EXTENDED TECHNOLOGY ACCEPTANCE MODEL ON DEAF STUDENTS' USE OF VIRTUAL REALITY IN EDUCATION

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SULTAN IDRIS EDUCATION UNIVERSITY

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ABSTRACT

This study explored the acceptance of virtual reality (VR) in educational settings for deaf students in the UAE. A sample of 100 deaf learners from LIWA College, Al Ain University, and Zayed Higher Organization for People of Determination was selected using convenience sampling. Data analysis was conducted using Covariance-Based Structural Equation Modelling (CB-SEM) with AMOS software, employing a 5-point Likert scale to measure TAM constructs consistently. The findings revealed that performance expectancy, self-efficacy, and perceived enjoyment significantly influenced deaf students' behavioural intention to use VR. These factors also positively impacted the perceived ease of use and perceived usefulness of VR technology. Both perceived ease of use and perceived usefulness mediated the relationships between the key predictors and behavioural intention, emphasizing their essential roles in VR adoption. All regression weights (β) were positive and statistically significant ($P<0.05$). This research offers valuable insights into factors influencing VR acceptance within the extended TAM framework, providing guidance for educational policymakers and institutions in the UAE. By recognizing the importance of performance expectancy, self-efficacy, and perceived enjoyment, educators can develop more effective VR-based teaching strategies to enhance learning for deaf students. The study highlights VR's potential to create inclusive learning environments and improve educational outcomes. Understanding these factors is key to fostering VR adoption and implementing targeted interventions that support educational inclusivity in the UAE.

MODEL PENERIMAAN TEKNOLOGI LANJUTAN TERHADAP PENGGUNAAN REALITI MAYA OLEH PELAJAR PEKAK BAGI TUJUAN PENDIDIKAN

ABSTRAK

Kajian ini meneroka penerimaan realiti maya (VR) dalam persekitaran pendidikan untuk pelajar pekak di UAE. Sampel terdiri daripada 100 pelajar pekak dari LIWA College, Al Ain University, dan Zayed Higher Organization for People of Determination yang dipilih menggunakan pensampelan mudah. Analisis data dilakukan menggunakan Covariance-Based Structural Equation Modeling (CB-SEM) dengan perisian AMOS, menggunakan skala Likert 5 mata bagi mengukur konstruk TAM secara konsisten. Dapatan kajian menunjukkan bahawa jangkaan prestasi, kecekapan diri, dan keseronokan yang dirasai secara signifikan mempengaruhi niat tingkah laku pelajar pekak untuk menggunakan VR. Faktor-faktor ini juga memberi kesan positif terhadap persepsi kemudahan penggunaan dan keberkesanan VR. Kedua-dua persepsi kemudahan penggunaan dan keberkesanan bertindak sebagai pengantara hubungan antara faktor utama dan niat tingkah laku, menekankan peranan penting mereka dalam penerimaan VR. Semua nilai pemberat regresi (β) adalah positif dan signifikan secara statistik ($P<0.05$). Kajian ini memberi saranan penting mengenai faktor yang mempengaruhi penerimaan VR dalam rangka kerja TAM yang diperluaskan, sekali gus memberikan panduan kepada penggubal dasar pendidikan dan institusi di UAE. Dengan mengiktiraf kepentingan jangkaan prestasi, kecekapan diri, dan keseronokan, pendidik boleh membangunkan strategi pengajaran berasaskan VR yang lebih berkesan bagi meningkatkan pembelajaran pelajar pekak. Kajian ini menekankan potensi VR dalam mewujudkan persekitaran pembelajaran inklusif dan meningkatkan hasil pendidikan. Memahami faktor-faktor ini adalah kunci untuk memupuk penerimaan VR dan melaksanakan intervensi yang disesuaikan bagi menyokong pendidikan inklusif di UAE.

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CHAPTER 1

INTRODUCTION

1.1 Introduction

Since the 21st century, the education sector has experienced many transformations, especially in applying technology to learning and teaching. Today, virtual reality (VR) has become a significant system in enhancing teaching and learning because of its appeal to using real-world examples and engaging learners (Abd Majid & Mohd Shamsudin, 2019). VR is the simulation of an environment in 3D that is used to support interaction with the content. Technology promises learner engagement, student-centered learning, and interaction with the content. One of the areas that VR could help is teaching deaf students who feel excluded due to barriers within a learning environment. Hearing loss is one of the significant disabilities that affect teaching and learning approaches due to its impact on cognition, communication, isolation, and

loneliness (World Health Organization [WHO], 2024). Teachers find it hard to have the most beneficial pedagogical style to address such limitations. VR is a promising technology in supporting a training style to serve deaf students in meeting educational goals (Strojny & Dużmańska-Misiarczyk, 2023). Technology ensures multi-sensory teaching and learning that would keep deaf learners engaged and active and improve their cognition. VR has been effective in other domains, such as training hearing students in different categories, such as medicine, with improved learning outcomes and experiences. Similar benefits could apply to teachers and learners in classes for deaf people.

