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Using the technology theory to adoption virtual reality among university students

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ABSTRACT

Virtual reality is a technology field that has become an integral part in most areas of life. Before the 20th century, virtual reality consisted primarily of artificial illusions. Students encounter early obstacles in learning and the current virtual reality (VR) learning mechanism. The research is based on previous studies by filling in the blank by observing the problems that students were facing. The second main point of this research was unified theory using model of technology acceptance and use. This paper focuses on the adoption of a virtual reality learning model in order to improve student academic performance. The results of this paper prove that hypotheses have a positive impact on the factors to use the proposed model.

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1. INTRODUCTION

Virtual reality (VR) has been made available in the spectrum of higher education for decades, since it was first created [1], [2]. A lot of testing was done to determine whether VR is appropriate for educational purposes. The benefits of VR in education are known, but there are also practical problems and difficulties of using VR. Zhao *et al.* [3] observed that in comparison to using traditional instructional techniques, VR learning was marginally more effective. Respective to the comparison, VR is best used not only in social skills, but also in other fields [3].

VR can be used to teach impressive skills through interactions with simulated. Active capability of VR skills is strongly dependent on the success of simulation [4]. Bailey and Bailenson [5] used the concept of using VR to teach action-related simulations to make students interpret the action by acting as one in the simulation of VR. The same description refers to the teaching by motivating the participant to take part in oral conversation [6], [7]. Using VR, it is possible to view events from a particular point of view.

From previous results, we find the problems that students were facing during their learning using VR. VR has been shown to be sufficient for a variety of educators to utilize. Adoption is particularly the first aspect to emphasized on, overall, VR tends to be better used in combination with existing theories of adoption. However, before implementing VR in education, multiple issues needed to be tackled. Digital technology provides unique environments that can benefit student learning; but must be specifically crafted for realistic instructional scenarios [8]–[12].

Following questions that guide this research study:

a. Does the mediator mediate the relationship between the acceptance and use of technological factors towards the adoption of virtual reality among graduate students in Omani universities?
b. How can the conceptual framework and related set of hypotheses be evaluated statistically?

Following objectives that aimed to be approved in this research study:

a. Developing an intermediate model, mediating the relationship between acceptance and the use of technological factors to acceptance of VR through students in Omani universities.
b. Statistical evaluation of the conceptual framework and related set of hypotheses.

This paper is organized into several sections, beginning with a literature review that covers the historical development of virtual reality. It then discusses the role of virtual reality in education, followed by its application in teaching and learning. The paper continues with an exploration of the benefits of VR in teaching, the different types of existing technology acceptance theories, and the unified theory of acceptance and use of technology (UTAUT) as well as the extended version, UTAUT2. Additionally, it includes a review of past studies and concludes with a summary.

2. LITERATURE REVIEW

The purpose of this paper is to provide a review of published literature on the three fields underpinning this study: VR, usability, and technology-acceptance theories. This would allow others who are not acquainted with the subject to be introduced to and acknowledge the basic elements of this study. The paper defines what VR is, determines its characteristics and functions, contrasts the commerciality and open-sources of VR, and lastly, outlines the advantages and drawbacks of VR. Technology adoption hypotheses are applied at the end of the paper to locate an acceptable methodological perspective for study.

Wieland *et al.* [13] added a significant body of research into the role of identification in forecasting media-through the study of smart glasses such as Google Glass or Microsoft Hololens. Next was the integration of a new wave of media and technologies into VR devices. Build the Big Five Human Personality Model was utilized, and the findings of two studies on the understanding and visions of smart glasses were also introduced. The researchers examined the direct and moderate effect of human personality. The findings indicated that Google Glass appears to be more accepting of open and emotionally secure consumers. Smart glasses, such as wearables, are more likely to be preferred by customers that see great potential in the product's guarantee to provide useful benefits and social conformism. The strength of these outcomes is underpinned by the individual personality of customers particularly their level of openness to facts, extraversion, and neuroticism [13].

On the other hand, the CorfuAR reality smartphone which invites customized feedback, as introduced by Kourouthanassis *et al.* [14]. This paper reflected on the method of development and constructed a computational model which reveals the acceptance of MAR applications through its emotional effects. Field research on Corfu visitors implies that efficient assets of CorfuAR elicit emotions of pleasure besides excitement, which influences the behavioral intent of CorfuAR to be used. This is the first research that empirically validates the connection between functional properties of devices, users' feelings and acts of adoption [10].

