Geojournal of Tourism and Geosites
ISSN 2065-0817, E-ISSN 2065-1198

Year XIX, vol. 65, no. 2, 2026, p.963-976
DOI 10.30892/gtg.65231-1736

FROM IMAGINATION TO REALITY: STUDENTS' PERCEPTION TOWARDS ACCEPTING AND USING VIRTUAL REALITY IN HOSPITALITY HIGHER EDUCATION

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Citation: Mansour, N., & Hasanein, A. (2026). From imagination to reality: Students' perception towards accepting and using virtual reality in hospitality higher education. *Geojournal of Tourism and Geosites*, 65(2), 963–976. https://doi.org/10.30892/gtg.65231-1736

Abstract: The integration of Virtual Reality (VR) into higher education offers transformative potential, particularly in hospitality and tourism, by bridging the gap between theoretical knowledge and practical industry experience. Grounded in the Unified Theory of Acceptance and Use of Technology (UTAUT), this study investigates Egyptian hospitality and tourism students' perceptions, behavioral intentions, and actual use of VR in educational contexts. A structured online survey was administered to 609 students across nine public universities, employing validated scales for performance expectancy, effort expectancy, social influence, facilitating conditions, behavioral intention, and actual VR usage. Data were analyzed using Partial Least Squares Structural Equation Modeling (PLS-SEM), enabling robust assessment of measurement and structural models. Findings indicate that performance expectancy significantly influences behavioral intention but does not directly predict VR usage, highlighting intention's mediating role in the adoption process. In contrast, effort expectancy, social influence, and facilitating conditions exert both direct and indirect effects on actual use, emphasizing the critical role of usability, peer endorsement, and institutional support. These results extend the UTAUT framework into immersive technology contexts, revealing behavioral intention as a psychosocial commitment mechanism for VR adoption. From a practical perspective, the study underscores the importance of designing user-friendly VR platforms, providing faculty training, and investing in institutional infrastructure to foster meaningful engagement. The findings suggest that effective VR integration requires alignment between technological access, pedagogical objectives, and social acceptance within educational environments. This research offers actionable insights for higher education policymakers, faculty, and curriculum designers seeking to enhance immersive learning, digital literacy, and practical skills among hospitality and tourism students. By highlighting both cognitive and social determinants of VR adoption, the study informs strategies for sustainable, skill-oriented, and experiential learning interventions in higher education.

Keywords: virtual reality, technology acceptance, hospitality education, higher education, educational technology, Egypt

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INTRODUCTION

As the technological ease of implementing the virtual reality (VR) technologies to the industries, and, specifically, to higher education, various research studies were carried out concerning the matter of VR platforms adopted by students in their academic work (Kamińska et al., 2019; Marks & Thomas, 2022; Shen et al., 2022). As a disruptive immersive technology, the virtual reality is potentially at the heart of helping students in their educational experiences such as simulating the tourism destinations and hospitality operations with the help of advanced visualization technologies (Buhalis et al., 2023; Mandalia, 2023). Among the innovative projects of the Ministry of Higher Education in Egypt to incorporate the emerging technologies during the academic year 2025-2026, the students have obtained a chance to use VR learning solutions in their educational processes (Saleh, 2025). Such technological implementation takes advantage of the immersive VR environments to close the divide between theory learning and industry-specific knowledge and allow students access to experiential learning in the destination management, cultural heritage exploration, and tourism operations development (Beck et al., 2023; Marougkas et al., 2023). Additionally, the immersion aspect of virtual reality has the potential to transform the way which curriculum is delivered, spatial awareness of the tourist attraction sites in Egypt, and digital transformation in the learning institutions (Hassan et al., 2025). Such initiative is effective, however, regarding the collective strategies, including the faculty training on VR technologies, modernization of the infrastructure with VR tools, and consistency between immersive learning capabilities and tourism curricula (Pramanik, 2024).

The use of virtual reality has proven to have such positive characteristics in higher education as immediate and immersive experience of the Egyptian tourism sites, enhanced spatial awareness and cultural understanding of the student, as well as enhanced practical skills of the student in tourism administration (Kamel & Elshiwy, 2022; Mohamed & Naby, 2017). According to another study conducted by Hou et al. (2023), virtual reality could be an experiential tool of students in their daily coursework activities, simulation of field studies and development of tourism projects.

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Although this trend is growing in the use of VR in educational processes, there are also rising worries among scholars, experts, and higher education leaders about the issues of VR application in educational processes with a particular interest in learning and teaching effectiveness (Samala et al., 2025; González-Zamar & Abad-Segura, 2020). These issues include possible technical constraints of VR systems, access problems, costs of equipment, and specialized training requirements, which can raise practical issues of the long-term sustainability of this immersive technology (Drożdż, 2021; Mondal & Mondal, 2025). In addition, excessive use of virtual experiences in education can have adverse impacts on practical capabilities of students, as well as direct interaction with real-life tourism setting (Balalle, 2025; Hofman et al., 2022).

Many attempts have been made to understand how emerging technologies are applied various sectors (Seraj et al., 2025a; Hasanein & Montaser, 2025) especially in higher education e.g., AR, VR, mixed reality (Ahmed et al., 2025; Hendric & Rosmansyah, 2025), but researchers have not elaborated on many attempts to determine how higher education students perceive the presence and usage of virtual reality in the educational context of Egyptian tourism (Marks & Thomas, 2022). One of the recent studies carried out by Ahmed et al. (2025) has examined the VR platform in the context of other immersive technologies to allow engaging students with the material concerning the Egyptian tourism, thereby leading to motivation and value of culture in students. To gauge the attitude of students towards the acceptability of VR platforms and their use, a study by Hendric & Rosmansyah (2025) recognized a gap in literature as to the acceptance and usage of immersive technologies in higher education. Bayaga & Du Plessis, (2024) used the UTAUT to quantify the variables that contribute towards the acceptance and use of emerging technologies in higher education among students. This approach is congruent with the focus of this study.

Using the framework of UTAUT, the paper examines students perceptions on the adoption and use of virtual reality as a revolutionary immersive technology in learning in the Egyptian higher education of hospitality and tourism. The knowledge of what drives the acceptance and utilization of virtual reality among students can help educational institutions and researchers learn more about drivers so that educational leaders can know how to best apply VR technologies in their learning process. Finally, this research was to benefit educational leaders in developing powerful principles that capitalize on potential application of virtual reality to enhance learning experiences of hospitality and tourism students of Egyptian culture and tourism sites, which will contribute to educational success through the educational experience that is immersive.