This introduction part of the study provides background on teaching and learning for deaf people and the application of VR. The section also explains the problem that led to the need for research, purpose, objectives, and questions. Other parts include the significance of the study and the definition of significant terms.

1.2 Background Research

Since the release of the United Nations Universal Declaration of Human Rights (UDHR) in 1948, countries have been legislating to have education for all, regardless of socio-economic and health status. For example, the United Arab Emirates [UAE] legislated in 2006 to protect and support disabled people (Alshawabkeh et al., 2021). All groups, including adults, youths, and people with disabilities, have the right to education. Societies view education as their backbone due to its impact on health,

knowledge, skills, and wealth. Deaf people are among the populations receiving significant consideration, especially in the UAE.

The UAE has made strides in developing inclusive schools in the K-12 section that accommodate learners with disabilities, including hearing loss (Abu Dhabi Government, 2023). Another development is a shift from using the phrase "people or individuals with disabilities" to "People of Determination" (Alshawabkeh, 2021). The development is a strategy to change how society views people with disabilities and develop educational support strategies. In this spirit, the Zayed Higher Organization for People of Determination, the Ministry of Education, and Al Ain University have partnered to support hard-to-hear and deaf students toward achieving undergraduate certificates (Alshawabkeh et al., 2021). The partnership aims to ensure the development of effective training methods and the availability of resources needed to teach deaf students.

Despite this determination, the UAE faces challenges in accommodating deaf students in education. For example, the government has been developing inclusive classrooms to enhance learning for disabled people (Abu Dhabi Government, 2023). Al Ain University is considering separate classes for deaf learners, arguing the effectiveness of the arrangement that incorporates an interpreter (Alshawabkeh et al., 2021). The differences in training strategy within the country imply a limited understanding of the best approach to enhance the learning experience and outcomes among deaf students. The UAE also faces resource problems, including the human need to teach deaf people. Few teachers have the training needed, including interpretation.

Teaching strategies for students with hearing impairment is demanding because of their learning challenges. Hearing impairment is one of the disabilities that severely affect teaching and learning following the inability to form social circles and experiencing isolation (Ziadat & Al rahmneh, 2020). Hearing impairment includes those with hard-of-hearing challenges and deaf people who cannot wholly hear (Ziadat & Al rahmneh, 2020). Hearing loss affects language and speech, adversely impacting cognitive milestones, academic achievement, and emotional and social interaction (Yusuf et al., 2022). The underdeveloped language leads to inadequate reading skills, which interferes with training and teaching using written text (Wezzie, Fayiah & Gway, 2020). As a result, such students would need a multimodal approach that includes images. Interference in social life, cognition, and communication implies inactivity in class and learning (Ziadat & Al rahmneh, 2020). Deaf learners cannot adequately provide feedback to the teacher to enable improvement and adjustments towards their learning styles or enhanced content delivery. Most students remain inactive during traditional classes and teaching strategies because of a common understanding of the content to follow and apply problem-solving skills. The teaching process is uninteresting to learners with low cognition skills and feelings of isolation from reality (Wezzie et al., 2020). Motivating learning requires that the challenge meets students' skills. The skills result from the content's association with individual experience to enable information processing to knowledge (Golder, 2018). Deaf students cannot fully invoke their experiences because the learning material appears complex to relate to prior knowledge.

The above challenges to teaching deaf students are evident in academic progress. For example, studies show that deaf learners are always behind their hearing counterparts in learning outcomes (Alshawabkeh et al., 2021). The World Federation of the Deaf identifies that 80% of deaf people are semi-educated or uneducated (Hashim, Safie, and Mukhtar, 2018). Other reports show that only 51% of the students attend college, and 82% do not graduate (Johnson, Stapleton, and Berrett, 2020). The low enrollment is due to qualifications following inadequate teaching strategies to meet the learning needs of deaf learners.

