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Study on the Acceptability of Virtual Reality Products Among Chinese Vocational Computer Students

Yan Song [a], Wei Hui Suan [b]

[a] *Faculty of Education and Liberal Studies, City University Malaysia, Petaling Jala, Selangor, 46100, Malaysia; School of Education, Hulunbuir Vocational and Technical College, Inner Mongolia Autonomous Region,021000, China*

[b], *Faculty of Education and Liberal Studies, City University Malaysia, Petaling Jala, Selangor, 46100, Malaysia*

Abstract

The paper investigates the acceptance of VR products among computer science students in vocational colleges in Inner Mongolia, China, through a questionnaire survey. Firstly, the quality of VR products is analyzed based on three factors: price, safety, and brand awareness. Subsequently, the acceptance level is determined by assessing the usefulness and ease of use of the products. All six hypotheses were confirmed by the results. The findings indicate that the main factors influencing college students' acceptance of VR products are product quality, usefulness, and ease of use.

Keywords: *Virtual Reality; VR Products; Product Acceptability; Product Quality; Vocational University Students, Inner Mongolia; Virtual Reality.*

1. Introduction

With the continuous improvement in people's living standards and the increasing demand for higher material quality, coupled with the rapid development of the Virtual Reality (VR) industry, the VR sector has emerged as one of the hottest emerging fields (Burdea & Coiffe, 1994). Consumers are establishing consumption habits and concepts regarding VR products, and the recent surge in VR-related products has garnered consumers' attention (Burdea & Coiffe, 2003).

VR involves the use of computers to simulate a three-dimensional virtual world, providing users with simulations of vision, hearing, touch, and other senses, allowing them to feel as if they are physically present, enabling them to observe objects within the three-dimensional space promptly and without limitations, thereby meeting consumer demands.

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Grigore C. Burdea and Philippe Coiffet initially pointed out three characteristics of virtual reality—immersion, interactivity, and imagination, known as the "3I" features of virtual reality, in their work "Virtual Reality Technology"（Burdea & Coiffe, 2003）.

Investment bank Goldman Sachs Group (2016) made predictions on the population and market size of the education sector in VR/AR in their investor report: by 2020, the user base is expected to grow to 7 million, reaching 15 million by 2025; software revenue was $300 million in 2020, projected to increase to $700 million by 2025. According to the "2016 China VR User Behavior Research Report for the First Half of the Year" (2016) jointly released by the China National Advertising Institute and several other institutions, the potential user base of virtual reality in China reached 450 million in the first half of 2016, with shallow users numbering around 27 million and heavy users approximately 2.37 million. It is anticipated that the domestic virtual reality market will experience explosive growth. The virtual reality user base is primarily composed of individuals born in the 1980s and 1990s, concentrated between the ages of 26 and 30.

1.1 Problem Statement

The practical civilian VR technology mainly consists of head-mounted displays with head tracking functionality, which can only provide limited simulation of visual sensations (Wang & Che, 2020). Due to the novelty of VR, production hardware technology, especially head tracking technology, and application markets are not matured enough. As a result, VR products currently face issues such as brand effects, limited application content, and poor convenience (Li & Zhang, 2019). Additionally, inadequate promotion of VR, coupled with the introduction of "pseudo-virtual" products by many domestic manufacturers, has intensified symptoms of nausea and dizziness among users, leading to trust issues in the market and contributing to insufficient purchasing power in the VR market (Wang & Che, 2020).

Therefore, from the perspective of students, this study empirically analyzes the acceptance degree and purchase intention of vocational college students to VR through questionnaire survey. Understand students' perception channels and purchasing preferences for VR. Adopt differentiated ways to promote their consumption. It is beneficial to alleviate the contradiction between VR supply and demand. It is of practical significance to ensure the rapid and orderly development of the future VR market.

