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The Intention of Professionals Using Virtual Reality in Training Vocational Skills for Individuals With Disabilities

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Abstract

The purpose of the current study was to develop an appropriate model to represent the relationships among the factors relating to the intention of vocational training professionals to use virtual reality vocational training systems for persons with disabilities. A questionnaire based on the theory of the value-based adoption model was used to collect data from 59 professionals working in vocational training for persons with disabilities. The results indicated that the usefulness and enjoyment positively related to perceived value, and perceived value had a direct effect on the intention of vocational training professionals. Usefulness and enjoyment had a positive impact on intention through perceived value. The model could explain 66% of intention for vocational training professionals. The findings demonstrate that vocational training professionals' perceived value may be a determinant factor in using VR as a vocational skills training tool, and that usefulness and enjoyment are mediated through perceived value.

Keywords

virtual reality, persons with disabilities, vocational skill training, value-based adoption model, perceived value

Introduction

According to the 2022 data from the Bureau of Labor Statistics in the United States, the unemployment rate for persons with disabilities (PWD) was 7.9%, which was approximately twice as high as the rate for persons without disabilities (United State Department of Labor, 2022). Strengthening the PWD's vocational skills to increase their employment rate is a critical issue (Cannella-Malone & Schaefer, 2017; Walsh et al., 2014). Vocational skills training programs, internships, and tailored support services can help equip them with the skills and confidence necessary to fulfill professional duties effectively. Vocational skills training programs for PWD are usually conducted in schools or vocational rehabilitation institutions with training at the job site, which requires considerable manpower. Virtual reality (VR) simulates situations in the real world, allowing learners to train and practice in a risk-free environment, reducing the likelihood of accidents which might provide vocational training professions with an alternative option for training PWD (Bozgeyikli et al., 2017; Michalski et al., 2021; Spilski et al., 2019).

Previous literature has demonstrated the effectiveness of using VR to train interview skills and vocational skills for PWD (Bozgeyikli et al., 2017; Giachero et al., 2021; Michalski et al., 2021; Morélot et al., 2021; Mulders et al., 2022; Shin et al., 2024). Through VR, there has been an improvement in emotional recognition, psychological understanding, non-verbal communication, social skills, and social cognitive abilities among PWD, consequently enhancing their interview skills and adaptability in the workplace (Cheng et al., 2015; Smith et al., 2014; Walker et al., 2016; Yang et al., 2017). Furthermore, through repeated practice in VR, PWD also benefit by acquiring vocational skills (Brooks et al., 2002; Michalski et al., 2021; Shin et al., 2024). Shin et al. (2024) created a virtual coffee shop for individuals with disabilities to learn the process of coffee making. The results showed that, following VR training, PWD experienced 37.43% improvement in accuracy rates in the espresso extraction procedure compared to before the training. Brooks et al. (2002) trained PWD to prepare simple meals and identify hazards in a computer-based simulation of a virtual kitchen. The results revealed that both virtual training and real-life training contributed to enhancing

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vocational skills for PWD, regardless of whether they had previous work experience or not. Based on the evidence above, VR should be considered as one of the tools for vocational training for PWD. Vocational training professionals are the frontline workers who work directly with PWD and offer employment counseling and vocational skills training for PWD. Therefore, it is important to understand the intentions of professionals regarding the application of VR to train vocational skills for PWD.

Past research on the application of VR as a teaching tool for general education teachers indicated that teachers' acceptance of using VR may be influenced by factors such as the perceived usefulness of VR, the perceived ease of use of VR, the characteristics of the curriculum, and the teacher's technology skills (Anderson & Putman, 2020; Bower et al., 2020; Raja & Lakshmi Priya, 2020; Scherer & Teo, 2019; Tzima et al., 2019). If the interface and operation of VR are user-friendly, and the content design contributes to enhancing student engagement and knowledge acquisition, then teachers will have a strong intention to use this technology (Bower et al., 2020; Raja & Lakshmi Priya, 2020; Scherer & Teo, 2019). In contrast, teachers lacking prior technology experience and negative perceptions of technology might decrease their intention to use VR (Bower et al., 2020; Tzima et al., 2019).

Past studies used the Technology Acceptance Model (TAM) to explore the factors that impact special education teachers' intention to use technology (Yeni & Gecu-Parmaksiz, 2016). Studies found that special education teachers had positive attitudes towards the use of technology, and that their perceptions of the usefulness of technology significantly affect their behavioral intention. When technology met the expectations of special education teachers, they perceived it as being more useful as an educational tool (Şahin et al., 2023; Yeni & Gecu-Parmaksiz, 2016). However, in addition to intention, other factors also influence the adoption of technology in teaching. TPACK is a model used to explain the factors critical for teaching with technology (Koehler et al., 2013). TPACK holds that content knowledge (CK), pedagogical knowledge (PK), and technological knowledge (TK) are foundational and necessary for effective technology integration. Courduff et al. (2016) explained the process leading to exemplary integration of technology into special education instructional practice by TAM and the technological pedagogical content knowledge (TPACK) model. Courduff et al. (2016) indicated that perceived usefulness and perceived ease of use motivated special education teachers to use technology. However, the skills and knowledge of technology can support them in the continuous use of technology (Courduff et al., 2016).

Literature Review

Theoretical Background

Users of technological products not only consider the system's usefulness and ease of use, but also evaluate the value of technological products from a consumer's perspective. Kim et al. (2007) proposed the value-based adoption model (VAM) to understand users' adoption intentions. The VAM asserted limitations of the technology acceptance model (TAM) in explaining the adoption of new information technology. It suggested that new information technology users should not solely be regarded as technology users but also as "consumers." The VAM reflects the decision-making process based on a cost-benefit paradigm, where the decision of the user to select a new technology or product is made by comparing its costs and benefits (Kim et al., 2007, 2017). Kim et al. (2007) hypothesized that a user's adoption intention is determined by the perceived value, a thorough comparison of benefits and sacrifices. The benefits that users of technology gain include usefulness as well as enjoyment. However, users may also make sacrifices when using new technology, including both monetary and non-monetary sacrifices. Kim et al. (2007) argued that the VAM is more capable than the TAM of explaining users' intentions to adopt new technology.