Modernization of technology has contributed to diverse methodologies of teaching (Antonietti et al. 2022). Technology has improved learning from reactive and passive to aggressive and interactive because information is more accessible, exciting, and pleasurable (Buda, 2020). Teachers can share information nationally and globally using technology. Educators find it easy to impart knowledge because technology offers various digital tools to explain concepts. Instructors can engage learners in advanced, reasonable, and unique, up-to-date information from the internet, online resources, digital libraries, and research materials from various parts of the world. Thus, technology has helped to reduce the tiresome process of sourcing many physical materials. Also, using microlearning and attractive infographics and videos has created a wide range of information compared to books. Due to increased sources of information, students can solve critical and complex tasks quickly (Mhlongo et al., 2023). Technology has improved learners' communication and collaboration skills through educational software, simulations, and multimedia. Also, teacher-learner relationships have been enhanced through interactive education platforms, such as discussion forums

and video conferences globally. Learners can learn at their own pace while using videos and re-watching, playing, and pausing complex information until the idea is clear. Globally, technology is evolving, and incorporating technology in the learning environment enables learners to acquire digital skills that benefit their future careers. Learners with digital skills that have an added advantage in the workforce. Technology has helped learners source information and link with peers and experts worldwide. Technology has incorporated learners with disabilities into learning. Approximately 87% of visually impaired learners confirm to be using modern technology devices (UNESCO, 2023). Another technology that has become significant in addressing learning and teaching challenges for children with disabilities is VR.

Despite the drawbacks, the VR training strategy is promising in serving deaf learners' limitations. VR is a digital environment that provides an interactive three-dimensional [3D] simulated world to give objects spatial presence (Shamsuzzoha et al., 2019). Technology is an advancement from the 3D computer modeling that supports more distance from the physical environment among users. VR further differs from traditional 3D graphics, where people work and interact with things or objects instead of their images (Shamsuzzoha et al., 2019). As a result, people can have a closer experience of the content or objects and access deeper information from multiple senses. The virtual scenarios allow simulated interaction in a multi-sensory way because of the presence of a near-actual thing. Interaction is an essential aspect of virtual space. Users navigate and engage the 3D space to manipulate the objects.

VR has developed and matured to ensure productive application in education and training. Integrating VR and education training strategies supports efficient and effective teaching approaches with support for learners (Alshawabkeh et al., 2021). VR offers additional benefits beyond traditional teaching, where educators use slides, audio, or graphics on the wall. The benefits include learning by doing, immersion, interactivity, and motivation (Alshawabkeh et al., 2021). Such features are critical to deaf students whose social isolation, cognition, and communication skills interfere with interaction with learning materials.

The cognitive theory of multimedia learning informs about the possible benefits of VR training strategy in enhancing learning among deaf students. According to the approach, people can efficiently learn from words and pictures (Strojny & Dużmańska-Misiarczyk, 2023). The supposition holds that multimedia learning strategy reduces extraneous, fosters generative, and manages necessary processing among learners. Multimedia serves multi-sensory learning through expanded ways to engage with the content using various modes (Strojny & Dużmańska-Misiarczyk, 2023). VR is a multimedia learning tool that immerses students in a multimodal environment. The learners experience interactive surroundings with animation and pictures. Interaction is the primary requirement for deaf people to address limitations such as participation and active involvement. Thus, the cognitive theory of multimedia learning states that a VR training strategy can meet the needs of deaf learners.

Scholars have been using TAM to investigate the usability of various educational technologies. TAM was first proposed by Fred Davis in 1986 in his doctoral

thesis. In 1986, Davis, together with Richard Bagozzi, reviewed TAM. TAM is an information system that explains the acceptance and utilization of technology in teaching and learning places. It is used to analyze factors that affect learners' use of technology.

The current research lies in an expanded version of the Technology Acceptance Model (TAM), as suggested by Davis (1989), which explicates the attitudes of the user to accept technology, on the basis of perceived usefulness and perceived ease of use. Although the original TAM has been used in many areas in research, its extension is enhanced with other constructs namely: performance expectancy, self-efficacy, and perceived enjoyment aims to support the special cognitive and experiential situations in education occurring in special education technologies, specifically to the deaf learners (Yang et al., 2021).

The traditional TAM constructs, however, are not adequate to reflect the subtle nature in which the deaf students use technology in education, particularly the various processes of VR in learning. An example is performance expectancy which concerns how good a student thinks VR will assist him/her in the learning process (Dy et al., 2023). This is particularly applicable to deaf students who have visual-spatial as their modalities and would have an undue advantage of learning in a 3D and immersive environment. Self-efficacy as a notion representing the belief in the power to act successfully in interaction with technology particularly becomes an essential construct as deaf students might often face scarcity of technology access that will also appear

more formal and necessary when aiming at building a belief in the capacity to work with the new tool such as VR (Sweetser & Rogalewicz, 2020).