2 Literature review

2.1 Perceived Quality

Within the marketing domain, it is well accepted that the perceived quality construct serves as the main motivator for purchase intention (Jacoby and Olson, 1985). Customers also benefit from perceived quality since it gives them a reason to purchase and sets the business apart from rivals. A consumer's assessment of a brand's overall excellence based on external (brand name) and intrinsic (performance and durability) cues is known as perceived quality. Since quality can be defined as the instant at which a consumer receives information or cues about the qualities of a product when shopping for or using it, quality is thus defined as a judgment about the overall excellence or superiority of a product or service. The implicit quality perception of the customer. The object of this paper is VR products. Combined with the specific situation of consumers buying digital products, product quality includes VR's price, safety and brand awareness.

There is some research on the brand characteristics, safety issues and price factors of virtual reality (VR) products. One study found that consumers are more inclined to buy brands with higher visibility. For example, Oculus, as a leader in the VR market, has brand awareness and reputation that make consumers more inclined to buy its products, especially in the absence of sufficient information (Smith, 2020). Another study found that consumers are very sensitive to brand reputation and user reviews of VR products. While some brands may perform well in terms of technical performance, consumers may switch to other brands if they receive negative reviews in terms of user experience and after-sales service (Jones et al., 2019). Another study explored the role of brands in virtual reality products and found that consumers are more likely to trust brands with innovation and leading technology. This indicates that a brand's position in the virtual reality product market depends not only on its popularity, but also on its performance in terms of technological innovation and product quality (Wang & Zhang, 2018).

When it comes to the price side of virtual reality (VR) products, there are some related research findings that deserve attention. Research shows that the price of virtual reality products has an important impact on consumers' purchase intention. This is especially true when the economy is sluggish or consumers have limited budgets. Some consumers may be

more inclined to purchase a relatively lower-priced product, while others may be willing to pay a higher price for a higher-quality VR experience (Brown & Jones, 2021). On the other hand, the study also found that price also has an impact on the market popularity and acceptance of virtual reality products. A low price helps to expand the user base and promote market growth, but too low a price may be considered as a sacrifice of product quality and performance, leading to consumers' doubts and hesitation about the product (White & Smith, 2019).

Security issues have been widely concerned in the research of virtual reality products. Studies have found that prolonged use of VR devices can cause discomfort such as eye fatigue, dizziness, nausea, and even, in some cases, movement disorders. Therefore, manufacturers and researchers need to design more ergonomic and physiologically appropriate products to mitigate these potential safety risks (Johnson et al., 2020). In addition, the content and experience in the virtual reality environment may also have an impact on the psychological safety of users. Some studies suggest that virtual reality experiences can trigger anxiety, fear, and even psychological trauma, especially in the face of uncomfortable content such as terror and violence (Smith & Brown, 2018).

2.2 VR product acceptance

Consumer acceptance of products is a multifaceted concept crucial for understanding consumer behavior and market success. It encompasses consumers' willingness and readiness to adopt and use a specific product, influenced by a myriad of psychological, social, and economic factors. According to the Technology Acceptance Model (TAM) proposed by Davis (1989), consumers evaluate a product's acceptance based on perceived usefulness and perceived ease of use. Furthermore, the Expectation-Confirmation Model (ECM) introduced by Oliver (1980) emphasizes the importance of consumer expectations and confirmation of those expectations in determining product acceptance. Quality perception, as highlighted by Garvin (1984), is another critical determinant, encompassing factors such as product performance, durability, and brand reputation. Additionally, the influence of social factors, as illustrated by the Diffusion of Innovation theory (Rogers, 1983), underscores the role of social norms, peer recommendations, and cultural values in shaping consumer acceptance. By integrating insights from these theoretical frameworks, marketers can develop strategies to enhance consumer acceptance and facilitate product success in the market.

In the research of virtual reality products, usefulness and ease of use are one of the important factors for consumers to consider. It is found that the functionality and performance of virtual reality products have an important impact on their usefulness. Consumers are more likely to choose products with rich functions and practicability, rather than products with single functions or unstable performance (Smith & Johnson, 2018).

In addition, the ease of use of the product is also an important factor for consumers to consider. Research has shown that factors such as user interface design, ease of operation and learning curve of virtual reality products affect user experience and satisfaction. Products with higher ease of use are more easily accepted and used by consumers, thus enhancing the market competitiveness of products (Jones et al., 2021).