The Relationship Between Usefulness and Perceived Value

Based on the VAM, usefulness is a perceived benefit which increases the perceived value of technology. Kim et al. (2017) used the VAM to examine consumers' perceptions of the value of smart home services, yielding results similar to those of Kim et al. (2007). Moreover, Liao et al. (2022) extended this model to examine consumers' intention to engage in e-learning. The results demonstrated that perceived usefulness has a positive impact on perceived value. The results of these studies indicated that perceived usefulness can predict perceived value (Kim et al., 2017; Liao et al., 2022). Based on the above perspectives, we hypothesized that vocational training professionals' perceptions of system value are influenced by system usefulness. Therefore, we proposed that:

Hypothesis 1. (H1). *Usefulness positively impacts perceived value.*

The Relationship Between Usefulness and Intention

Many studies have demonstrated that usefulness of technology has a positive impact on users' intentions (Abd Majid & Mohd Shamsudin, 2019; Geng et al., 2021; Liao et al., 2022). Geng et al. (2021) explored VR in geography education from 187 teachers' perspectives. The research results indicated that teachers gave high ranking to the usefulness of VR and intention to use VR in teaching, and the perceived usefulness has a significant influence on intention to use VR (Geng et al., 2021). Abd Majid and Mohd Shamsudin (2019) explored the in-service teachers' acceptance of VR in classrooms based on the Technology Acceptance Model, and found that teachers' perceived usefulness of VR in the classroom had a significant influence on their intention to use VR in the classroom.

Based on the above perspectives, we hypothesized that vocational training professionals' intention is influenced by system usefulness.

Hypothesis 2. (H2). *Usefulness positively impacts intention to use VR*.

The Relationship Between Perceived Enjoyment and Perceived Value

In the VAM, enjoyment is the other component of benefits which positively affects perceived value. Enjoyment refers to the degree of pleasure associated with the usage of a product (Kim et al., 2007). Some researchers have suggested that when a user experiences more enjoyment using a technology, he/she has increasingly perceived value of that technology (Lee et al., 2013; Vishwakarma et al., 2020). Vishwakarma et al. (2020) employed the VAM framework to examine the perceived value and intention to adopt VR among 208 Indian tourists. The result indicated that tourists' enjoyment had a significantly positive impact on perceived value (Vishwakarma et al., 2020). Lee et al. (2013) examined the effects of enjoyment on 275 players of virtual golf simulators. Results showed that perceived enjoyment was significantly positively related with perceived value. Therefore, we proposed that:

Hypothesis 3. (H3). *Perceived enjoyment positively impacts perceived value.*

The Relationship Between Perceived Enjoyment and Intention

Perceived enjoyment is also a key variable in the intention to use technology. According to a TAM meta-analysis by El Shamy and Hassanein (2017), perceived enjoyment has a large effect on intention to use innovative devices such as VR, wearable devices, and robots. Lee et al. (2019) conducted a study with 350 people to explore consumers' adoption of VR devices using an extended TAM to empirically test the role of perceived enjoyment and social network activity in the adoption of VR devices. The results of this study indicated that perceived enjoyment had a direct effect on intention and an indirect effect on intention via attitude. Lee et al. (2019) believed that VR provides users with new experiences that bring joy. Therefore, the perceived enjoyment of VR directly improves attitude towards VR among users, and attitude is a core determining factor in increasing willingness to use it. Manis and Choi (2019) explored the impact of consumers' perceptions of usefulness, ease-of-use, and enjoyment on the intention to use VR hardware. This study finds that a consumer's perceptions of enjoyment are positive predictors of purchasing VR hardware (Manis & Choi, 2019). Based on the above perspectives, we proposed that vocational training professionals' intention to use VR is influenced by perceived enjoyment when PWD use the system.

Hypothesis 4. (H4). *Perceived enjoyment positively impacts intention to use VR*.

The Relationship Between Perceived Value and Intention

Perceived value by consumers has been considered a determining factor in consumers' behavioral intentions (Kim et al., 2017; Liao et al., 2022; Lin et al., 2020; Roostika, 2012; Yin & Qiu, 2021). Perceived value encompasses the costs consumers incur and the benefits they receive when using a product or service. Wang et al. (2021) utilized an online questionnaire to investigate the perspectives of 296 individuals who had previously used a VR online learning system, regarding the perceived value and intention. The result indicated that perceived value is an important factor affecting users' intention to use VR online learning systems. Lin et al. (2020) conducted an online questionnaire survey to examine individuals' experiences with mobile payment services and to delve into the factors influencing their intention to use these services. The findings of this study revealed that the intention to utilize mobile payment services was significantly influenced by perceived value (Lin et al., 2020). Liao et al. (2022) extended the VAM to investigate the acceptance of an e-learning system by 417 e-learning customers. The findings indicated that both attitude and perceived value played a significant role in influencing consumer adoption of the e-learning system.

Based on the results of the above literature, we adopted the following hypothesis:

Hypothesis 5. (H5). *Perceived value positively impacts intention to use VR*.

The Perceived Value of VR Systems as a Mediating Factor

Kim et al. (2007) believed that customers' evaluation of a product includes both cognitive and affective elements, and that products are purchased for both their utilitarian and their hedonic benefits (Kim et al., 2007; Liao et al., 2022). Kim et al. (2007) examined Mobile-Internet adoption from the perspective of 161 technology users using the VAM. The results indicated that usefulness and enjoyment were, respectively, an extrinsic and intrinsic determinant of perceived value, and were the major factors determining adoption through perceived value (Kim et al., 2007). Based on the results of the above literature, we adopted the following hypotheses:

Hypothesis 6. (H6). *Perceived value is a mediating factor between perceived usefulness and intention to use VR.*

Hypothesis 7. (H7). *Perceived value is a mediating factor between perceived enjoyment and intention to use VR.*

Research Model

Based on the systematic review above, this study adopted the VAM to explore the decision-making model of vocational training professionals when choosing VR as a vocational training tool for PWD. A theoretical framework was proposed, which (shown in Figure 1) consists of four variables, among which there are two independent variables, "usefulness" and "enjoyment," one mediating variable, "perceived value," and one dependent variable, "intention." This study employed Partial Least Squares Structural Equation Modeling (PLS-SEM) to explore the causal pathways among these variables. The specific research questions addressed in this study were:

(1) Do professionals have intentions to utilize VR for training PWD's vocational skills?
(2) Could a PLS-SEM model be established which includes the related factors comprising the phenomenon of professionals' intentions to use VR to train PWD's vocational skills?