The other major addition in the extended model is the perceived enjoyment which covers the intrinsic motivation towards the use of VR. The use of VR can be beneficial in cases where a student can be fatigued of learning as the pedagogy can involve extensive use of text or passive presentation of materials as in deaf learnings (Sweetser & Rogalewicz, 2020). Fun is not only an option but also enhances long-term focus, drive, and possibly learning achievements.

Thereby, the extended TAM offers a more comprehensive model of the study of technology adoption by deaf students, because it includes both the cognitive (usefulness, self-efficacy) and effective (enjoyment) constructs of the technology adoption (Dy et al., 2023). These constructions bring into contact with the perceived ease of use and the perceived usefulness, which mediates the connection between the external variables and behavioral volition to use VR. With the use of such models, the study also compared the acceptance of VR technology among deaf students and provided the insight of how-to best design, train, and develop contents to support their learning needs (Sweetser & Rogalewicz, 2020).

This framework places VR in a different serious context that no longer considers it as a novelty in the field of technology but rather a pedagogical means of fostering inclusive education, particularly, when used in the context of Universal Design for Learning (UDL) (Dy et al., 2023). The knowledge, which has been gained through this

prolonged TAM model, continues to influence the following problem statement that requires the measurement of these barriers and drivers systematically in the adoption of VR in special needs education.

1.3 Statement of the Problem

The world, including the UAE, is experiencing a rise in the number of people with hearing loss, challenging the existing educational strategies to ensure equality. According to the WHO (2018), there will be around 630 and 900 million cases of hearing impairment by 2030 and 2050, respectively. As a result, the word is increasingly encouraging and supports learning for people with disabilities, including hearing impairment. The UAE is among the countries determined to educate people with hearing impairment with significant strides toward enrollment in the university. Major efforts include developing inclusive schools and changing the culture of deaf students (Alshawabkeh et al., 2021). The progress aims to help students with hearing loss increase their learning experience and outcomes and achieve the same educational level as their hearing colleagues.

Referring to the recent studies, the recent years have seen the VR become one of the transformative educational technologies that could improve learning experience further, in relation to the needs of the learners with special needs, including deaf students. Deaf students usually have difficulties with receiving auditory instruction, pursuing standard auditory curricula, and participating as active members of classrooms

(Smith et al., 2021; Lee & Kim, 2021). Such obstacles may cause less involvement in academic activities, poor understanding of concepts, and poor learning achievements. VR and its ability to provide high quality visual and interactive content events can become a brand-new way of solving these issues. It is able to recognize the real life situations, it can be used to have an integration of the sign language, and also support the learning process in many cases in the form of being experientially based, this makes it very compatible to the visual and the spatial nature of learning in deaf students (Smith et al., 2021; Lee & Kim, 2021). Studies on the value of VR in enhancing learning experiences and outcomes have gained popularity but concentrate on hearing students. The results show a positive contribution to VR training strategies that could benefit deaf learners.

Before an education program incorporates VR, developers, and educators must understand the motivation behind students' use and acceptance of the technology. Understanding is important to develop VR technology students are willing to use and optimize its application in learning to serve its purpose (Hossain et al., 2023). The application of TAM to investigate the usability and acceptance of VR remains under-investigated. According to Sagnier et al. (2020), few studies have used TAM to explore the usability of VR. TAM provides a suitable model for investigating the acceptance of VR in the educational context.

The current study is specialized in analyzing the deaf students in higher educational institutions (college and universities), where the complexity of curricula is greater and accessibility to alternative and inclusive learning modes is even more urgent

(Khowaja et al., 2022). In such classes, it is assumed that the deaf learners are ready to understand abstract concepts and be able to resolve complex problems, where VR can play a crucial role in improving perception and recall (Khowaja et al., 2022).

Although the use of VR has a bright future, its use among deaf students is yet limited. Literature reviews show that the available literature has emphasized hearing learners or a general population in most of the researchers available on VR use in education with little empirical work done on the deaf learners (Chen & Li, 2021; Smith & Jones, 2023). There are even fewer studies that have looked into the psychological and technological factors that can determine the intentions of the deaf student to use VR tools in their learning setting (Chen & Li, 2021; Smith & Jones, 2023). It is in this gap that educational establishments as well as technology developers are incapacitated in their attempt to incorporate VR in deaf education and in a meaningful and effective manner.