In order to explore factors which govern the use of augmented-reality virtual technology (ARIT) in sustainable relationship behavior [15] blended the model of technical implementation with the concepts of experiential importance. In line with industry trends, this study found that the degree of cognitive growth of a consumer does affect their continuous engagement using ARIT. Online customers with high cognitive innovation rely more on the importance, aesthetics, and consistency excellence elements of ARIT; While on the other hand, the playfulness and ease of use of ARIT are dependent on those with lower cognitive innovation [11], [16]–[18].

Aydin [19] uses a continuity model to determine customers' loyalty and subsequently recommend VR games based on markers. By applying the process theory, this research also explored the differences in these systems between high-and low-innovative groups visiting theme parks in Jeju Island, South Korea. Questionnaires from 241 theme park visitors claimed that consumers' satisfaction was affected by material, customized service and device usability, as well as the aim of proposing solutions for VR. In addition, personal imagination has been developed to strengthen the relationship between quality of content, personalized service quality, implementation quality, and increased realism [19].

Meanwhile, Dayana *et al.* [20] drew on past technological adoption research and offered an exploratory model on past smart glass launches. Scientific studies showed the value of multiple drivers, such as technological advantages, ease of use, differences in individual components, brand behavior, and social expectations [20]–[22]. While smart glasses are worn in the same manner as fashion accessories and contain different personal information, it seems less likely that the advent of smart glasses will affect the elements of

self-presentation and potential privacy concerns. The findings provided pre-market knowledge of smart glasses; which would make it easier for educators and executives to embrace this new technology.

The study investigates how VR technology affects consumers' brand perceptions and purchasing intentions [23]. In study 1, which used a real brand, the results indicated that consumers were more likely to form stronger self-brand connections and make purchasing decisions when they saw themselves trying on a product in a simulated mirror, as opposed to viewing professional models wearing the product. In study 2, which used a fictitious brand, narcissistic participants experienced positive effects from self-examination, while non-narcissistic participants reported weaker effects [14], [24]–[26].

One of the fundamental foundations of VR is immersion [27]. Immersion is one of the fundamental factors that distinguishes VR from traditional instructional approaches and learning environments, and it is frequently associated with educational VR. Stationary head-mounted displays (HMDs) are fully immersed, providing optimum resolution and viewing quality [28]. They are frequently outfitted with a computer or haptic device for additional immersion [29]–[31].

3. EXTENDED UNIFIED THEORY OF ACCEPTANCE AND USE OF TECHNOLOGY (UTAUT2)

The extended UTAUT is one of the latest theories and models in the field of information systems. Venkatesh *et al.* [30] employed UTAUT to examine technology acceptance in the context of consumers' behavior. Besides the four determinants of UTAUT, Venkatesh *et al.* [30] adapted three additional factors namely motive, price value, and habit. Definitions of these determinants were presented in Figure 1. The extended model, referred to as UTAUT2, assumed that performance expectation, effort expectation, social influence, facilitation of conditions, tasty motive, price value, and habits as influential on behavioral intent. Meanwhile facilitating conditions, habits, and intent influence positively and directly upon users' behavior.