LITERATURE REVIEW AND HYPOTHESES DEVELOPMENT

1. Students' Acceptance of Using Virtual Reality and Actual Use

Performance expectancy is the scale to which individuals think that their professional or personal performance is going to be improved with the use of virtual reality (VR) technology (Désiron et al., 2023; Puiu & Udriștioiu, 2024; Hasanein, 2025). This ideology is a base motivator in the buying process because individuals just tend to gravitate toward the tools that offer tangible benefits (Gries et al., 2022). According to recent studies, there is a close positive correlation between performance expectancy and intentions to use VR, especially in the fields of education and clinic (Tessfay et al., 2025). Under the example that clinical nurse educators view VR as an option to improve the training process and the results, the desire to implement it skyrockets (Johansen et al., 2025; Obeid et al., 2025). This trend does not just stop with teachers but research indicates that performance expectancy is a major predictor of VR adoption and successful utilization by students, faculty, and even administrators (Bower et al., 2020; Köroğlu, 2025). Simply stated, the narrative starts with the promise of better outcomes, preparing the way to expansion.

On its basis, the next chapter of the adoption story is effort expectancy, which addresses the perceived simple use of VR systems (Tan, 2024). In contrast to the conventional tools, the immersive feature of VR may also present some complexities, and usability becomes a serious obstacle (de Freitas et al., 2022). Once users, e.g., students or educators, perceive VR as simple and easy-to-use, their intentions to utilize it become more solid (Papakostas et al., 2023). The trick is to create VR interfaces with the lowest levels of technical barriers: those that are easy to use, do not need many skills, and can be considered approachable at the very beginning (Creed et al., 2024; Sanchit et al., 2025). The lack of this ease can lead to the downfall of the most promising performance gains, and effort expectancy fills the gap between the potential and the practical use.

With the unfolding adoption story, social influence also introduces a layer of relation making decisions based on the opinion of other people (Turner et al., 2022). This factor is based on the idea of social learning, indicating how the perceptions of peers, supervisors, colleagues, or even family members can influence people into VR (Zeb et al., 2023). The motivation of the users to acquire VR technologies can grow exponentially based on the positive endorsements provided by these influences (Jhawar et al., 2023). Leadership support and recommendation of peers frequently prove to be more decisive in the context of an organisation, whereas in education, positive instructors and friendly circles of peers help spread acceptance further (Zhang, 2025). Therefore, adoption is not only a personal decision, but it is a community story with the voice of the community (Yavo-Ayalon et al., 2023).

Facilitating conditions are the critical infrastructure that helps achieve a successful completion of the entire tale, which includes the organizational and technical assistance to integrate VR successfully (Kure et al., 2022; Omrany et al., 2023). All these factors, including the availability of hardware and technical support, training options, funding, and compatibility with the system, eliminate the barriers to practice and instil confidence in users (Agbeyangi & Suleman, 2024). Once these conditions are strong, they increase the willingness of users to use VR and form a powerful atmosphere in which innovation will flourish (Hastuti et al., 2022; Yemenici, 2022). All this creates a unified story: with the promise of performance, through the convenience of effort, and the force of social bonds, to the concrete support of resources, and finally leading to the mass adoption of VR in areas such as nursing education. Based on this discussion, we hypothesize the following:

H1. Performance Expectancy has a positive significant effect on VR Actual Use

H2. Effort Expecting has a positive significant effect on VR Actual Use
H3. Social Influence has a positive significant effect on VR Actual Use
H4. Facilitating Conditions has a positive significant effect on VR Actual Use

2. Students' Acceptance of Using Virtual Reality and Behavioral Intention

The adoption of virtual reality (VR) technologies is heavily influenced by the correlation between behavioral intention and four main Unified Theory of Acceptance and Use of Technology core factors, namely, performance expectancy, effort expectancy, social influence and facilitating conditions (Rejali et al., 2023; Nurlaela & Tuti, 2022). The first and the strongest one is performance expectancy- the idea that VR will improve task performance. The desire of users to receive tangible benefits, e.g., increased learning, better skills acquisition, increased efficiency, or enhanced task performance markedly increases their willingness to use VR (Di Palma et al., 2025). Research findings are consistent indicating that performance expectancy is a robust predictor of intention among students, faculty, and administrative employees (Abd Aziz et al., 2023). In a way, such anticipated benefits are calculated mentally and are what feeds the desire to implement VR in work or study (Shirtcliff et al., 2024).

To this is complemented by effort expectancy, a parameter that indicates the ease with which the users feel VR will be to work with. The balance between effort and benefit is a large aspect of what determines adoption (Fares et al., 2024; Sujood et al., 2024). The motives to wear VR gain much power when these systems are user-friendly and easy to learn (Chuang et al., 2023). On the other hand, an extremely steep learning curve/ complicated interface may kill the passion (Desai et al., 2023). This relation is especially high among users who have no or have minimal technical skills or strict time constraints, and whose simplicity is paramount (Tsalmpouris et al., 2021).

Social influence is also a very important role. People tend to adopt VR when they believe that their powerful friends, supervisors or communities of practice are anticipating or even encouraging the use of VR (Arellano et al., 2021; Cronshaw et al., 2022; Resa Nurlaela & Tuti, 2022). This influence works through several established social-psychological mechanisms; conformity to perceived norms, identification with reference groups, and internalization of group norms (The empirical data demonstrate that positive social cues (colleagues, mentors, friends, etc.) may both dramatically increase behavioural intention to use virtual platforms (Al-Sharafi et al., 2023; Khaskheli et al., 2024).

The perceived barriers are minimized by facilitating conditions the organizational and technical infrastructure which enables VR, which makes the organizational environment conducive to adoption (Lee et al., 2025). Dependable hardware, technical support, training, and operating systems all give the users a sense of confidence that they can effectively use VR (Checa et al., 2023). With such supports present, facilitating conditions turn out to be one of the most effective predictors of behavioural intention (An et al., 2023). Based on this discussion, we hypothesize the following:

H5. Performance Expectancy has a positive significant effect on Behavioural Intention
H6. Effort Expectancy has a positive significant effect on Behavioural Intention
H7. Social Influence has a positive significant effect on Behavioural Intention
H8. Facilitating Conditions has a positive significant effect on Behavioural Intention

3. Student`s Behavioural Intention and Actual Use of Virtual Reality

The intentions to use immersive VR are directly associated with the behavior of actual usage (Huang et al., 2021; Liu & Sutunyarak, 2024; Xie et al., 2022; Hasanein & Sobaih, 2023). The intentions of the users to adopt the VR technologies are quite influential predictors of their future interest in these systems (Ashraf Ahmed et al., 2025; Cummings et al., 2023; Lee et al., 2019). High behavioral intentions, caused by the positive attitude to performance benefits, ease of use, social support, and enabling conditions, are transformed into the increased rates of actual VR adoption and continuation patterns (Abbad, 2021; Sujood et al., 2024; Vafaei-Zadeh et al., 2025). Thus, we hypothesize that:

H9. Behavioural Intention has a positive significant effect on VR Actual Use

4. The Role of BI in the Connection between Students' Acceptance and Use Virtual Reality

Behavioural intention acts as a pivotal bridge between people's perceptions of virtual reality (VR) and their actual adoption of the technology (Huang, 2023; Rashidin, 2025). Within the Unified Theory of Acceptance and Use of Technology (UTAUT), it serves as the critical mediator that converts perceived benefits and supports into real decisions to use VR (Farhi, 2024; Huang, 2023). The clearest example of this mediation is the link between performance expectancy and VR adoption. In cases where students, faculty, or administrative staff are convinced that VR will improve their performance, the perception initially reinforces their desire to use the technology and subsequently anticipates the use (Alexander & Moore, 2025; Girmanová et al., 2022). Simply recognizing potential performance gains—such as more effective learning or higher task efficiency—is not enough; those beliefs must be translated into a firm behavioural intention before adoption occurs (Wijaya et al., 2025; Ashrafi & Easmin, 2023; Hasanein et al., 2024; Sung et al., 2022).

The same tendency can also be observed with effort expectancy, the impression of the ease of learning and use of VR. The intention to adopt VR systems is more likely to be formed by the users who see VR systems as simple and intuitive, and it is the intention that leads to the eventual adoption (Fares et al., 2024; Koh et al., 2023). The mediation effect places emphasis on the fact that perceived ease of use is not the ultimate cause of adoption; instead, it influences motivational intentions which indirectly results to action (Chen et al., 2025; Putro & Takahashi, 2024; Qu & Wu, 2024).

Social influence also works through behavioural intention. The internal drive to use VR involves social support, peer acceptance, and normative expectation (instead of external compliance) (Al-Emran et al., 2025; Joa & Magsamen-Conrad, 2022). When individuals sense that important people in their social or professional circles favour VR, they develop stronger intentions to use it, which subsequently predicts actual behaviour (Bhatia & Dassani, 2025; Su et al., 2023).

The adoption is indirectly influenced by facilitating conditions the presence of organizational support, technical infrastructure and training (Al Hadwer et al., 2021; Hasanein & Ayad, 2024). This is because the illusion of the existence of these resources creates trust and growing interest in utilizing VR among the users that predicts the actual utilization (Ball et al., 2021; Sobaih et al., 2024). The presence of robust support systems thus encourages adoption by building intention, even if it does not directly dictate usage behaviour (Gajić et al., 2024). In sum, behavioural intention consistently mediates the relationship between key acceptance factors and VR adoption (Huang, 2023; Lv et al., 2025). Performance gains, ease of use, social endorsement, and enabling environments all matter, but they lead to adoption only when they first translate into a concrete personal intention to embrace the technology (Fakhr Hosseini et al., 2024). Therefore, the following hypotheses are:

H10. Behavioural Intention mediates the relationship between Performance Expectancy and VR actual use

H11. Behavioural Intention mediates the relationship between Effort Expectancy and VR actual use

H12. Behavioural Intention mediates the relationship between Social Influence and VR actual use

H13. Behavioural Intention mediates the relationship between Facilitating Conditions and VR actual use

By adopting the UTAUT framework, this study seeks to close this gap by applying the following theories (Figure 1 presents the research conceptual model).

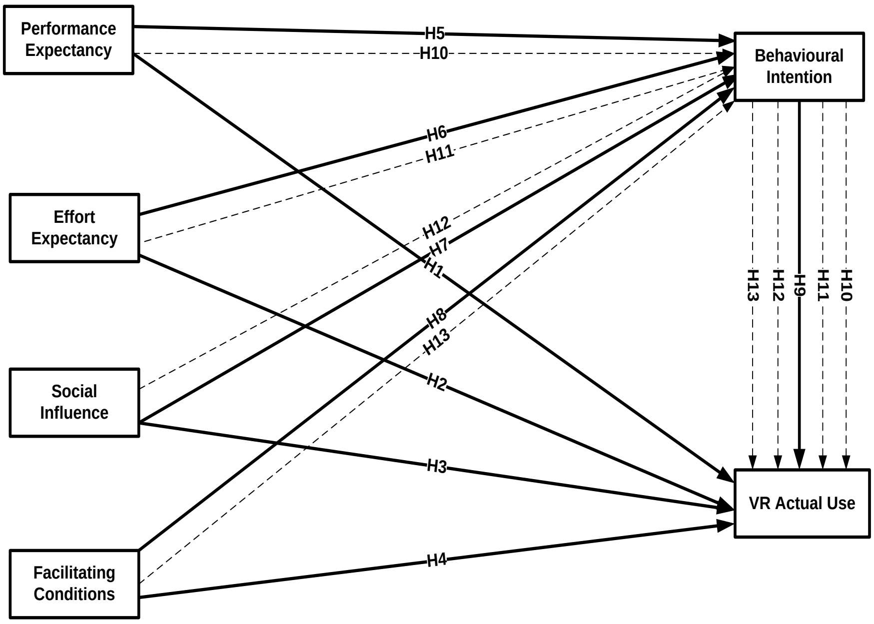

Figure 1. Research Conceptual Model

RESEARCH METHODOLOGY

The methodology of the study was conducted according to the following Figure 2.