2.3 Theory

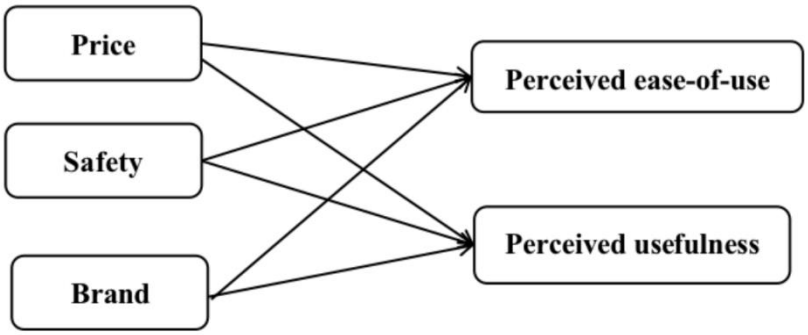
Self-construal refers to individuals' cognition of the relationship between themselves and others, divided into independent and interdependent types (Markus & Kitayama, 1991). Self-construal influences how consumers respond to product information (Aaker & Maheswaran, 1997), thereby affecting their brand attitudes, brand evaluations, and perceptions of brand image (Ng & Houston, 2006). Research on consumer behaviors related to self-construal mainly focuses on aspects such as product quality, including VR, price, safety, and brand awareness.

The Technology Acceptance Model (TAM) is a type of behavioral model proposed by Davis (1986) based on the Theory of Reasoned Action (TRA), mainly used to explain and predict users' acceptance of information systems after interacting with the system for a period. Since consumers typically purchase digital products for use online, consumers purchasing digital products have dual characteristics—they are both purchasers of goods and users of computers and networks.

2.4 Conceptual Model

According to TAM model, this paper believes that the factors that directly drive consumers to buy VR products are perceived usefulness and perceived ease of use. The perceived usefulness and ease of use are regulated by other factors in the process of influencing the purchase intention of digital products. At the same time, each factor influences each other and acts together to eventually form the behavioral intention of consumers. Based on this, the following conceptual model is constructed (Figure 1).

Figure 1: Conceptual Model



2.5 Research Hypothesis

The model contains the following assumptions:

H1: The price of VR products will positively affect consumers' perceived ease of use of VR products;

H2: The safety of VR products will positively affect consumers' perceived ease-of-use of VR products;

H3: The brand of VR products will positively affect consumers' perceived ease of use of VR products;

H4: The price of VR products will positively affect consumers' perceived usefulness of VR products;

H5: The safety of VR products will positively affect consumers' perceived usefulness of VR products;

H6: The brand of VR products will positively affect consumers' perceived usefulness of VR products;

3. Methodology

3.1 Population and Sampling

The study population is students of vocational colleges in Inner Mongolia, China. Firstly, stratified sampling was conducted to select only 29 students from public colleges and universities, and then stratified to select students majoring in computer science. Then the survey adopted random sampling, and selected students in one

computer class in each school as the survey sample. The questionnaire was distributed in September 2023, and a total of 564 questionnaires were collected in October. After eliminating invalid questionnaires such as missed selection and wrong selection, 539 questionnaires were effectively recovered.

3.2 Questionnaire

Questionnaires were divided into two parts. The first part was to retrieve profile information of the respondents; consisting of questions such as gender, age, level of education and funding. The second part of the questionnaire measures items for individual characteristics which are perceived quality, emotional value and purchase intention. All items measured are the independent and dependent variables and were rated on a 5-point Likert type scale ranging from strongly disagree to strongly agree.

4. Results and discussion/Themes and findings

4.1 Respondent's Profile

The findings reveal that 291 of them are 54% men and 248 are 46% women; 53.6. % of students were freshman, 18% were Sophomore, and 13.4% were junior student. In the paper about familiarity with VR Technology, 292 people said it in general 54.2%, followed by 215 people proficient 39.9%; A slight 5.6%, two people said they didn't know how to use it 0.4%. A total of 259 individuals use this service monthly, accounting for 48.1% of the user base. The weekly utilization rate among a sample of 199 individuals is reported to be 36.9%, while the daily utilization rate is found to be 6.3%. This resource's utilization rate is relatively low, as it is accessed by a mere 47 individuals, constituting around 8.7% of the total population. The most used scenarios were 65.3% in education, 17.3% in entertainment, 6.5 in travelling, 5.9% in fitness, and 5% in other scenarios.