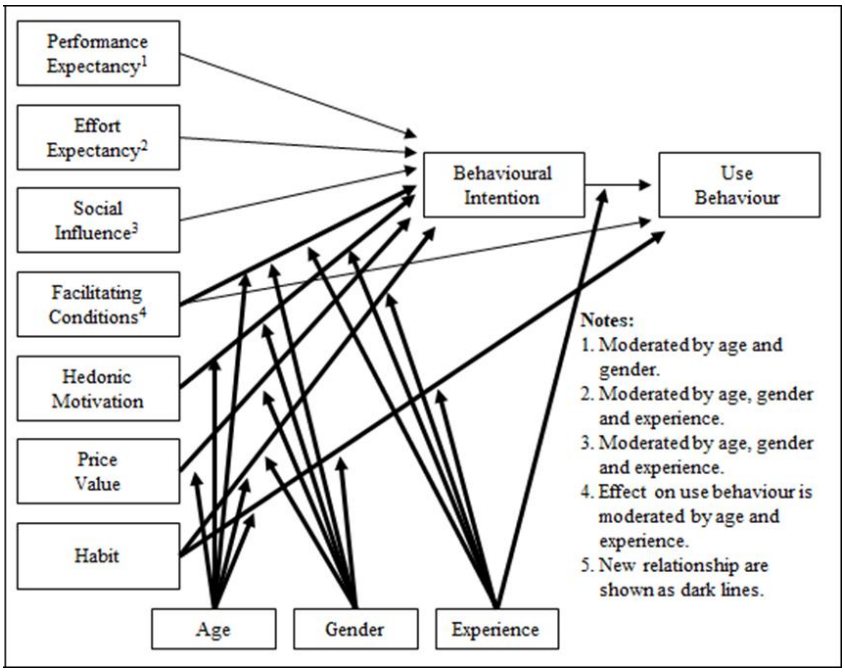

Figure 1. The extended model, referred to as UTAUT2

In addition to the moderating influence suggested in the UTAUT, the UTAUT2 theorizes that personal attributes, age, gender, and experience have an impact on the interaction between main determinants as well as purpose nor usage of behavior. The effect of fostering constraints on behavioral intentions is moderated by age, gender, and experience - making it more relevant for older, fewer and less-experienced consumers. In addition, age, gender, and maturity moderate the impact of hedonic motivation on intent which makes it more relevant for younger, male, and less-experienced consumers. The effect of price value on behavioral intentions is moderated by age and gender, making it more relevant for younger, female consumers. Meanwhile, the effects of habit on behavioral purpose and behavioral usage is moderated by the three moderators, making it more relevant for older, male, and more seasoned consumers [21], [22], [27],

[28]. Finally, practice moderates the impact of purpose on the use of actions such that it is stronger for less advanced consumers.

Venkatesh *et al.* [30] empirically checked UTAUT2 via 1,512 mobile internet users in Hong Kong. The findings showed the effectiveness of the proposed voluntary settings' model. The model clarified 74% variation in behavioral intent and 52% variation in behavior. However, both the UTAUT and the UTAUT2 have been blamed for creating prejudice across cultures.

4. THE HYPOTHESIS AND THE RESEARCH MODEL

In this part, we discuss the factors affecting the model which branches out from UTAUT2. The basic factors of work are used in building cognitive development and the influence of accepting the virtual reality method in the educational procedures and field. In this section, the relationships between these factors and their behavioral intention on virtual reality are dependent in this study. They are explained by the design the model shown in Figure 2. It is notified that previous studies provide knowledge whereby it enhances the continuity of intention to use virtual reality and depends on several factors. Such factors are student satisfaction, the intent of the behavior which confirms their continuing intent. However, fewer studies addressed the specifics of determining academic performance. This study aims to draw the characteristics of behavioral intention that depends on the teacher's knowledge level of the subject and the interaction as shown in Figure 2.

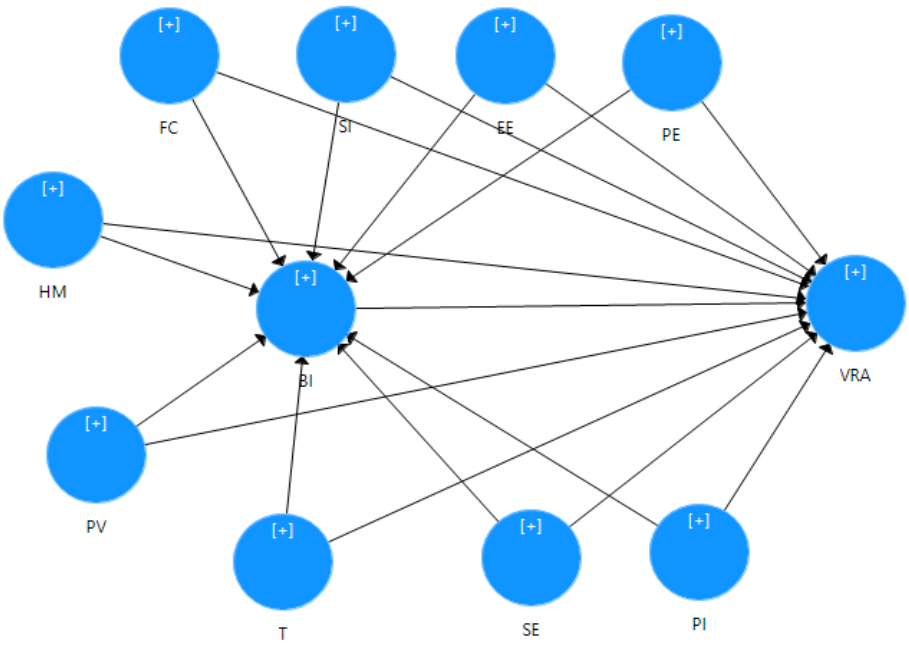

Figure 2. Research model

5. RESULTS AND DISCUSSION

5.1. Demographic profile of respondents (questionnaire part 1)

The main goal of using demographic profiles was to check the validity of the collected data. Table 1 provides background information for the respondents.