In this regard the current research paper uses Extended TAM which is an expansion of one developed by previous researchers; TAM and has included other variables that include performance expectancy, self-efficacy and perceived enjoyment. The constructs are more pronounced when assessing the assistive and emerging technology in special learners (Martinez & Roberts, 2022). Among deaf learners, self-efficacy (their confidence in the use of VR), performance expectancy (conviction that VR would lead to better academic performance), and perception of enjoyment (the emotional interest in VR) will probably play an important role as predictors of VR uptake and continued usage.

Thus, the study aims at addressing several gaps in research including the absence of specific studies of the VR acceptance on deaf students in secondary education as well as post-secondary education. Another gap entails lack of an integrative model which describes both the cognitive and the affective aspects that influence the use of VR in deaf education. The few insights into mediating consequences, including predicting how perceived usefulness and perceived ease of use mediate the association between the individual beliefs (self-efficacy, performance expectancy, enjoyment) and the behavioral intention to use VR.

Additionally, the Incorporation of additional factors into the existing TAM and their use in different contexts of learning and technology has attracted researchers to enhance the predictive power of acceptance of educational technology. Additional factors accommodate the dynamic learning environments and nature of learning to improve the explanation for approval of a specific technology. For example, Wang et al. (2022) addended personal investment and relevance in the TAM model to investigate the intention to use language learning applications in Chinese students. Personal investment and relevance are essential in the Chinese context (Lin & Yu, 2023). As a result, the two features were worth investigating to have a higher prediction of acceptance of language learning applications in the country.

Personal characteristics are significant predictors of usability and acceptance of VR among deaf learners. Most deaf learners feel disabled and excluded from the learning environment because of their inability to become engaged and interact with the content. According to Sagnier et al. (2020), few studies have included user or

student characteristics in investigating acceptance of VR. To the best of the current researcher's knowledge, performance expectancy, self-efficacy in using VR, perceived enjoyment, and TAM have not been combined to determine the usability of VR among deaf learners.

Exploring such gaps, the research will produce a more understandable picture of which variables affect the behavioral intentions of deaf students to use VR in educational contexts. The result should guide teachers, curriculum writers, and technologists on how to plan, deploy and scaffold VR solutions that will be reachable, interesting, and powerful to this underserved learner segment.

1.4 Study Objectives

The study objective is to determine the effects of extended TAM dimensions in VR on the intention to use VR and attitudes towards VR among people who are deaf or hard of hearing. Specific objectives are as follows:

1. To determine the effect of extended TAM dimensions of VR (performance expectancy, self-efficacy, perceived enjoyment) on behavioral intention (BI) to use among deaf students.
2. To determine the effect of extended TAM dimensions of VR (performance expectancy, self-efficacy, perceived enjoyment) on perceived ease of use to use among deaf students.

3. To determine the effect of extended TAM dimensions of VR (performance expectancy, self-efficacy, perceived enjoyment) on perceived usefulness among deaf students.
4. To examine the mediation effect of perceived ease of use on the relationship between extended TAM dimensions of VR (performance expectancy, self-efficacy, perceived enjoyment) on behavioral intention to use among deaf students.
5. To examine the mediation effect of perceived usefulness on the relationship between extended TAM dimensions of VR (performance expectancy, self-efficacy, perceived enjoyment) on behavioral intention to use among deaf students.

1.5 Research Questions

The following questions guided the study in achieving the purpose:

1. What is the effect of extended TAM dimensions of VR (performance expectancy, self-efficacy, perceived enjoyment) on behavioral intention to use among deaf students?
2. What is the effect of extended TAM dimensions of VR (performance expectancy, self-efficacy, perceived enjoyment) on perceived ease of use to use among deaf students?
3. What is the effect of extended TAM dimensions of VR (performance expectancy, self-efficacy, perceived enjoyment) on perceived usefulness among deaf students?

4. What is the mediation effect of perceived ease of use on the relationship between extended TAM dimensions of VR (performance expectancy, self-efficacy, perceived enjoyment) on behavioral intention to use among deaf students?
5. What is the mediation effect of perceived usefulness on the relationship between extended TAM dimensions of VR (performance expectancy, self-efficacy, perceived enjoyment) on behavioral intention to use among deaf students?

1.6 Hypotheses

H1a. There is a statistically significant relationship between performance expectancy and behavioral intention towards VR among deaf students.

H1b. There is a statistically significant relationship between self-efficacy and behavioral intention towards VR among deaf students.

H1c. There is a statistically significant relationship between perceived enjoyment and behavioral intention toward VR among deaf students

H2a. There is a statistically significant relationship between performance expectancy and the perceived ease of use of VR among deaf students.

H2b. There is a statistically significant relationship between self-efficacy and the perceived ease of use of VR among deaf students.