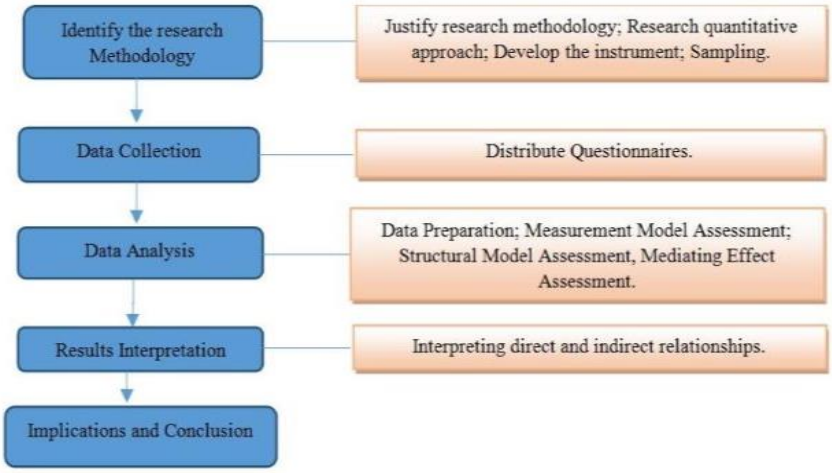

Figure 2. Research Methodology Flowchart

1. Measures

This research used a structured questionnaire that had three different parts of the questionnaire with all the questions being based on the previously tested scales which were then revised by experts hence achieving content validity. The introduction section presented the respondents with a brief description of the study purpose, and explicit instructions were also given so that the survey can be completed correctly. The second part provided demographic data, such as gender, age, education level, and technological literacy of the participants. The third section covered the key constructs of the study, which were assessed by a seven-point Likert scale, where (1) meant strongly disagree and (7) strongly agree. The perceptions of students towards the acceptance and use of Virtual Reality (VR) in hospitality higher education grounded upon UTAUT theory based on the four constructs of performance expectancy (four items), effort expectancy (four items), social influence (three items), and facilitating conditions (four items), which developed from Venkatesh (2022). The behavioural intention to use VR was assessed by a three-item scale according to Ajzen & Fishbein (1972), and actual VR use was operationalized according to the scales suggested by Venkatesh et al. (2012). This strategy enabled a multifaceted evaluation of student attitudes, intentions, and behaviour concerning the adoption of VR in the framework of hospitality education.

2. Sample and Data Collection

The present study employed an online survey to examine hospitality and tourism students' acceptance and use of Virtual Reality (VR) in higher education, grounded in the UTAUT framework. The questionnaire was developed in both English and Arabic to accommodate linguistic diversity among participants from nine public universities in Egypt. To ensure accuracy and cultural appropriateness, bilingual experts reviewed the translations, verified semantic equivalence, and introduced minor modifications to enhance clarity and contextual relevance. A pilot study was conducted with fifteen students and educational experts from governmental hospitality colleges to assess the instrument's comprehensibility, relevance, and suitability for measuring VR adoption. Feedback was collected through structured interviews and written comments, leading to refinements in wording, simplification of technical terms, and contextual adaptation of items. The pilot testing followed established methodological guidelines (Presser et al., 2004; Dillman et al., 2014), thereby ensuring both content validity and contextual appropriateness for the study population.

A purposive sampling method was used to reach out to hospitality and tourism students of nine public universities in Egypt. Although purposive sampling limits the generalizability of findings, it is widely recognized in educational and hospitality research as an effective strategy when targeting specific populations, such as students enrolled in hospitality and tourism programs (Etikan et al., 2016; Taherdoost, 2016). To enhance the sample reach and reduce potential bias, recruitment efforts were extended through referrals within university departments and student organizations. Initial participants were invited to share the survey with peers who met the study's eligibility criteria. While this approach helped increase sample size and diversity, it may have introduced some selection bias, as students within the same programs or networks often share similar academic experiences and technological exposure (Goodman, 1961; Heckathorn, 2011).

The survey was distributed through a secure online platform between the May-September 2025, the duration of the collection period was four months. Out of the 700 questionnaires, 609 were filled and returned making the response rate of 87%, as there was no missing data. Based on the criterion of Nunnally & Bernstein (1994) to have a 1:10 ratio between item and sample, the 609 valid responses offered a sufficient sample to conduct the study. Out of the 61.4% of the respondents, 374 students were male, and 235 students were female. Most of the participants, constituting 56.6% of the sample, were in the age group of 20-25 years. Among this group of age, 57.2% were junior and senior students, which is the main group of interest when analyzing the attitudes toward the development and usage of virtual reality in the hospitality higher education. To address potential concerns associated with self-reported cross-sectional data, such as social desirability bias and common method variance (Podsakoff et al., 2003) participants were assured of complete anonymity and confidentiality. The survey's introductory section clearly outlined the study's objectives, emphasized the voluntary nature of participation, and informed respondents of their right to withdraw at any point without consequence. No personally identifiable information was collected, and all data were securely stored in encrypted files accessible solely to the research team, thereby protecting participants' privacy and promoting the authenticity of responses.

3. Data Analysis and Evaluation

The research data were analyzed with SmartPLS version 4.01 by using Partial Least Squares Structural Equation Modeling (PLS-SEM). That method was deemed suitable, because of its predictive focus and strength in dealing with complex models with several latent constructs and pathways, which are interdependent (Hair et al., 2017). The proposed framework, which included the perception of VR acceptance by the students, their intention to use it, and the actual usage, involved several relationships, which are interrelated, and this ability is attributable to the use of PLS-SEM to estimate a complex model (Henseler et al., 2009). Moreover, the effective sample of 609 students was larger than the suggested minimum ones in PLS-SEM, even in a model with a more extensive path structure (Hair, 2017). The initial data screening showed moderate skewness and kurtosis scores that indicated non-adherence to multivariate normal distribution, which further supported the choice of PLS-SEM as the method that does not presuppose multivariate normal distribution (Do Valle & Assaker, 2016; Seraj et al., 2025b). As the research was primarily predictive, to test the role of behavioral intention in mediating the relationship between VR acceptance and actual use, PLS-SEM provided a more methodologically sound alternative to covariance-based research methods (Hair et al., 2017; Henseler et al., 2009).

To reduce the possibility of the common method bias (CMB), procedural remedies as well as statistical remedies were applied in accordance with the recommendations of Podsakoff et al. (2003). Procedurally, the respondents were guaranteed anonymity and confidentiality to reduce evaluation apprehension; the wording of items was meticulously revised to remove ambiguity and leading phrasing; and time intervals were introduced, where predictor and criterion variables were measured over different intervals to reduce consistency artifacts. The single factor test performed by Harman statistically showed that none of the factors explained most of the variance meaning that CMB was not a widespread issue. Moreover, full collinearity test suggested by Kock (2015) was performed, and all the Variance Inflation Factor (VIF) level of the latent constructs was not above the conservative level of 3.3.

RESULTS

1. Measurement model

To assess the possibility of common method variance (CMV), an Exploratory Factor Analysis (EFA) was performed on the 21 measurement items. These findings showed that the initial unrotated factor explained 25.3% of total variance, which is lower than the conservative 50% indicating that CMV is not a significant issue in this research (Podsakoff et al., 2003). Multicollinearity diagnostics also supported the strength of the model, with all the values of the variance inflation factor (VIF) lower than 5.0, which implies that no collinearity among multivariate in the model was found (Hair et al., 2017; Hasanein & Ayad, 2025). Average Variance Extracted (AVE), Composite Reliability (CR) and Cronbach's alpha were the psychometric properties used to measure the measurement model. Criterions were all above the suggested thresholds (AVE ≥ 0.50, CR ≥ 0.70, $\lambda \geq 0.70$) indicating good convergent validity and internal consistency. Particularly, AVE values ranged between 0.747 (Performance Expectancy) and 0.933 (Behavioral Intention), CRs were above 0.901 and the values of Cronbach alpha were above 0.832, and all standardized factor loadings were above 0.70, thus affirming high indicator reliability. Nothing was eliminated through an analysis, and this adds strength to the integrity of the measurement model.