Method

Participants

This study utilized a convenience sample from the Taipei Metropolitan Area. The research assistant contacted candidate vocational rehabilitation centers and special education schools by phone to invite professionals to participate in this study. If they were willing to participate, the research team explained the entire experimental process to them and had them sign a consent form before the experiment. This study recruited a total of 59 professionals from three vocational rehabilitation centers and one special education school from September to October, 2021. They were all working in the field of vocational training for PWD, including as job coaches, employment specialists, vocational evaluators, special education teachers, and others. Among these 59 participants, there were 13 males and 46 females. The average age of the participants was 36.8 years, and their average experience in the field of vocational training for PWD was 9.6 years. Of the participants, 66.1% had experience using VR. Table 1 provides further details on the participants' demographic information.

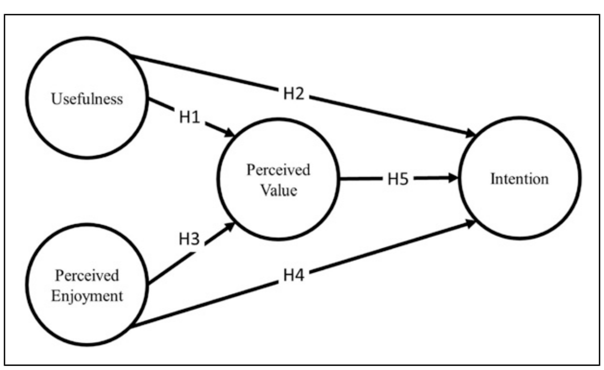

Figure 1. Conceptual proposed model.

Instrument

VR Vocational Skills Training System. The "VR Vocational Skills Training System" used in this study was developed by the research team at National Taiwan Normal University, in Taipei, Taiwan. This system comprises two subsystems: kitchen assistant and car-detailing, which were designed to train users to work as a kitchen assistant or a car detailing assistant. The kitchen assistant subsystem primarily trains users' skills of ingredients preparation, such as cutting cabbage, removing fish scales, and shredding pork (Figure 2). The car-detailing subsystem comprises four tasks: wheel and rim cleaning, car-detailing cleaning, waxing, and wiping (Figure 3).

When PWD enter the virtual system, the system will require them to complete the preparatory work, such as putting on gloves, work clothes, and safety goggles before they begin the tasks. The system provides visual cues to guide the users to the location of the clothing items. After PWD complete the preparatory work, they begin the tasks. The system provides text prompts for the procedures of the ingredients preparation tasks or car detailing tasks, which were established through task analysis, to the users who can then follow the procedures step-by-step (Figures 4 and 5). In addition to textual instructions, the system also provides visual cues to guide users to the areas to cut or to clean (Figures 6 and 7). Taking cutting cucumber as an example, the system uses blue dashed lines to indicate where users should cut (Figure 6). This visual cue guides users on how to evenly cut the cucumber into five chunks. If the users make mistakes, such as water gun too

Table 1. Demographic Information of Participants.

	Frequency	Percentage (%)
Gender		
Male	13	22.0
Female	46	78.0
Age		
20–29	11	18.6%
30–39	28	47.5%
40–49	17	28.8%
Above 50	2	3.4%
missing	1	1.7%
Work experience		
Less than 5 years	11	18.6%
5–10 years	23	39.0%
11–15 years	16	27.1%
More than 16 years	9	15.3%
VR experience		
Yes	39	66.1%
No	20	33.9%

Figure 2. The kitchen assistant subsystem trains students' skills of ingredients preparation, such as cutting cabbage.

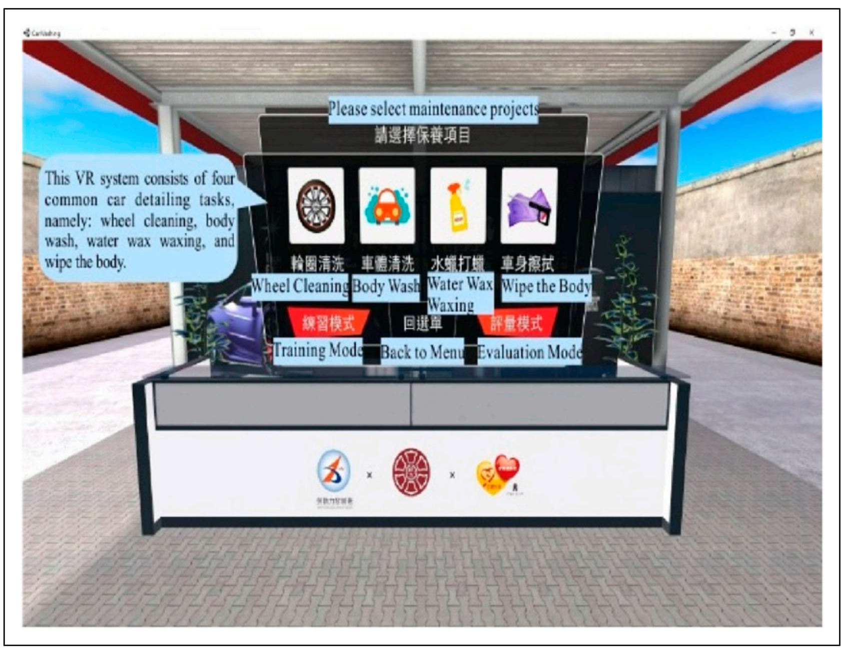

Figure 3. The car-detailing subsystem comprise four tasks: Wheel and rim cleaning, car-detailing cleaning, waxing, and wiping.

close to the wheels during the cleaning process, the system will also prompt them to move the water gun away (Figures 8 and 9).

The VR Device. In this study, the Acer Windows Mixed Reality headset (AH101 model) with integrated gyroscope, acceleration sensor, magnetometer (compass), and proximity sensor, along with the Acer AR/VR remote controller, were employed. The learners simply had to follow the sequential prompts to complete each task step.

