including Part A, which used to collect demographic information (gender, grade, faculty, VR technology related experience) and Part B, which is the core construct of this research, external factors consisting of previous experience, related training, policy, perceived cost, technicality and behavioral intention to VR technology adoption. In detail, the constructs of Part B were guided by the theoretical foundation, technology acceptance model. External factor part comprises of 23 items adapted from (Al-Qaysi et al. 2023), while behavioral intention part was consists of 3 items adapted from (Rahman, 2020). Likert five-point scale is the suitable rating format for survey with highly reliable based on (Bertram, 2007). In this study, the respondents' answer was categorized through five degrees, from "strongly agree" on one side to "strongly disagree" the other side with "uncertain" in the middle. The agreement level of respondents was labelled with number from "5" to "1", while the score range is used to determine the feasibility of the questionnaire with range from 1.00 to 5.00.

The instrument was developed based on extensive literature and validated for content validity by experts from related fields, including Language, TVET and Technology. This process is conducted to ensure the concept and information from literature are reasonably transformed (Drost 2011). The content validity is used to secure items are relate to the research topic. Then, this study revised the instrument based on experts' comments and make sure there is no more details need to be modified before administering it. Generally, the instrument has no big correction. Table 1 shows the result of content validity and construct validity that all constructs and items are fall within the acceptable range.

TABLE 1: Content validity index and KMO

Constructs	CVI	KMO
Previous experience	0.9	3
Related training	0.75	5
Policy	0.8	4
Perceived cost	0.75	5
Technicality	0.95	5
Behavioral intention	1	3

The reliability can be examined through correlation values analyzation among items and interpreted with the degree of internal consistency reliability (Streiner, Norman & Cairney 2024). This study tests it through Cronbach alpha and the results are shown in the table 2.

TABLE 2: The Cronbach alpha measure of reliability

Construct	Variable	Items	Cronbach's Alpha
External factors	Previous experience	4	0.906
	Related training	5	0.848
	Policy	4	0.916
	Perceived cost	5	0.929
	Technology	5	0.925
Behavioural intention	Behavioural intention	3	0.898

DATA ANALYSIS METHOD

The collected data were analysed by Structural Equation Modelling (SEM), a statistical method for estimating relationships between constructs. Particularly, this study employed Partial Least Squares Structural Equation Modelling (PLS-SEM). PLS-SEM is suitable for this study as it not only test relationships but also evaluate the overall fit of the proposed research model. The SPSS was used to examine collected data i.e., missing data, identification of outliers, and unengaged responses. The data was imported into the Smart PLS to do further analysis and hypothesis testing.

The analysis verified a theoretical model that depicting hypothesized relationships between external factors and behavioral intention. The results of assessment of measurement model ensure that the measurement model has adequate reliability and validity. Meanwhile, the loadings are all above 0.7, means the indicators are reliable measures of the latent constructs. The results were shown in the following tables.

TABLE 3: Composite reliability and Average variance extracted

Second order construct	First order construct	Composite Reliability (CR0.7)	Average Variance Extracted (AVE0.5)
External factors	-	0.829	0.500
	Technically	0.934	0.738
	Policy	0.934	0.779
	Perceived cost	0.948	0.784
	Previous experience	0.935	0.783
	Related training	0.939	0.754
Behavioral intention	-	0.935	0.827

Table 3 displays that CR and AVE are fulfill the standard. Then, table 4 shows the results of first stage of HTMT value.

TABLE 4: First stage of HTMT values

	BI	P	PC	PE	RT	T
BI		0.469	0.284	0.324	0.337	0.314
P	0.469		0.453	0.361	0.279	0.456
PC	0.284	0.453		0.384	0.414	0.407
PE	0.324	0.361	0.384		0.377	0.404
RT	0.337	0.279	0.414	0.377		0.437
T	0.411	0.456	0.407	0.404	0.437	

The results in Table 4 indicates that all the values are lower than 0.9. The second stage of HTMT is 0.619, suggesting that the constructs are empirically distinct, and their indicators are not excessively correlated."

TABLE 5: Second stage of HTMT values

	Behavioral intention	External Factors
Behavioral intention		
External Factors		0.619

The result in table 6 shows the result of CI HTMT is 0.508, means the indicators for the constructs are not excessively correlated with those of other constructs. Meanwhile, it provides evidence of satisfactory discriminant validity, confirming the constructs are distinct.

TABLE 6: CI HTMT

	CI HTMT
External Factors <-> Behavioral intention	0.508

Then, after assessing the measurement model, the multiple steps involved in structural model analysis were processed to provide understanding of the models' explanatory, including assessing multicollinearity among exogenous constructs, evaluating the coefficient of determination (R^2), calculating path coefficients, examining effect sizes (f^2), and determining the predictive relevance (Q^2) (Sarstedt, Ringle & Hair 2022). Luckly, the results are all acceptable and shown in the tables below.