Descriptive statistics indicate that students' responses across all latent constructs are consistently high, with mean scores ranging from 5.82 (VR Actual Usage) to 6.14 (Social Influence) and standard deviations between 0.80 and 0.95, reflecting moderate dispersion and acceptable variability (Table 1).

The high factor loadings (0.739–0.973), strong internal consistency (Cronbach's α = 0.832–0.964), composite reliability (CR = 0.839–0.972), and average variance extracted (AVE = 0.748–0.933) provide robust empirical support for the reliability, convergent validity, and overall psychometric quality of the measurement scales. Collectively, these findings confirm that the instruments employed are well-suited to capture Egyptian hospitality students' perceptions, behavioral intentions, and actual use of VR in higher education settings (Hair et al., 2017; Henseler et al., 2009; Hasanein et al., 2025).

Table 1. Measurements and Variables Parametric Attributes

Scale Variables	α	VIF	M	SD
Performance Expectancy: [α=0.886, CR=0.951, AVE=0.747]				
PE-1: Using VR enhances my learning performance in hospitality courses.	0.955	1.292	6.050	0.880
PE-2: VR helps me complete academic tasks more efficiently.	0.806	1.965	5.980	0.920
PE-3: VR increases my productivity in my studies.	0.739	1.711	5.870	0.950
PE-4: Overall, I find VR useful for my learning in hospitality higher education.	0.940	1.293	6.100	0.840
Effort Expectancy: [α=0.908, CR=0.916, AVE=0.782]				
EE-1: Learning how to use VR systems is easy for me.	0.886	2.635	5.890	0.870
EE-2: My interaction with VR systems is clear and understandable.	0.896	2.823	5.940	0.900
EE-3: I find VR systems easy to use.	0.887	2.065	5.920	0.880
EE-4: It is easy for me to become skillful at using VR in my courses.	0.868	2.892	5.910	0.890
Social Influence: [α=0.925, CR=0.972, AVE=0.867]				
SI-1: My classmates who influence my behaviour think I should use VR in my learning.	0.928	2.868	6.020	0.820
SI-2: The opinions of instructors and peers are important in encouraging me to use VR.	0.909	2.577	5.980	0.850
SI-3: In my hospitality courses, students who use VR are respected and valued.	0.955	2.250	6.140	0.800
Facilitating Conditions: [α=0.891, CR=0.901, AVE=0.756]				
FC-1: My university provides the resources necessary to use VR effectively.	0.809	1.867	5.880	0.860
FC-2: I have the knowledge required to use VR systems.	0.815	1.972	5.910	0.880
FC-3: The VR systems in my courses are compatible with other technologies I use.	0.932	2.539	6.000	0.840
FC-4: Technical support is available when I need help with VR.	0.915	1.882	5.960	0.870
Behavioural Intention: [α=0.964, CR=0.965, AVE=0.933]				
BI-1: I intend to use VR regularly in my hospitality courses.	0.973	2.237	6.120	0.780
BI-2: I will try to use VR in my daily academic activities.	0.968	2.571	6.080	0.810
BI-3: I plan to continue using VR in my studies in the future.	0.958	2.623	6.100	0.800
VR Actual Usage: (α=0.832, CR=0.839, AVE=0.748)				
VRAU-1: I frequently use VR systems in my hospitality studies.	0.874	1.997	5.820	0.890
VRAU-2: I use VR whenever it is appropriate for learning activities.	0.877	2.105	5.850	0.910
VRAU-3: I rely on VR to support my daily academic tasks.	0.844	1.747	5.840	0.900

As shown in Table 2, all constructs included in the proposed model possess strong discriminant validity. Constructs are empirically distinct because each construct is more strongly correlated with its indicators than with those of other constructs. The square roots of the AVE (as indicated on the diagonal in bold) are also always greater than the inter-construct correlations, which fulfills the Fornell & Larcker (1981) requirement.

Furthermore, the Heterotrait-Monotrait (HTMT) ratio all have values (in brackets) that are less than the conservative value of 0.90, which again confirms the existence of discriminant validity of the constructs. Taken together, these results offer a solid basis to the validity of the measurement model and can support the soundness of the further structural model analyses (Chin, 1998; Hair et al., 2017; Al-Romeedy et al., 2025).

Table 2. Fornell and Larcker and HTMT Values (*Bold ratios show the square root of AVE; *In brackets value shows the HTMT)

	Behavioural Intention	Effort Expectancy	Facilitating Conditions	Performance Expectancy	Social Influence	VR Actual Use
Behavioural Intention	**0.966**					
Effort Expectancy	0.287 [0.307]	**0.884**				
Facilitating Conditions	0.136 [0.146]	0.563 [0.420]	**0.869**			
Performance Expectancy	0.357 [0.362]	0.271 [0.292]	0.178 [0.203]	**0.864**		
Social Influence	0.116 [0.124]	0.023 [0.062]	0.122 [0.138]	0.386 [0.450]	**0.931**	
VR Actual Use	0.360 [0.403]	0.690 [0.384]	0.575 [0.466]	0.348 [0.399]	0.222 [0.241]	**0.865**

2. Test of research hypotheses

The findings of the hypothesis testing, characterized in Table (3) and Figure (3), indicate that several important relationships, as hypothesized in conceptual model, were found. The initial hypothesis tested the direct impact of the performance expectancy (PE) on VR actual usage (VRAU). The findings revealed that the effect was nonsignificant (β=0.027;T=0.307;p=0.759). This result indicates that the perceptions of VR usefulness among students do not always directly correlate with the actual usage of this educational method in hospitality higher education.

This insignificant result might be an effect of the context (e.g., low exposure to immersive virtual reality technologies before, varying degrees of digital literacy, or adherence to traditional learning methods). Thus, even though students can be aware of the possible advantages of VR, these impressions should be transformed into behavioral intentions to initiate the effect on real involvement with the technology. However, the second hypothesis proved that the effort expectancy (EE) is also a reliable predictor of VRAU (β=0.378;T=4.131;p=0.001) that students are more willing to use VR when they find it easy to use. This is in line with the previous studies regarding the use of technology acceptance that note that usability is a decisive factor in the actual adoption. Likewise, hypothesis three proved that a positive impact of social influence (SI) exists on VRAU (β=0.216;T=2.806;p=0.005), which supports a motivating effect of peers and instructors on the involvement of VR by the students. Hypothesis four (H4) was also supported and facilitating conditions (FC) had a positive impact on VRAU (β=0.388;T=3.895;p<0.001), indicating that institutional support, access to resources, and technological infrastructures are critical to the integration of VR in hospitality curricula.