The Acceptance Scale for VR Vocational Skills Training System. The "Acceptance Scale for VR Vocational Skills

Figure 4. There are step by step text tips or voice prompts for reminding learners of the procedure.

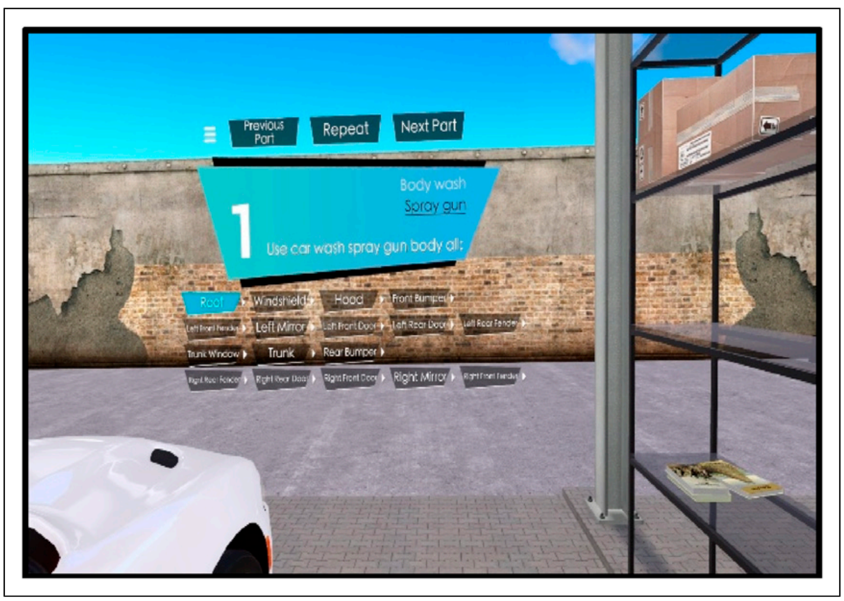

Figure 5. There are step by step text tips or voice prompts for reminding learners the procedure.

Training Systems (ASVR-VT) " (see Appendix A) was used in this study to measure the acceptance of the VR vocational skills training system by professionals working with individuals with disabilities. The ASVR-VT questionnaire was adapted from the "Immersive Mobile Virtual Reality Usability Survey Items" developed by Birt and Vasilevski (2021). It was modified based on the Technology Acceptance Model (TAM) proposed by Davis (1989, 1993). The questionnaire utilizes a 4-point Likert scale. The ASVR-VT consists of four concepts and a total of 15 questions: usefulness (3 items), enjoyment (5 items), value (3 items) and intention (4 items). Usefulness means the perception of vocational training professionals that VR is a useful tool for enhancing the job skills of PWD. An example item for usefulness is *"This system is helpful for person with disabilities to learn vocational skills."* Enjoyment refers to the perception of vocational training professionals regarding the involvement of PWD when using virtual reality. An example item for enjoyment is *"This system provides a sense of novelty, helping users to focus their attention on the learning material."* Value refers to vocational training professionals' evaluation of the system, where a higher value may lead to increased intention to use, and a lower value may lead to no intention. An example item for value is *"This system helps users become familiar with vocational skills through repeated practice."* Intention means the

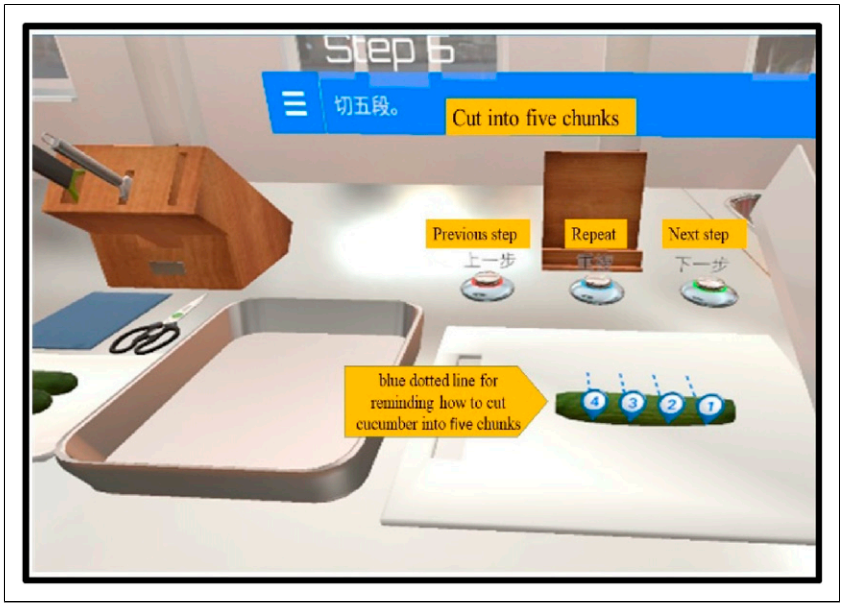

Figure 6. There are blue dashed lines reminding users how to cut cucumber into five chunks.

Figure 7. There are blue flash tips reminding users where they need to clean.

vocational training professionals' intention to use VR as a tool for vocational skills training. An example item for intention is "*If given the opportunity, I would use this system as one of the tools for vocational skills training.*"

The study employed Confirmatory Factor Analysis (CFA) through PLS-SEM (Smart-PLS 3.3.9) software to assess ASVR-VT validity and reliability (Ramayah et al., 2018). Factor loadings above 0.7 were considered. The values of all standardized factor loadings ranged from 0.746 to 0.967, which indicated a good basic fit between the theoretical model and the empirical data in this study. Internal consistency was evaluated using Cronbach's alpha and composite reliability values, which both exceeded 0.7. It suggested that ASVR-VT had strong reliability across constructs (Table 2) (Bagozzi & Yi, 1988). Convergent validity was assessed by Average Variance Extracted (AVE) values. It demonstrated that ASVR-VT had strong validity (0.71–0.91) for each construct (Table 2) (Bagozzi & Yi, 1988).