TABLE 7: The results of multicollinearity among exogenous constructs

External Factors -> Behavioral intention	2.218 (VIF)

Table 7 shows that VIF values are below the recommended threshold value of 5.0, indicating there are no significant levels of collinearity among the exogenous constructs.

TABLE 8: The results of the coefficient of determination

Constructs	R^2	R^2 adjusted
Behavioral intention	0.238	0.230

The table 8 displays the value for the model was 0.238 for behavioral intention. It implies that 23.8% of the variance in the behavioral intention can be explained and predicted by the exogenous constructs linked to it respectively. After adjustment, the value becomes 0.230.

TABLE 9: The results of effect sizes

	f-square	Effect size
External Factors -> Behavioral intention	0.013	No effect

The table 9 shows relationship between external factors and behavioral intention no effect size.

TABLE 10: The results of predictive relevance

	PLS-SEM RMSE	LM RMSE	PLS-SEM RMSE < LM RMSE
BI1	1.096	1.115	Yes
BI2	0.754	0.769	Yes
BI3	0.758	0.768	Yes

Results in table 10 show that a several indicators for Behavioral intention have lower values of RMSE in PLS model compared to LM model, inferring that predictive relevance is confirmed and the model has high predictive power. All the values higher than 0.

By using SEM software, path coefficients were used to quantify the strength and direction of relationships between constructs. P value carried out to help determine the relationships are established or not. The confidence interval demonstrates the degree of association of the relationships.

FINDINGS AND DISCUSSION

This part shows the findings of the study, presenting the relationships between external factor and behavioral intention to implement VR in English learning in vocational colleges. The results are carried out from analysis using Structural Equation Modelling (SEM).

THE RELATIONSHIP BETWEEN EXTERNAL FACTORS AND BEHAVIORAL INTENTION

The hypothesis H1 was tested to answer the research objective: "How do external factors impact students' behavioral intentions to adopt VR for English learning in vocational colleges". The statistical outcomes of the path analysis for this relationship are summarized in Table 11.

TABLE 11: Path Coefficients for External Factors and Behavioral Intention

	Path	Path Coefficient (B)	Std. Deviation	T statistic	P-value	LCL	UCL
H1	External Factors -> Behavioral intention	0.150	0.080	1.887	0.059	-0.012	0.300

The result reflects the relationship between external factors and behavioral intention is statistically insignificant, with the p value is 0.059, which higher than recommend value (p <0.05) and path coefficient is 0.150, which suggests a positive correlation between external factors and behavioral intention. The result of lower confidence limit (-0.012) and upper confidence limit (0.300) further support the insignificance of this relationship. Therefore, H0 is not supported, means external factors in general does not impact on behavioral intention to adopt VR in English learning in vocational colleges.

Contrary to the previous findings and TAM based assumptions, this study suggests that external factors and the subconstructs have no significant impact on behavioral intention to VR adoption in the context of vocational colleges.

Overall, the hypotheses proposed in this study were rejected, means that the external factors have no significant impact on vocational students' behaviroal intention in their English learning. Furthermore, the results of each sub-element of external factors are consistent with the result and indicate that it did not affect students' intention. For example, although the policy was estimated plays critical role in shaping educators' behavioral intention of VR adoption in the study of (Chahal & Rani 2022) , it still has less impact on students' behavioral intention. This phenomenon may be caused by students' individual characteristics, they are more concerned about their own feelings toward English learning and the use of VR than the external factors (Xiong 2020). That also means the specific environment of vocational colleges may account for the findings. Different from general higher educational students, vocational students usually with weak motivation on studying and unwilling to overcome any challenges related to study. Thus, the encouragement or influence from external plays the unimportant role in promoting VR adoption.

In details, the previous studies underlined by Technology Acceptance Model (TAM) have demonstrated that external factor is the influential element affect technology acceptance (Davis, Bagozzi & Warshaw 1992). Typically, the external factor is expected to effectively impact educators' intention to use VR in their education process. However, the relationship between external factor and behavioral intention in this study challenges the assumption, meanwhile, the small correlation further suggesting that external factors might have minimal influence on students than on teachers, especially in vocational college settings. Considering the characteristics of vocational students, who have less motivation and interest toward English learning and weak academic background, the external stimulations usually play a less important role in encouraging them to adopt VR for English learning (Chen & Liao 2022b). Therefore, this study holds that place more attention to explore the impact of intrinsic factors on vocational students is more meaningful than external factors, while improving the use of VR in English learning in vocational college settings (Alfadda & Mahdi 2021).