Table 3. Results of Hypotheses Testing (Note: p<0.05=*, p<0.01=**, p<0.001=***)

	β	T Statistics	P values
H1- PE → VRAU	.027	0.307	.759
H2- EE → VRAU	.378	4.131	.000***
H3- SI → VRAU	.216	2.806	.005**
H4- FC → VRAU	.388	3.895	.000***
H5- PE → BI	.408	3.478	.001***
H6- EE → BI	.414	3.466	.001***
H7- SI → BI	.233	2.020	.043*
H8- FC → BI	.413	3.887	.000***
H9- BI → VRAU	.339	3.282	.001***
H10- PE → BI → VRAU	.138	2.228	.026*
H11- EE → BI → VRAU	.140	2.574	.010**
H12- SI → BI → VRAU	.079	2.516	.010**
H13- FC → BI → VRAU	.140	2.408	.016*

Concerning behavioural intention (BI), hypothesis five disclosed that PE is a significant predictor of BI (β =0.408;T=3.478;p=0.001); indicating that, although perceived usefulness does not directly induce VR use, it does affect the intention to derive the technology in students. Hypotheses six, seven and eight were also confirmed, demonstrating that EE (β=0.414;T=3.466; p=0.001), SI (β=0.233;T=2.020;p=0.043) and FC (β=0.413;T=3.887; p<0.001) all played significant roles in reinforcing the intention of students to use VR. These findings show that usability, social encouragement, and organizational facilitation are all constructive determinants of behavioural intentions among students that are important antecedents to actual VR adoption. The ninth Hypothesis confirmed that BI significantly predicts VRAU (β=0.339;T=3.282;p=0.001), confirming its mediating role in translating perceptions and contextual support into actual VR engagement. The indirect effects examined in hypotheses H10 to H13 further highlight the mediating function of BI.

Specifically, BI fully mediates the relationship between PE and VRAU, as the direct effect of PE on VRAU was nonsignificant, while the indirect effect through BI was significant (β=0.138; T=2.228; 0.026). This indicates that students' perceived usefulness influences VR usage entirely through their intention to engage with the technology. In contrast, BI partially mediates the relationships between EE, SI, FC and VRAU. For EE, the direct effect on VRAU remains significant (β=0.378;T=4.131;p<0.001) alongside the indirect effect through BI (β=0.140;T=2.574;p=0.010). Similarly, SI exhibits a direct effect (β=0.216;T=2.806;p=0.005) and an indirect effect via BI (β=0.079;T=2.516;p=0.010), while FC maintains both direct (β=0.388;T=3.895;p< 0.001) and indirect effects (β=0.140;T=2.408;p=0.016). These findings suggest that usability, social encouragement, and institutional facilitation influence VR adoption through both intention-driven and direct pathways, reflecting the combined effects of cognitive evaluation, peer influence, and environmental support.

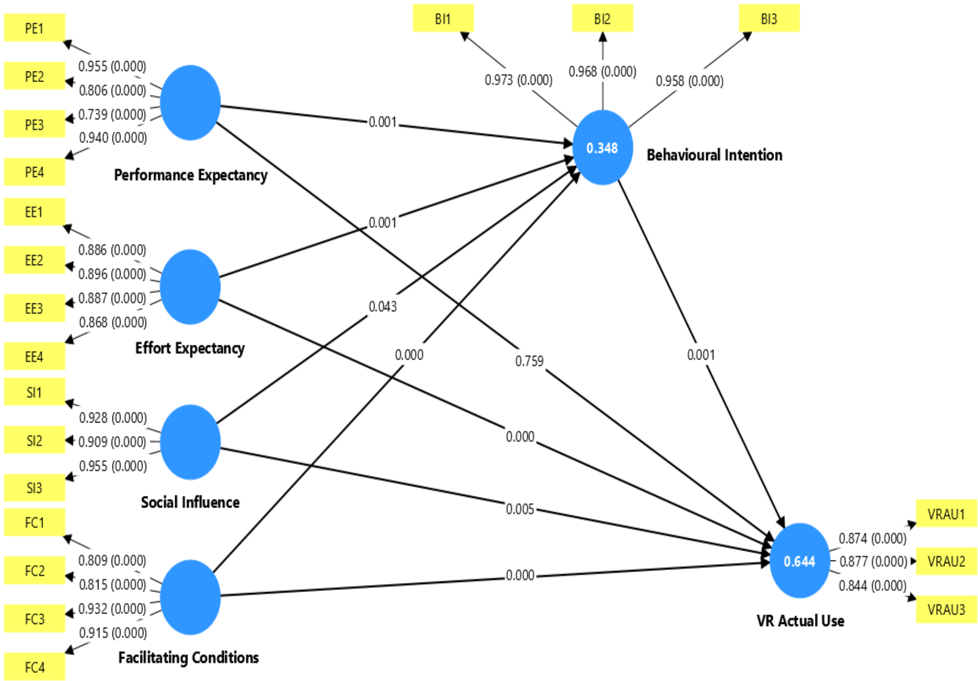

Figure 3. Research Final Model

DISCUSSION

The results of the research provide compelling insights into the multifaceted dynamics shaping virtual reality (VR) acceptance and usage among hospitality and tourism students within Egyptian higher education, interpreted through the Unified Theory of Acceptance and Use of Technology (UTAUT) framework. Contrary to the simplistic assumption that technological usefulness alone drives adoption, this study underscores the complex interplay between cognitive beliefs, motivational drivers, and institutional readiness. Consistent with theoretical expectations, the findings reaffirm behavioral intention (BI) as the pivotal psychological mechanism that translates perceptions and contextual affordances into actual behavioral engagement. In other words, the bridge between perception and action is not automatic but mediated by volitional commitment shaped by usability, social persuasion, and infrastructural facilitation.

Although students recognized the potential advantages of VR, the nonsignificant direct effect of performance expectancy (PE) on VR actual usage (VRAU) suggests that perceived usefulness alone is an insufficient catalyst for behavioral uptake. This highlights a cognitive–motivational gap, wherein awareness of benefits does not necessarily engender engagement unless operationalized through intentionality. Such a pattern resonates with earlier research emphasizing that performance beliefs require a motivational intermediary to activate behavioral realization (Bower et al., 2020; Köroğlu, 2025). Conversely, effort expectancy (EE) demonstrated a robust influence on both BI and VRAU, reinforcing the primacy of perceived ease of use as a determinant of adoption in immersive learning contexts (Papakostas et al., 2023; Creed et al., 2024). This finding aligns with the human–computer interaction paradigm, where technology engagement under cognitive load depends on low friction, intuitive interfaces, and reduced extraneous mental effort.