Discriminant validity (DV) was assessed via the Fornell-Larcker approach, confirming satisfactory discriminant

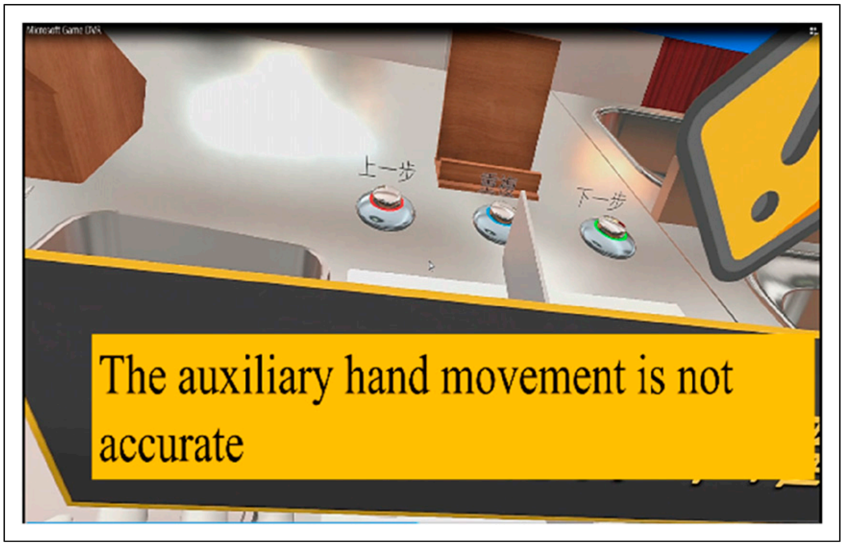

Figure 8. There are prompts reminding users that the auxiliary hand movement is not accurate.

Figure 9. There are prompts for reminding users that the water gun is too close to the wheel.

validity, as all squared correlation coefficients between constructs were lower than their respective AVE values (Table 3) (Fornell & Larcker, 1981). Using the Heterotrait-Monotrait (HTMT) criterion, which has been suggested as an alternative to Fornell and Larcker's traditional metric, all constructs exhibited HTMT values below 1, further affirming discriminant validity (Henseler et al., 2015; Voorhees et al., 2016). An extensive bootstrapping approach with 500 samples at a 95% confidence level supported these findings.

Procedure

Participants were first asked to sign a consent form, and then the researchers introduced content and operation methods of the VR system. After participants became familiar with the controller, they selected one task to perform in each of the two systems. After participants completed the tasks of the VR system, they proceeded to fill out the ASVR-VT.

Data Analysis

In the present study, the descriptive statistics by SPSS 23.0 was used to analyze the scores of ASVR-VT. The Partial Least Squares-Structural Equation Modelling (PLS-SEM) by Smart-PLS 3.3.9 software was used to construct the structural model (Ramayah et al., 2018). Path coefficients were conducted by simulating 500 bootstrapping iterations to test the significance.

Table 2. Reliability Measures for the Measurement Model.

Variables	Factor Loading	CR	AVE	Cronbach's α
Usefulness				
USE1	0.878			
USE2	0.791	0.880	0.710	0.796
USE3	0.856			
Perceived enjoyment				
ENJ1	0.746			
ENJ2	0.895			
ENJ3	0.851	0.931	0.729	0.906
ENJ4	0.884			
ENJ5	0.883			
Perceived value				
VAL1	0.916			
VAL2	0.882	0.910	0.772	0.851
VAL3	0.836			
Intention				
INT1	0.954			
INT2	0.967			
INT3	0.939	0.975	0.907	0.966
INT4	0.949			

Table 3. Discriminant Validity.

	1	2	3	4
1. Usefulness	0.843			
2. Perceived enjoyment	0.548	0.854		
3. Perceived value	0.620	0.679	0.878	
4. Intention	0.707	0.678	0.740	0.952

Results

The Intention to Use VR for Vocational Training Professionals

Descriptive statistics of ASVR-VT are shown in Table 4. The mean score of each concept was from 3.127 to 3.336. The scores are ranked in descending order as enjoyment (M = 3.336), value (M = 3.226), intention (M = 3.127), and usefulness (M = 3.127), with enjoyment having the highest average score. The results demonstrated that vocational training professionals agree that this system can enhance the motivation of PWD and enable them to focus on activities within the VR environment. They also agreed that PWD would feel excited while using this system and would want to engage in it repeatedly.

Constructing a PLS-SEM Model of Vocational Training Professionals' Acceptance

This study used Smart PLS 3.3.9 to validate the factor model of vocational training professionals' acceptance of the VR system. The path coefficients and their significance are shown in Figure 10. Based on the PLS analysis (Table 5), the results

Table 4. The Descriptive Statistics of ASVR-VT.

Variables	*M*	*SD*	*M*	*SD*
Usefulness				
USE1	3.07	0.672	3.127	0.558
USE2	3.36	0.580		
USE3	2.95	0.729		
Perceived enjoyment				
ENJ1	3.37	0.613	3.336	0.527
ENJ2	3.29	0.589		
ENJ3	3.34	0.548		
ENJ4	3.37	0.641		
ENJ5	3.31	0.701		
Perceived value				
VAL1	3.05	0.705	3.266	0.542
VAL2	3.21	0.614		
VAL3	3.54	0.536		
Intention				
INT1	3.14	0.629	3.127	0.634
INT2	3.17	0.620		
INT3	3.03	0.742		
INT4	3.17	0.673		

supported the theoretical framework, as we expected. The composite reliability (CR = 0.880–0.975) and average variance extracted (AVE = 0.710–0.907) of the four latent variables in this model were also good, thus indicating the good internal structure of this model. The path coefficient in this model is shown in Figure 10 and Table 5. The results indicated that usefulness had a direct effect on perceived value (0.354, p < .001), while enjoyment had a direct effect on perceived value (0.484, p < .001). Usefulness and enjoyment explained 53.2% of the total variance of perceived value.

For intention, usefulness, enjoyment and perceived value all had direct positive effects (usefulness: 0.353, p = .08; enjoyment: 0.242, p = .05; perceived value: 0.357, p = .007). Regarding the mediating effects, the path coefficients for usefulness and enjoyment mediating through perceived value to intention were 0.127 and 0.173. Overall, this model explained 66.0% of the total variance of intention.

The intentions of vocational training professionals regarding emerging technologies will significantly influence the adoption and effective utilization of those technologies within the field of vocational training for PWD. Therefore, it is important to understand the factors relating to vocational training professionals' intentions.