H2c. There is a statistically significant relationship between perceived enjoyment and the perceived ease of use of VR among deaf students.

H3a. There is a statistically significant relationship between performance expectancy and the perceived usefulness of VR among deaf students.

H3b. There is a statistically significant relationship between self-efficacy and the perceived usefulness of VR among deaf students.

H3c. There is a statistically significant relationship between perceived enjoyment and the perceived usefulness of VR among deaf students.

H4. There is a statistically significant relationship between perceived ease of use and behavioral intentions towards VR among deaf students.

H5. There is a statistically significant relationship between perceived usefulness and behavioral intentions towards VR among deaf students.

H6a. Perceived ease of use mediates the relationship between performance expectancy and behavioral intention towards VR among deaf students.

H6b. Perceived ease of use mediates the relationship between self-efficacy and behavioral intention towards VR among deaf students.

H6c. Perceived ease of use mediates the relationship between perceived enjoyment and behavioral intention towards VR among deaf students.

H7a. Perceived usefulness mediates the relationship between performance expectancy and behavioral intention towards VR among deaf students.

H7b. Perceived usefulness mediates the relationship between self-efficacy and behavioral intention towards VR among deaf students.

H7c. Perceived usefulness mediates the relationship between perceived enjoyment and behavioral intention towards VR among deaf students.

1.7 Significance of Study

The proposed study contributed to academic knowledge through research on the acceptance of VR among deaf people. Current literature has avoided the deaf population in assessing the acceptance of VR. As a result, there is a lack of data that can guide other researchers and technology developers to understand the extent and usability power of deaf learners. The proposed study informs the avoided area of deaf learners by adding to the existing TAM model about the acceptance of VR among deaf learners. Focusing on the neglected deaf population also informs us of the most appropriate method, including validating tools to collect data. Research projects involve adapting, adopting, creating, and validating data collection tools. The study validates tools that apply to a survey of the acceptance of VR in deaf students, especially measurement tools for the extended dimensions, including performance expectancy, self-efficacy, and perceived enjoyment.

Moreover, the outcomes are important in informing educators and institutions about accepting one of the most promising teaching and learning technologies to enhance the learning experience and results among deaf learners. Literature shows that the UAE teaching approaches for deaf learners are ineffective in addressing their needs and promoting learning outcomes. The study informs how UAE educators can overcome teaching and learning for deaf learners through VR technology.

Results further validate or disapprove the application of VR to inform institutions and educators who have started and those who have not purposed to use VR

with deaf learners. Relevant government departments and organizations gain information on boosting education equality by applying technology with a certain level of usability. Thus, the data informs education policy, including funding schools to acquire VR technology.

1.8 Scope of the Study

The study is about the usability and acceptance of VR among students with hearing loss. The research covered deaf students pursuing bachelor's degrees in IT at LIWA College, Al Ain University, and Zayed Higher Organization for People of Determination in UAE. Hard of hearing and deaf students vary in their learning needs because of variations in experience with the world. The demands for deaf learners are more profound due to their detailed limitations. As a result, deaf learners could optimize the examination of VR training strategy by assessing the level at which they perceive usability and accept its use in learning. LIWA College provides a convenient location and population due to the support from partners such as the Ministry of Education and Red Crescent Society of the UAE to handle students with hearing impairment. The college has optimal resources, including humans, to ensure the reliability of the collected data following established training strategies for deaf learners. Al Ain University has adopted significant technological resources including an Information Technology center which supports the institution’s effective implementation and maintenance IT services including virtual reality to enhance students’ performance.

Zayed Higher Organization for People of Determination on the other hand has initiated various IT programs and applications for easier engagement for learning.

Additionally, the study focuses on the original TAM dimensions in VR: behavioral intentions, perceived usefulness, and perceived ease of use. The study also extends the dimensions to include those that assess learner characteristics, including performance expectancy, self-efficacy in using VR, and perceived enjoyment. The added TAM dimensions increase the prediction power of the model on the usability of VR among deaf learners.

1.9 Study Limitations

One of the study's limitations is the communication barrier between the researcher and respondents. The population is deaf students who have language and speech problems. The researcher is also not conversant with sign language. A sign language interpreter helps mitigate the language barrier by instructing participants and collecting data. Another limitation is the unwillingness to share information with the population. Deaf students face stigma and isolation and exclude themselves from the general population. The exclusion affects willingness to participate or truthfulness in responding to the surveys due to using an interpreter. Sensitization on the value of the study in improving teaching strategy helps mitigate the limitation. Deaf students look forward to an inclusive teaching approach that supports their needs. Hence, explaining the importance

of the research outcomes to their learning raises their willingness and faithfulness in responding to the surveys.