The previous experience, one of external factors has no significant impact on vocational students' intention to use VR in their English learning. The finding aligns with the study and further verify that external factors cannot sway students' intention to adopt VR. On the contrary, (Pletz 2021) had mentioned that the technology using experience in certain field could further influence its adoption in other areas, which is also confirmed by teachers. However, this conclusion cannot suit for vocational students, their application of VR in English learning more likely driven by their inner motivation because they grew up in the digital era, with sufficient experience in using technology (Lu et al. 2021). Therefore, the research can focus more on students' intrinsic interests toward English learning to promote VR adoption in their learning process.

Similarly, related training also has no significant impact on students' behaviroal intention of VR adoption in their English learning. The finding contradict the study (Pletz 2021), which suggests that training could impact behavioral intention and reduce fear of contact with technology. However, the current study focuses on students rather than educators, meanwhile, the educational settings are vocational colleges. The vocational students' intention more influenced by intrinsic factors, such as perceived ease of use and perceive usefulness (Abu-Dalbouh 2022). Thus, as one of external factors, the related training cannot significantly affect vocational student's behavioral intention in their English learning.

In terms of policy, it is regarded as a power influencer for technology adoption. In contrast, policy was suggested that it has no significant impact on students' behavioral intention toward VR adoption in their English learning procedure. Policy was considered to be an effective factor to promote technology adoption, especially in educational

institutions, the corresponding policies will directly affect educators' use of technology in teaching (Ha & Kim 2023). By contrast, the impact of policies on educators is different from that on students. As students, particular who studying in vocational colleges with less interests in English learning, would care more about whether technology adoption will have a positive effect on their academic performance and whether it is easy to control (Mulders, Buchner & Kerres 2022). In detail, if VR technology can promote learning outcomes and reduce learning difficulties, students will actively use VR, but their intention of VR using cannot be impacted by policy issued. In other words. Vocational students are more concerned about their own experience of using VR rather than the promotion of external forces.

The perceived cost also cannot significantly affect vocational students' intention of VR adoption. Perceived cost consists of non-monetary part, like effort that refers to the effort put into learning with VR, and monetary part, like cost of technology (Liao et al. 2022). In general, the behaviroal intention of users' VR utilization was influenced by perceived cost was verified in previous studies (Jingnan et al. 2023). In this study, the perceived cost has no influence on students' intention of VR adoption may be caused by students' different focuses. Students usually put emphasize on whether the effort is balanced with the learning rewards but put less attention on the price.

The last element of external factors, technicality, also plays an unimportant role in affecting students' intention of VR adoption. Technicality usually considered as important factor affecting users' using experience and decision of adoption in the future (Kim & Kyung 2023). However, the finding in this study doesn't align with previous research. This study sets vocational students, who have poor motivation for English learning and VR using, as the research subjective. Previous research had mentioned that technicality of a certain device would influence its adoption (Al-Maroof et al. 2021). However, different from educators or other users, vocational students are less affected by the technicality of VR and concern more about the effective way to improve learning outcomes.

The findings suggest that external factors that TAM construct are limited explanatory power for vocational students' VR adoption. Instead, emphasis should be placed on understanding intrinsic factors, like personal motivation to effectively promote VR adoption.

CONCLUSION

The objective of this study is to explore how the external factors impact vocational students' behavioral intention of VR using in English learning. Meanwhile, the relationship between the two variables is also be

investigated. The findings suggested that external factor cannot impact vocational students' intention of VR adoption, which is contrast with previous research and reveal deviations from technology adoption models, like Technology Acceptance Model. It may attribute to the specific research subject, vocational students who are with low level academic performance and unique characteristics of vocational education that focus on practical skills and job readiness would be the reason for this phenomenon. The modest relationship between external factors and behavioral intention reveals that vocational students are willing to consider the influence of external factors to a certain extent while using VR, especially for those factors that can positively align VR utilization with their English learning objectives. The finding also indicates that students would positively adopt VR when they regard VR as a valuable tool for enhancing their learning outcomes and innovating the learning methods than the promotion from external influences upon their focus, which is more on their own feelings and benefits.

The research limitations are also should be mentioned. This study focuses on the students studying in vocational colleges but fails to cover students in normal universities and even educators and haven't comprehensively address all the issues related to the VR adoption in the context of higher education. Therefore, to support institutions or educators promote the new technology adoption in educational field, this study suggests the more comprehensive study in the future should involve more survey subjects. The broader research scope includes not only English education, but also other disciplines in vocational colleges, and even general higher education. Further research can examine the factors affecting VR adoption through longitudinal studies to conclude the difference and similarities over time. At the same time, the study only highlights the role of external factors in promoting VR adoption in English learning. Considering the insignificant impact of external factors on students' intention, the more intrinsic factors should be mentioned in the future. Further study should not only focus on external factors but also the factors from internal aspect. In addition, the research methods also can be more diverse. This study conducted quantitative methods only, thus qualitative methods can be used in the future, including interviews or focus groups, could help to grasp nuanced attitude toward VR adoption and illustrate the challenges and opportunities of VR utilization in educational settings.

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