Asked how many people have bought VR products, most students (79.2%) said they had not purchased them, and just 20.8% had purchased them. Further understanding the reasons for not buying, 54.9% were because of the price, 25.8% because the content was not attractive enough, 10.2% were worried that the product was not mature enough and would be a safety hazard, and 9.1% due to the unsound purchasing channels.

48.6% of the students reported that two courses currently use VR technology, and 42.9% said

one course uses VR technology, followed by three courses at 6.9%. Fewer, only 1.7%, offered more than three courses. When participants were asked to guess whether VR is widely used in education, 53.2% thought it is being used in teaching. Most, many respondents, namely 53.2%, held the belief. The application is not commonly used. A significant proportion of individuals, namely 42.3%, had the belief. The use of the item above is widespread, with a decrease of 4.5% in its utilization. When asked if they think VR will be widely used in teaching in the future, 96.7% of the participants agreed, and 3.3% disagreed with this view.

Table 1: Respondent's Profile

Demographic variable	**Description**	**Frequency**	**Percent (%)**
Gender	Male	291	54
	Female	248	46
Level	Freshman	117	21.7
	Sophomore	164	30.4
	Junior	81	15
	Senior	177	32.8
Frequency using VR	Daily	34	6.3
	Weekly	259	48.1
	Monthly	199	36.9
	Less time	47	8.7
What's scenario often use VR equipment?	Entertainment	93	17.3
	Education	352	65.3
	Fitness	32	5.9
	Tourism	35	6.5
	Others	27	5
Have you ever bought VR products?	Yes	112	20.8
	No	427	79.2
What are the reasons why you haven't bought VR	Price expensive	296	54.9

products?			
	Content not attractive enough	139	25.8
	Few purchase channel	49	9.1
	Safety problem	55	10.2
How many courses using VR?	1	231	42.9
	2	262	48.6
	3	37	6.9
	Above 3	9	1.7
Opinion of VR is being used in teaching?	Widely used	228	42.3
	There is application but not widely	287	53.2
	Less	24	4.5
Would you like to see VR integrated into the curriculum?	Yes	521	96.7
	No	18	3.3

4.2 Convergent Validity and Reliability

Convergent validity is defined as the degree of correlation between two conceptual measures (Amora, 2001). Two indicators, composite reliability (CR) and Average Variances Extracted (AVE) extracted value, are usually used in research to evaluate the convergent validity of a model. When the AVE value is greater than 0.5 and the CR value is greater than 0.7, the aggregation validity of the scale is high. As shown in Table 2, the factor loading of each observed variable are above the minimum standard of 0.5, and the calculated results of the combined reliability and mean variance extracted values are greater than 0.7 and 0.5, which mean the scale has a good convergent validity.

Table 2: Convergent Validity and Reliability

Domains	Items	loadings	CR	(AVE)	VIF
Price	Price1	0.819	0.811	0.568	1.678
	Price2	0.734			1.527
	Price3	0.747			1.626
	Price4	0.753			1.653
	Price5	0.71			1.449
Safety	Safety1	0.816	0.863	0.646	2.122
	Safety2	0.799			2.864
	Safety3	0.774			2.737
	Safety4	0.83			3.105
	Safety5	0.799			2.787
Brand	Brand1	0.776	0.858	0.637	2.196
	Brand2	0.802			2.413
	Brand3	0.783			1.777
	Brand4	0.816			2.273
	Brand5	0.813			2.179
Perceived ease-of-use	PEU1	0.799	0.837	0.605	1.974
	PEU2	0.748			1.832
	PEU3	0.721			1.66
	PEU4	0.786			1.923
	PEU5	0.83			2.261
Perceived useful	PU1	0.809	0.873	0.664	1.979
	PU2	0.854			2.208
	PU3	0.828			2.288
	PU4	0.836			2.354
	PU5	0.744			1.664

4.3 Hypothesis Testing

The Table 3 displays the outcomes of hypotheses testing, examining the influence of different factors on Perceived Ease of Use (PEU) and Perceived Usefulness (PU). The hypotheses investigate the relationships between Brand, Price, and Safety, and their impact on PEU and PU.