Discussion

The Intention to Use VR for Vocational Training Professionals

Based on the findings of ASVR-VT, vocational training professionals exhibited a strong intention to utilize VR for

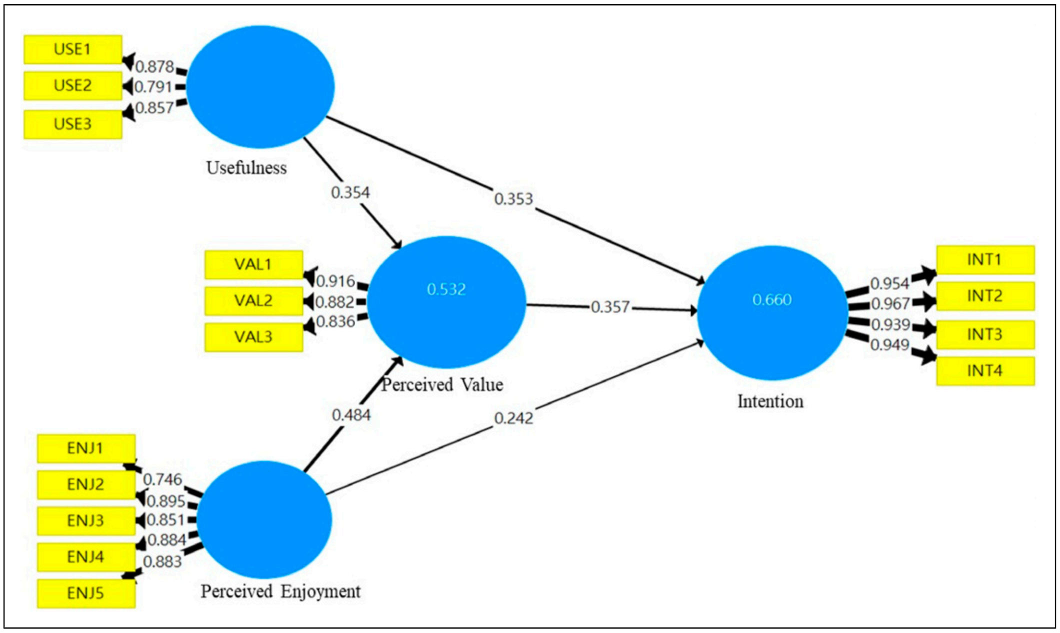

Figure 10. Verification of the research model.

Table 5. The Path Coefficient of Models.

Hypotheses	Path	Path Coefficient	*t*-Value	% of Variance
H1	Usefulness → perceived value	0.354***	4.148	53.2
H2	Perceived enjoyment → perceived value	0.484***	4.839	
H3	Usefulness → intention	0.353***	3.511	66.0
H4	Perceived enjoyment → intention	0.242*	1.964	
H5	Perceived value → intention	0.357**	2.696	
H6	Usefulness → perceived value → intention	0.127*	2.192	
H7	Perceived enjoyment → perceived value → intention	0.173*	2.272	

*$p \leqq .05$; **$p \leqq .01$; ***$p \leqq .001$.

training PWD's vocational skills. Vocational training professionals agreed they would consider using this VR system as one of the tools for vocational training for PWD to assist them in understanding the job content and to become familiar with the tasks of kitchen assistants or car detailing. This finding is consistent with the study of Raja and Lakshmi Priya (2020), whose study also identified teachers' intentions to use VR in their classrooms. These teachers pointed out that they would utilize VR to attract students' attention and to diversify their teaching approaches.

The study conducted by Bower et al. (2020) also explored preservice teachers' behavioral intentions to use immersive VR; they indicated that utilizing VR in teaching is a future trend, and considered VR as a valuable tool that surpasses traditional textbooks. Consequently, they planned to continue incorporating VR into their teaching in the future (Bower et al., 2020; Raja & Lakshmi Priya, 2020).

Vocational training professionals approved that this system can help PWD to learn vocational skills and to facilitate step-by-step procedure knowledge of vocational skills. This result is consistent with previous studies which indicated that VR-based learning can effectively enhance students' procedural knowledge (Giachero et al., 2021; Morélot et al., 2021). Although most of participants in our study appreciated the usefulness of VR and intended to use it in training for PWD, there were still a few vocational training professionals who expressed some concerns about utilizing VR as a training tool. They expressed that although VR can simulate real-life situations, the physical characteristics and operation methods of tools still differ from the real world. Therefore, the PWD may still need time for practice to be familiar with controlling the human-computer interface of VR. Some studies have also indicated that the user-friendliness of the interface is a factor when considering VR as an educational tool (Bower & Sturman, 2015; Makransky et al., 2019).

A PLS-SEM Model Illustrating the Factors Related to Intention to Use VR

The purpose of the current study was to develop an appropriate model to represent the relationships among the factors influencing the intention of vocational training professionals to use VR. Our results reconfirmed the hypotheses in the VAM model which demonstrated that usefulness and enjoyment have direct effects on perceived value, and perceived value is a significant determinant of intention. This is the first study we are aware of to use the VAM to determine VR acceptance in vocational training for PWD. From the results, it was found that the model proposed in this study can explain the overall 66.0% variation of intention of using VR for vocational training professionals.

Usefulness has a Direct Impact on Perceived Value and Intention

According to the results of our study, vocational training professionals agreed on the usefulness of the VR vocational skills training systems for training PWD. These findings indicate the unique functionalities of VR that can enhance the acquisition of vocational skills for PWD, consequently increasing vocational trainers' perceived value of VR and their willingness to use VR in vocational training.

In our PLS-SEM model, we found that usefulness had a direct and positive impact on perceived value and intention. Our results validated the VAM model and aligned with previous research findings. Past literature has indicated a positive correlation between consumers' perceived usefulness and perceived value regarding various new technologies, such as wearable devices and mobile internet (Hsu & Lin, 2016; Kim et al., 2007; Liao et al., 2022; Vishwakarma et al., 2020; Yang et al., 2016). Liao et al.'s study (2022) examined the influencing factors of customers' adoption of e-learning from both a technology acceptance perspective and a value perspective. The results showed that usefulness is a crucial factor affecting perceived value. The result implies that by providing rich learning content and paying attention to learners' experiences, it will increase the customers' perceived value. The difference in our results from the VAM is that usefulness not only has a direct influence on perceived value but also on intention. Raja and Lakshmi Priya (2020) highlighted in their study that the perceived usefulness of technology significantly affects the intention to use VR. Teachers perceive VR as an enhancement of their teaching activities rather than as an additional burden. This indicated that emphasizing the usefulness of technology and its potential benefits can positively impact users' perceptions and intentions to adopt it.