Social influence (SI) also exerted a significant positive effect on both intention and actual VR use, indicating that peer and instructor endorsement functions as a critical normative driver within collaborative academic environments.

This result suggests that adoption in hospitality education—where learning frequently involves teamwork, simulation, and reputation building—depends heavily on collective validation and perceived social legitimacy. Prior literature confirms that social endorsement operates as both a motivational reinforcer and a social cue of professional alignment (Jhawar et al., 2023; Yavo-Ayalon et al., 2023). Thus, technology adoption emerges not merely from individual cognition but as a socially constructed phenomenon embedded within academic culture.

Similarly, facilitating conditions (FC) emerged as a decisive determinant of both behavioral intention and actual usage. This reinforces the notion that institutional readiness—manifested in hardware reliability, technical support, and administrative commitment—is indispensable for sustainable technology integration (Kure et al., 2022; Agbeyangi & Suleman, 2024). Unlike lightweight e-learning tools, VR's high technological demand transforms infrastructural provision from a supportive background factor into a prerequisite condition. The absence of reliable institutional scaffolding can therefore nullify even strong motivational drivers, emphasizing that technological innovation must be co-constructed with organizational capability. The mediation analysis further elaborates the structural logic of the UTAUT framework, identifying BI as the central conduit linking attitudinal, cognitive, and contextual antecedents to behavioral outcomes. Specifically, the full mediation observed between PE and VRAU confirms that students' awareness of VR's utility only translates into action when internalized as a goal-oriented intention. In contrast, EE, SI, and FC exhibit partial mediation effects, signifying that these constructs influence adoption through both rational intention and direct experiential or environmental pathways. This dual-path mechanism—where usability, social reinforcement, and institutional affordance operate directly and indirectly—illustrates the multi-layered nature of behavioral decision-making in technology-enhanced learning (Huang, 2023; Ashrafi & Easmin, 2023). Such findings enrich the socio-cognitive interpretation of technology acceptance, suggesting that VR adoption depends not solely on rational evaluation but also on identity alignment, perceived control, and community participation (Fares et al., 2024; Al-Sharafi et al., 2023; Ball et al., 2021).

This conceptual nuance reinforces the argument that effective technology integration in education is as much a social and institutional process as it is a psychological one. In sum, the study advances the understanding that meaningful VR engagement in higher education requires an ecosystemic alignment between individual motivation, social endorsement, and infrastructural readiness—bridging the persistent gap between technological potential and educational practice.

Theoretical Implications

This work further develops the theoretical knowledge of technology acceptance literature by advancing the explicatory limits of the Unified Theory of Acceptance and Use of Technology (UTAUT) in the new area of immersive technologies in higher education. Although UTAUT has been extensively tested on more traditional digital platforms like e-learning systems and mobile applications, its use on virtual reality, which is an embodied, multisensory and spatially interactive medium, brings forth significant nuances that can be theoretically reevaluated. First, the fact that performance expectancy failed to have a direct influence on actual VR usage, but was completely mediated by behavioral intention, underscores the perceived usefulness as being sufficient to influence adoption in highly immersive situations.

However, contrary to transactional technologies where use can be directly predicted by functional efficiency, it seems that VR adoption necessitates some extra motivational commitment, which implies that intention formation is not a predictive but constitutive characteristic of the use preparedness. This highlights the necessity of considering the difference between cognitive appraisal of utility and embodied preparedness to engage, meaning that intention needs to be re-conceptualized as a psychosocial activation threshold as opposed to a linear precursor of behaviour.

Second, the partial mediation results of effort expectancy, social influence and facilitating conditions show that immersive technologies are mediated in two-way paths, having both rational appraisals (ease, support) and situation enablers (peer norms, infrastructural accessibility) as a joint determinant of adoption. The results justify the incorporation of socio-material views in UTAUT because more than an intention, acceptance is also determined by the affordances inherent to the learning environment. The current results indicate that the existing models should consider the facilitating conditions as contextual catalysts that can overcome or strengthen the intention formation based on the levels of system embodiment, whereas the existing models consider them to be residual infrastructure variables. This evidence demands a theoretical refreezing of UTAUT-Embodied where the incorporation of immersion, presence, and sensory load are included as possible moderators.

Third, that behavioral intention is a central figure in all the relationships and a mediator makes it a boundary construct instead of a universal one. Intent is optional or weak predictive in lightweight technologies, but in the case of VR, where meaningful engagement requires cognitive effort, physical motion and social presence, intention is a psychological commitment device that normalizes engagement. This brings about additional theoretical research in terms of the strength of intention, persistence, and transformation, which may include self-determination theory, flow theory, or even habit formation models to enhance the motivational architecture of UTAUT.

Finally, the research moves UTAUT a step further to a collective and dynamic concept of adoption by emphasizing that VR acceptance does not occur solely in the form of individual cognition but through the institutional support of it, co-experience among peers, and cultural discourses of innovation. Theoretical extensions into the future should go beyond the cross-sectional prediction of the future and be trajectory-based models of acceptance that consider the decay of novelty, experiential fatigue, and identity alignment with new technologies.

Practical Implications

This research provides strategically actionable insights for higher education policymakers, hospitality institutions, curriculum designers, faculty members, and students seeking to harness the pedagogical potential of Virtual Reality (VR) in hospitality and tourism education. The findings emphasize that mere awareness of VR's advantages among students does not automatically translate into behavioral adoption; therefore, institutional strategies must move beyond advocacy toward structured integration and sustained engagement. Firstly, higher education policymakers and institutional administrators should recognize that effective VR adoption requires deliberate curricular and infrastructural alignment rather than isolated experimentation. Awareness-building must be coupled with practical incentives and formal inclusion of VR-based learning outcomes in assessment frameworks. Universities should design immersive modules—such as virtual tourism sites, simulated hotel operations, and interactive heritage experiences—explicitly tied to skill acquisition, performance evaluation, and academic credit. Investment in dedicated VR laboratories equipped with industry-standard simulations can enable students to practice destination management, event coordination, or service recovery decision-making in a safe and controlled digital environment, enhancing both competence and confidence.