The choice of LIWA College was delimitation because of the support that the population receives from different partners. Deaf learners from LIWA College are aware of the investment from the Ministry of Education, the university, and other organizations towards their learning. As a result, most of them might resist giving negative responses even where such data is the correct feedback from the VR training strategy. However, LIWA College deaf students are the best choice because they engage in learning technologies and experience learning through a well-developed environment. The choice of Al Ain University was also based on the fact that the institution has adopted significant technological resources including an Information Technology center. Zayed Higher Organization for People of Determination was selected because it has initiated various IT programs and applications for easier engagement for learning. Most understand the study instrument and avoid excitement about using VR technology to provide reliable feedback. The use of university deaf learners is also a delimitation because they have shown determination, commitment toward learning, and self-motivation. The students might provide positive feedback unrelated to the usability of VR due to their dedication to utilizing every opportunity as their success reveals. Fortunately, their commitment and success are an opportunity to objectively assess the acceptance of VR because the learners have proposals for the best training strategy that meets their needs.

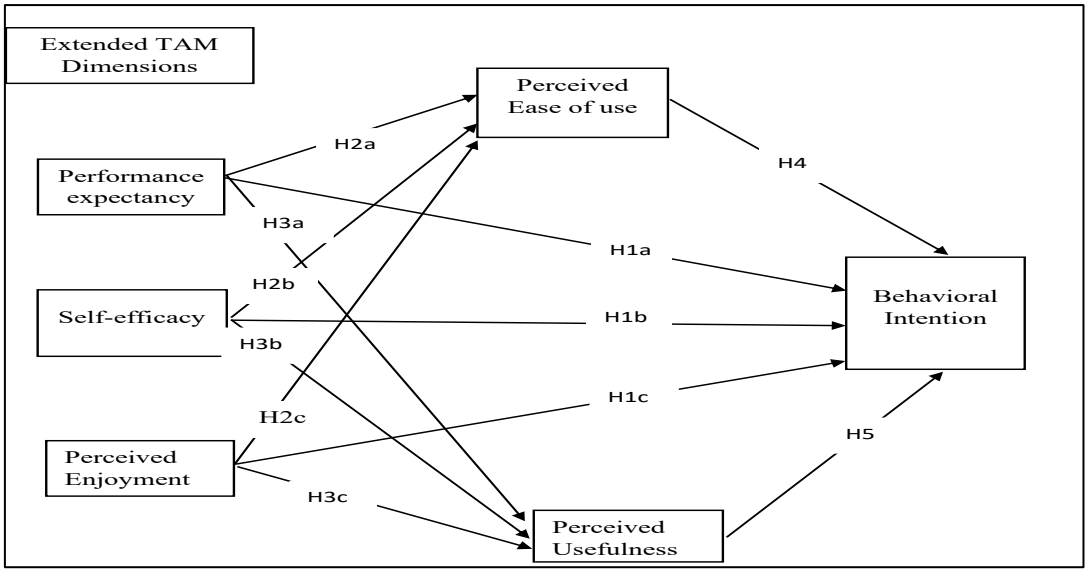
1.10 Conceptual Framework

The TAM information system model explores how users use and accept a certain technology. According to the theory, the last impact of technology on people is utilization. As a result, TAM suggests factors that motivate people to use specific technology, including perceived ease of use, perceived usefulness, and behavioral intention (AL-Oudat & Altamimi, 2022). The theory guided the identification and further exploration of areas to assess the usability of VR among deaf learners.

The conceptual framework in Figure 1.1 shows the relationship between concepts following findings from the literature and theoretical explanations. Independent variables include original TAM dimensions and extended ones. The added TAM dimensions were derived from the literature following careful examination of their application in deaf learners and VR technology for education. Intention to use and attitude towards VR are the dependent variables. Each independent variable acts on the dependent variable separately to have 12 paths of relationship that the study tested.

Figure 1.1

Conceptual Framework



Mediation Path

H6a Performance Expectancy → Perceived Ease of Use → Behavioral Intention

H6b Self-Efficacy → Perceived Ease of Use → Behavioral Intention

H6c Perceived Enjoyment → Perceived Ease of Use → Behavioral Intention

H7a Performance Expectancy → Perceived Usefulness → Behavioral Intention

H7b Self-Efficacy → Perceived Usefulness → Behavioral Intention

H7c Perceived Enjoyment → Perceived Usefulness → Behavioral Intention

1.11 Theoretical Framework

The constructivist learning, embodied cognition, and TAM theories guide the study by connecting to the existing knowledge about the topic and supporting decisions on research methods and data analysis. Constructivism proposes that learners actively participate in the training and learning process by constructing knowledge (Golder, 2018). Students use the information provided to relate to their prior experience before assuming understanding (Golder, 2018). As a result, motivating learners' experience during a lesson is critical for cognition development. The theory applies to the proposed study because it relates to the variables, intention to use, and attitude toward VR. Constructivism was significant in further understanding and explaining the choice of VR within the extended TAM model dimensions.