Perceived Enjoyment has a Direct Impact on Perceived Value and Intention

Perceived enjoyment refers to the extent to which the activity of using a product is perceived to be enjoyable in its own right, apart from any performance consequences that may be anticipated. The results of this study indicated that professionals strongly agree that this system can increase enjoyment of PWD. The professionals highly agree that VR helps enhance the attention and motivation of PWD, and PWD would feel excited about using the system. Previous research indicated that using VR is stimulating, and VR can lead to positive emotions such as enjoyment in learning (Alfalah, 2018; Anderson & Putman, 2020; Bower et al., 2020).

In our PLS-SEM model, we found that perceived enjoyment had a direct and positive impact on value and intention. This result indicates that vocational training professionals believe PWD will feel pleasure when using such systems, thereby increasing their perceived value and intention to use VR. Previous studies analyzing the acceptability of VR have indicated that perceived enjoyment emerged as a significant predictor for purchasing VR (Lee et al., 2013; Manis & Choi, 2019). The study by Lee et al. (2013) that explored the intentions of golf players regarding golf simulators also indicated that the perceived value associated with perceived enjoyment levels may positively influence the intention to revisit simulation games (Lee et al., 2013). VR gives users pleasure by providing a new experience. When users had positive emotional experiences with a product or service, it often translated into favorable attitudes and consequently increased the likelihood of their repeated use or purchase. In this study, after professionals experienced the VR, they reported that the virtualized scenarios and gamified design of the system made it enjoyable for them. They believed that PWD would also feel enjoyment when using this system. Therefore, these professionals intended to use VR to train PWD, and believed that VR could enhance the learning motivation of PWD and improve their vocational skills.

Perceived Value has a Direct Impact on Intention

According to the VAM, individuals' behavioral intentions are influenced by the perceived value of a technology product or service (Kim et al., 2007). In the context of our study, value refers to the perception of professionals regarding the value of VR as a tool for vocational training. In our PLS-SEM model, we found that perceived value has a direct and positive impact on intention. The result supports the findings of previous studies that adoption of technology is determined by perceived value of technology (Kim et al., 2007, 2017; Liao et al., 2022). The professionals' belief in the effectiveness and usefulness of VR in enhancing PWD's vocational skills would contribute to their behavioral intention to use the system. If professionals perceive VR as a valuable resource that can effectively support training programs and improve the learning outcomes of PWD, they are more likely to have a positive intention to adopt and use VR in training.

Perceived Value as a Mediator Between Usefulness, Perceived Enjoyment and Intention

In this paper, we found that usefulness and perceived enjoyment would increase perceived value and also enhance intention through perceived value. The results confirmed the VAM, indicating that both usefulness and perceived enjoyment, as extrinsic and intrinsic benefits respectively, encourage customers' intention to adopt technology through perceived value. The results are similar to the findings of previous studies on intention, in which usefulness has emerged as one of the major factors determining intention through perceived value (Kim et al., 2007, 2017; Liao et al., 2022; Yin & Qiu, 2021). The literature has highlighted the mediating role of perceived value in the correlation between usefulness and enjoyment of VR systems and customers' intention (Kim et al., 2007, 2017; Liao et al., 2022; Yin & Qiu, 2021). Whether a customer adopts a technology or a system can be influenced by perceived value. When designing a product, product designers need to consider not only the functionality and usefulness of the product, but also the psychological aspect of enjoyment, as well as users' perceptions of the product's perceived value. This is because perceived value not only directly affects intention but also serves as a significant mediating factor (Kim et al., 2007; Liao et al., 2022; Poushneh & Vasquez-Parraga, 2019).

The intention of professionals to use VR is also influenced by the usefulness of VR systems and the level of perceived enjoyment. Therefore, designing content to meet the needs and characteristics of PWD would increase the motivation of professionals to use VR. Moreover, the rich sensory stimulation and enjoyment offered by VR can enhance user attention and motivation, constituting one of the factors that encourage professionals to use VR as a training tool. It seems that VR system designers should seriously consider how to design the content to meet the needs and characteristics of PWD.

In our study, vocational training professionals noted that the system delineates standardized task steps, which are based on the principles of job analysis, enabling PWD to systematically practice these vocational skills. Furthermore, the interface design of this system contributes to enhancing the motivation and focus of attention for PWD. Therefore, vocational training professionals are willing to choose this VR system as a training tool for PWD if they are able to have one.

In our study, the explanatory power of usefulness, enjoyment and perceived value on the professionals' intention to use was 66%. However, there may be other influencing factors on the intention to use, including users' technological proficiency, the price of VR, and skill transferability. According to feedback from vocational training professionals, PWD might not possess enough technology skills to operate the VR system. Therefore, when designing VR in the future, designers should consider various user characteristics. The human-computer interaction interface should be clear and easy to understand, and the controller should be user-friendly. Additionally, skills acquired by PWD in a virtual environment may not necessarily transfer to real-world settings. Therefore, to better facilitate the transfer of learning outcomes for PWD to real-life settings, one could consider a blended learning approach that combines VR with real-world training. Another consideration is using mixed reality technologies, such as smart glasses, as training tools.

Although the VAM mentioned that usefulness and enjoyment are the benefits that promote consumers' perceived value and usage intention, it also indicated that technical aspects and perceived costs act as barriers influencing intention (Kim et al., 2007). The greater the perceived cost and subsequent risk, the more hesitant customers become to embrace the technology (Kim et al., 2007). Therefore, these crisis factors may still need to be taken into consideration in the future.