Hypotheses H1 and H2 investigate the impact of Brand on PEU and PU, respectively. The findings reveal a positive and significant effect of Brand on both PEU and PU, with T-values of 5.995 and 5.145, respectively. Hypotheses H3 and H4 explore the influence of Price on PEU and PU, respectively. While the effect of Price on PEU is positive but not significant (T-value = 2.3, P-value = 0.021), it significantly affects PU positively (T-value = 3.769, P-value = 0). Hypotheses H5 and H6 analyze the impact of Safety on PEU and PU, respectively. The results indicate a significant negative effect of Safety on both PEU and PU, with T-values of 4.189 and 6.823, respectively (both P-values = 0).

Table 3: Results of Hypothesis H1-H7 Testing

Hypothesis	**Path**	**Std.beta**	**Confidence intervals**		**T-value**	**P - values**	**Decision**
			2.50%	**97.50%**			
H1	Brand -> PEU	0.004	0.232	0.46	5.995	0	Accepted
H2	Brand -> PU	0.002	0.152	0.344	5.145	0	Accepted
H3	Price -> PEU	0.002	0.017	0.227	2.3	0.021	Accepted
H4	Price -> PU	0.002	0.094	0.301	3.769	0	Accepted
H5	Safety -> PEU	-0.002	0.125	0.356	4.189	0	Accepted
H6	Safety -> PU	-0.001	0.26	0.472	6.823	0	Accepted

5. Conclusion and recommendations

5.1 Conclusion

The hypotheses testing aimed to examine the relationships between various factors (brand, price, and safety) and two key constructs, Perceived Ease of Use (PEU) and Perceived Usefulness (PU). The outcomes shed light on the nuanced impacts of these factors on user perceptions. Hypotheses H1 and H2 postulated the influence of brand on PEU and PU, respectively. The results revealed a positive and significant effect of brand on both PEU and PU. This suggests that a strong brand presence enhances users' perceptions of both ease of use and usefulness of the product or service. Such findings align with previous research emphasizing the importance of brand reputation in shaping user attitudes and behaviors. Hypotheses H3 and H4 examined the effects of price on PEU and PU, respectively. Interestingly, while the impact of price on PEU was positive, it failed to achieve statistical significance. However, price significantly affected PU positively, indicating that users perceive products or services with higher prices as more useful. This finding underscores the complex interplay between price perceptions and perceived usefulness, warranting further exploration into the underlying mechanisms driving these relationships. Hypotheses H5 and H6 investigated the influence of safety on PEU and PU, respectively. The results indicated a significant negative effect of safety on both constructs, implying that concerns regarding safety detract from users' perceptions of ease of use and usefulness. This highlights the critical role of safety assurances in bolstering user confidence and fostering positive perceptions.

5.2 Recommendation

First, it is recommended to prioritize brand management efforts with a focus on continuously cultivating and maintaining a strong brand reputation to positively influence students' perceptions of ease of use and usefulness. This requires strategic investment in marketing campaigns to emphasize the reliability and credibility of the brand. Second, organizations should adopt pricing strategies that emphasize the value proposition of their products, rather than focusing solely on affordability, to justify higher price points and enhanced perceived usefulness. Third, there is an urgent need to prioritize safety assurance in product design and communication efforts, ensuring that safety measures and certifications are clearly

communicated to allay student concerns and instill confidence. Fourth, comprehensive user education and support resources should be provided to enhance user understanding and mitigate perceived barriers to ease of use. Finally, continuous assessment of user perceptions and feedback is essential to identify areas for improvement and strategies for improvement accordingly, ensuring alignment with student needs and preferences. Implementing these recommendations can effectively optimize the user experience and increase satisfaction and loyalty to the product or service. Further study of other factors and their interactions can provide deeper insights into improving student satisfaction and engagement in vocational colleges.

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