Moreover, the embodied cognition theory also applies to the study because it explains the process of cognitive development. According to embodied cognition, the entire human body shapes cognition (Negri et al., 2022). The approach adds another aspect of knowledge development from the cognitive psychology perspective of the mind by recognizing the value of the body. According to the theory, the body accesses symbolic information from the environment that the mind would not access (Negri et al., 2022). Embodied cognition aligns with the study variable, the TAM dimensions of VR, because they determine learners' level of engagement and cognition. The theory is vital in analyzing and explaining how TAM dimensions of VR promote its acceptance by exploring their impact on the body.

1.12 Operational Definition of Terms

Virtual Reality

Empirical studies such as Hall et al. (2019) define VR as a spatial technology that allows people to interact with its content, depicting the natural world in an immersive environment. The research operationalized VR as a 3D technology that enables user immersion and interaction with the natural world.

Hearing Impairment

According to Ziadat and Al rahmneh (2020) hearing impairment is loss of hearing to > 25-30 dB. The study interchangeably uses hearing loss and hearing impairment as people who can partially hear through hearing or cannot completely hear. The hard phrase of hearing represents people who can partially hear. Individuals with complete loss of hearing are deaf.

Perceived Usefulness

Perceived usefulness is the subjective chance of a technology user using the system to enhance performance (Abd Majid & Mohd Shamsudin, 2019). This research operationalized perceived usefulness as the belief that using VR technology would be beneficial in enhancing learning and performance.

Perceive Ease of Use

Perceive ease of use is the extent to which a user expects a given technology to be efficient, including using minimal effort (Abd Majid & Mohd Shamsudin, 2019). In this

study, perceived ease of use the perception that using VR technology for learning required little effort to operate, including navigating the content.

Perceived Enjoyment

Perceived enjoyment is the extent to which using a certain technology is imaginary to be enjoyable the way it is, regardless of any consequences from the system used (Hunde et al., 2023). In this study, perceived enjoyment was the perception that using VR technology for learning is interesting and provides extra pleasure beyond its benefits because it keeps a learner engaged.

Self-efficacy

Self-efficacy is a personal judgment on the capability to do a certain task or use a specific tool (Humida et al., 2022). This study operationalizes self-efficacy as confidence that learners can use VR technology in education, including operating it to navigate the content with their current abilities and knowledge.

Performance Expectancy

Performance expectancy is the degree of easiness and convenience of accessing, adopting, and utilizing technology (Luo et al., 2022). In this study, performance expectancy is the belief that using VR improves the learning processes by closing the gaps in accessing content and engagement in learning, leading to expected academic performance.

Intention to use

Intention to use technology is the measure of the probability of a person using the system (Abd Majid & Mohd Shamsudin, 2019). In this study, the intention and conscious plan to use VR in learning.

1.13 Chapter Summary

This chapter has defined the research topic, problem, scope, limitations, and justification for its need. The proposed purpose is to investigate the impact of extended TAM dimensions in VR on the intention to use and attitude towards VR among deaf learners. In the beginning, the chapter shows that the world, mainly the UAE, supports equality in education as a human right. Thus, deaf learners benefit from the legislation implementing the right to education. Technology, including VR, has also grown to enhance training strategies that effectively meet learning needs. The section has also shown that there is a problem of an increasing number of deaf people who require special education. Countries, including the UAE, face a challenge to continue meeting the right to education for the population. Current training strategies do not maximize learning outcomes and experience for deaf learners. Researchers have demonstrated that VR training strategies can benefit teaching and learning to improve outcomes but failed to investigate the same among deaf learners. Results from the study inform theory on the relationship between VR training strategy and learning outcome and experience among deaf learners and the mediation effect of flow experience. The UAE

government, educators, and educational institutions also benefit through information on how to boost learning outcomes and experiences for deaf students.

The remaining part of this proposal includes a literature review and suggested methodology. The review covers empirical and theoretical studies and a conceptual framework showing the proposed relationship between variables. Hypotheses development is also part of the review following previous outcomes studying the concepts.