The Gap Between Intention and Actual Use

A past study indicated that intention is not related to actual use (Siyam, 2019). Self-efficacy, perceived ease of use, time, and access to technology were the factors which influenced special education teachers' actual use of technology. Although this study did not investigate these related factors, two out of the three vocational rehabilitation centers where the professionals were located had VR devices available, meaning that they had the opportunity to engage with VR. Some participants also mentioned that although the centers had VR, due to their tight work schedules, they did not have extra time to try using new technology to train PWD. In addition, previous research indicated that although teachers had strong intentions to use VR in their teaching, they felt that they lacked the technical skills to perform certain teaching tasks using VR (Bower et al., 2020; Siyam, 2019). Therefore, to enhance the actual utilization of new technology, besides providing relevant resources and equipment, increasing professionals' proficiency with new technology, their self-efficacy, and providing sufficient time may potentially enhance practical application.

Furthermore, special education teachers have mentioned that PWD may encounter difficulties in using VR, which might be a potential barrier when using VR (Yakubova et al., 2022). Nevertheless, the findings from our earlier research on the usability of VR among students with intellectual disabilities revealed that these students did not find difficulties in using the VR system. This might be due to the fact that this particular VR system, which provides voice prompts, text prompts, and visual cues, was designed to meet the needs of students with disabilities and so was beneficial to their learning (Wu et al., 2020). Therefore, in the future, whether in hardware or software design, consideration should be given to the characteristics of PWD, enabling them to have equal opportunities to access VR.

Implications

Implications for Special Education Practitioners

Traditionally, professionals usually train PWD's vocational skills at actual work sites. However, in real-world settings, professionals may be constrained by limited space or tools, making it impossible to provide multiple practice opportunities for PWD. According to the results of this study, the vocational training professionals agreed that if they used VR as a pre-employment training tool, PWD can familiarize themselves with the work environment and workflow before entering the actual workplace. The vocational training professionals agreed that VR can increase the attention and motivation of PWD, and enhance their pleasure. Professionals believe that using VR can facilitate PWD acquisition of vocational skills, thereby enhancing professionals' perceived value of VR. As professionals' value of such systems is enhanced, their intention to use them will also increase. This study will help designers better understand how to maximize the perceived value of the product.

However, the professionals also mentioned that PWD may face challenges in transferring the learning outcomes in VR to the real world. There is a lack of tangible manipulation of real objects in the VR environment, and the learned procedure knowledge of vocational skills for PWD may not automatically transfer to the workplace. Therefore, it is still necessary to provide hands-on experience for PWD in order for them to transfer the learned skills to the real world. The blending of VR and hands-on practice may be a solution for training PWD.

Lo et al. (2024) investigated the effectiveness of using a blended learning approach combining VR and traditional instruction on car detailing skills for students with intellectual disabilities. The students with intellectual disabilities demonstrated significant improvement after a 4-week blended learning course (Lo et al., 2024). From the research by Lo et al. (2024), it is evident that VR combined with traditional instruction had good effectiveness. Therefore, special education practitioners can use VR to stimulate the learning motivation of students with disabilities, and incorporate hands-on practice to enable students to acquire skills through a blended approach.

Implications for Special Education Educators

Integrating technology into teaching has been a trend, but it is not inevitable for special educators. Having intention is only the first step in teachers applying VR to vocational skills training for PWD. To effectively integrate VR into training, special education teachers need to have the knowledge of content, technology and pedagogy. Therefore, in the pre-service training of pre-teachers or in the in-service training of special education teachers, it is essential to provide courses or workshops related to the knowledge of emerging technologies, to enhance the technology competencies of special education teachers, and to enable them to subsequently apply those technologies in teaching students with special needs.

Implications for Special Education Technology Scholars

This study validated the TAM model and verified the relationships among perceived usefulness, perceived enjoyment, perceived value and intention. However, the model in this study only explained 66% of usage intentions, leaving 34% of the variation unexplained. Future research can refine the model by exploring other factors such as teachers' technology competencies, pedagogical knowledge, and technology support, all of which may influence their usage intention and teaching practice.

Limitations and Future Study

According to the VAM, perceived value is influenced by two factors: perceived benefits and perceived sacrifices. However, in our study, we only discussed the influence of perceived benefits, including usefulness and enjoyment, on perceived value and intention. We did not explore the impact of perceived fees and technicality on perceived value and intention. In future research, it is imperative to include factors such as perceived fees and technicality in exploring the user adoption model.

This study only explored the perspectives of professionals using VR in training PWD's vocational skills. It did not explore the professionals' knowledge of VR or their actual use of VR. Further investigations should explore perceptions of the actual application and professionals' technological innovativeness and their skills in using VR to better understand the relationships among technological innovativeness, skills, and behavioral intention.

This study only explored the potential of VR application in vocational training for PWD from the perspective of professionals. It did not discuss the acceptance of VR from the perspective of PWD. In the future, further investigation should be conducted from the perspective of PWD to explore their acceptance of technology and the factors influencing the acceptance of PWD. In addition, this study also did not assess the tangible outcomes of using VR in vocational training. Future research can further explore the performance of PWD in the employment after using VR in training.

Appendix

Appendix A. The Acceptance Scale for Virtual Reality Vocational Training Systems (ASVR-VT)

Concept	Item Number	Items
Usefulness	USE 1	This system is helpful for individual with disabilities to learn vocational skills
	USE 2	Through this system, users can learn the step-by-step procedures of vocational skills, such as the proper order of preparing ingredients for chopping vegetables
	USE 3	Through this system, users can enhance their awareness of safety while performing vocational skills, such as proper hand gestures when chopping vegetables
Perceived enjoyment	ENJ 1	This system provides a sense of novelty, helping users to focus their attention on the learning material
	ENJ 2	This system features visually appealing graphics, which helps users to concentrate and focus their attention on the learning material
	ENJ 3	This system is able to stimulate users' motivation to learn and engage in the training activities
	ENG4	Users feel excited when using this system
	ENG5	Users have the desire to continue playing even after the game ends
Perceived value	VAL1	This system helps users achieve their goals in learning vocational skills
	VAL2	This system helps users gain confidence in their learning
	VAL3	This system helps users become familiar with vocational skills through repeated practice
Intention	INT1	I Am willing to use this system as one of the tools for vocational skills training. 。
	INT2	If given the opportunity, I would use this system as one of the tools for vocational skills training
	INT3	If given the opportunity, I would continue using this system as one of the tools for vocational skills training
	INT4	If given the opportunity, I would recommend this system to others for their use in vocational skills training

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