Table 1. Demographic profile of respondents

Demographic factor	Category	Frequency	Percent
Gender	Male	239	63
	Female	139	37
Scientific degree	Bachelor	306	81
	Diploma	72	19

5.2. Questions survey

The survey questions were distributed to the students and all of the questions as well as options in each question have been checked before being handed over to the next involved personnel. The questionnaire was once again checked and corrected by expert professors from the Information Technology Department from different universities in the Sultanate of Oman. The questionnaire was hereby approved and published among the students through Google form to retrieve answers.

5.3. Measure validity

The model is examined to assess the validity of the variables used in this study. According to [32], indicator loadings should exceed 0.70, and the significance level should be set at 0.05. A loading of 0.70 indicates that a latent variable can explain at least 50% of the variance of its indicator. Resampling techniques, such as jack-knifing or bootstrapping, are used to assess the significance of the loadings. Pozin and Nawi [33] stated that when eliminating indicators, researchers should adhere to the characteristics of PLS, removing any indicator with a loading value below 0.70. In this study, all loading values exceeded the threshold of 0.70, so no indicators were removed. The skewness value is calculated to assess the symmetry of a distribution. No value exceeded the acceptable skewed range proposed by [27], which is between -2.58 and +2.58 at the 0.05 significant level. Based on the skewness results, there is no reason to be concerned about the data's normal distribution; thus, they are enough for further research. Table 2 presents the measurement model along with the construct loadings.

According to [34], dependability is "an indication of the stability and consistency with which the instrument assesses the idea and aids in determining the goodness of a measure." A critical stage in the validation of the item is to assess its reliability to ensure measurement accuracy [35]. This is being done to reduce measurement errors. Measures are often more dependable when they have a higher correlation with other measures or have higher Cronbach's alphas. The alpha coefficient has no conventional restriction; however, the Cronbach's alpha has a typical lower limit of 0.70. The data is reliable based on the results and can be utilized for hypothesis testing. Similar to Cronbach's Alpha, composite reliability (CR) assesses the consistency of an instrument but takes into account the different loadings of items on the construction. It is another reliability measure. Values above 0.7 are generally considered acceptable. All constructions show high composite reliability.

Table 2. Outer loading for constructs

Variables	Items	Loadings	p-value
Performance expectancy	PE1	0.869	0.000
	PE2	0.749	
	PE3	0.858	
	PE4	0.843	
Effort expectancy	EE1	0.770	0.000
	EE2	0.780	
	EE3	0.811	
	EE4	0.836	
Social influence	SI1	0.900	0.000
	SI2	0.881	
	SI3	0.908	
Self-efficacy	SE1	0.857	0.000
	SE2	0.797	
	SE3	0.867	
Personal innovativeness	PI1	0.713	0.000
	PI2	0.882	
	PI3	0.805	
	PI4	0.873	
Behavior intention	BI1	0.880	0.000
	BI2	0.880	
	BI3	0.818	
Virtual reality adoption	VRA1	0.706	0.000
	VRA2	0.750	
	VRA3	0.805	
	VRA4	0.745	
	VRA5	0.769	

5.4. Hypothesis testing

It can be concluded that all of these factors do indeed enhance the “behavior intention to use” model. As a recommendation, the decision-makers of the higher educational institutions should take these results into consideration in their future attempt to construct a virtual reality learning infrastructure.

From previous studies related to VR technology, technologies were used within many studies which intended to forecast and elucidate how users will behave in relation to the adoption and use of new technology. The Unified Theory of Acceptance and Use of Technology 2 (UTAUT2), as well as its educational environment, were employed in this study. This study in relation to the literature reviews claimed that behavior is a major contributor as a mediator in the adoption of VR an education devices-for that impacting upon UTAUT2 prototype components. This model was able to account for about 70 % of the variance in behavioral intention to use the intended technology. Moreover, this study also confirmed the influence of factors on intentional behavior. A strong and economical model that aids in understanding the behavior of technology adoption is the UTAUT2 [36].

6. CONCLUSION

The virtual learning environment is an interactive simulation which allows the user to go through different learning atmospheres, such as through participating in classes or visiting specific places while just sitting at home. This study, in relation to the literature review from the outset, declared that behavior plays a key role as a mediator in the adoption of virtual reality as learning tools. Hence, this outcome significantly influences the variables in the UTAUT2 model. This study was able to give educators with a number of suggestions for smooth integration based on the experiences and answers of participants. These tactics are based on participant recommendations, suggestions, and researcher reflection on existing technology use in Oman.

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CONFLICT OF INTEREST STATEMENT

Authors state no conflict of interest.

DATA AVAILABILITY

Data availability is not applicable to this paper as no new data were created or analyzed in this study.

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