Secondly, ease of use remains a pivotal determinant of student engagement, underscoring the need for intuitive and accessible VR systems. Curriculum developers and faculty should select or design platforms with minimal cognitive load, incorporating guided orientations, embedded tutorials, and adaptive interfaces to reduce technological anxiety. Pedagogical design should integrate collaborative and experiential elements—for example, group-based virtual projects, co-creation of interactive cultural heritage tours, or VR-based competitions—to leverage peer influence as a social driver of adoption. Such initiatives not only enhance behavioral intention and digital literacy but also mirror teamwork and problem-solving skills demanded in the hospitality industry. Thirdly, institutional and social support mechanisms are critical for long-term sustainability. Universities should establish robust VR infrastructures, including mobile VR kits, cross-platform compatibility, reliable technical support, and regular maintenance schedules. Institutional endorsement should be reinforced by faculty leadership and peer modeling, where instructors actively integrate VR demonstrations in lectures, provide formative feedback on simulations, and celebrate student success in VR-enabled assignments. These practices create a normative culture of innovation, positioning VR use as both academically valued and socially reinforced within the institutional ecosystem.

Collectively, these implications suggest that successful VR implementation demands an integrated strategy aligning motivational, social, and infrastructural enablers. Embedding VR as a core pedagogical element—rather than an optional supplement—can bridge the persistent gap between theoretical instruction and experiential learning. By doing so, institutions can foster immersive engagement, enhance skill transfer, and cultivate technologically adept graduates prepared for the evolving digital demands of the hospitality and tourism sectors. Ultimately, the strategic adoption of VR not only elevates the learning experience but also cultivates industry-ready professionals equipped with both cognitive insight and operational fluency in technology-mediated environments.

CONCLUSIONS

This study investigated the determinants influencing the adoption of Virtual Reality (VR) in Egyptian hospitality and tourism education, revealing that usage is not solely determined by students' perceptions of usefulness but is primarily driven by behavioral intentions shaped by usability, social influence, and institutional support. While performance expectancy was found to explain students' intentions to use VR, it did not directly predict actual usage, emphasizing the mediating role of intention as a critical conduit between perception and practice. In contrast, effort expectancy, social influence, and facilitating conditions exerted both direct and indirect effects on actual usage, highlighting the synergistic significance of cognitive simplicity, peer endorsement, and infrastructural readiness.

Theoretically, the findings contribute to the extension of the Unified Theory of Acceptance and Use of Technology (UTAUT) into immersive, multisensory learning contexts, uncovering the nuanced pathways through which embodied technologies like VR are assimilated in higher education. By clarifying the interplay between cognitive, social, and institutional determinants, this study enhances understanding of technology adoption beyond conventional, task-oriented tools and situates VR as a transformative pedagogical instrument in experiential learning. Practically, the results suggest that meaningful VR integration requires more than mere access to technology. Success depends on institutional investment, faculty training, curriculum alignment, and the deliberate design of collaborative, skill-oriented learning activities that leverage VR's immersive capabilities. For policymakers and educational administrators, the findings emphasize the importance of harmonizing technological convenience, cultural acceptance, and pedagogical objectives to ensure sustainable adoption. Strategic interventions should include incentives for student engagement, faculty capacity building, and the creation of supportive infrastructural and social environments.

Despite its contributions, this research has several limitations. The study focused exclusively on student perceptions within the Egyptian context, excluding faculty perspectives and longitudinal usage patterns. Additionally, potential contextual biases—such as institutional variability and cultural influences—were not fully explored. Future research should extend these findings through cross-institutional and cross-cultural comparisons, incorporate longitudinal designs to assess sustained engagement, and examine the perspectives of educators and industry partners to capture the full spectrum of adoption determinants. Furthermore, investigating the impact of VR on learning outcomes, skill acquisition, and career readiness in hospitality and tourism would provide a more comprehensive evaluation of its pedagogical value. Ultimately, VR represents a promising mechanism to bridge theoretical instruction and industry practice, enhancing experiential learning in hospitality and tourism education. However, its long-term impact hinges on deliberate institutional planning, the removal of structural and psychological barriers, and the cultivation of an ecosystem that supports immersive, collaborative, and skill-oriented learning. This study lays a foundation for understanding and optimizing VR adoption, providing both theoretical and practical insights for leveraging immersive technologies in higher education.

Limitation and Future Directions

The study is subject to several methodological and contextual limitations that constrain the interpretive breadth and generalizability of its findings. Firstly, the sample was restricted to hospitality and tourism students within a single national public university, thereby limiting the ecological validity and cross-contextual applicability of the results. Differences in institutional cultures, resource allocation, curricular design, and technological infrastructure between public and private institutions—or even across regions—may produce substantially different adoption patterns. Consequently, the findings should be interpreted as contextually bounded rather than universally generalizable.

Secondly, the use of a cross-sectional and self-reported design introduces susceptibility to common method variance, recall inaccuracies, and social desirability bias. Although procedural and statistical remedies were implemented, the residual risk of inflated correlations or response bias cannot be fully discounted. A longitudinal or multi-wave design would better capture the temporal evolution of behavioral intention and actual usage, mitigating simultaneity bias and improving causal inference. Thirdly, the study did not incorporate objective system-generated telemetry or interaction diagnostics, such as session duration, motion tracking fidelity, latency, or frame rate stability—metrics that are critical for understanding user comfort, immersion, and physical usability in VR human–computer interaction (HCI). The absence of these data restricts the ability to triangulate self-reported perceptions with empirical behavioral indicators, thereby constraining insights into the psychophysiological underpinnings of technology acceptance.

Fourth, the study lacked experimental control over hardware and content heterogeneity. Variation in head-mounted displays, tracking accuracy, software optimization, and instructional content may have introduced uncontrolled confounds that differentially influenced perceived ease of use, presence, and motion discomfort. This technological inconsistency may obscure the true structural relationships among UTAUT constructs, particularly effort expectancy and facilitating conditions. Fifth, certain theoretically salient constructs were excluded from the structural model, such as embodiment, simulator sickness, accessibility barriers, and sensory fatigue, all of which are critical moderators in immersive learning contexts. Moreover, measurement invariance across subgroups (e.g., gender, experience level, or digital literacy) was not assessed, potentially masking subgroup-specific variations or boundary effects within the UTAUT framework.

Future research should adopt multi-institutional and cross-cultural designs to test the transportability and robustness of the proposed relationships across diverse academic and infrastructural settings. Longitudinal modeling is recommended to trace the evolution of intention–behavior dynamics over time and the emergence of habitual technology engagement. Integrating privacy-preserving usage telemetry (e.g., session logs, dropout events, and performance errors) with psychometric instruments could facilitate a more comprehensive human–system interaction analysis, blending behavioral data with perceptual indicators. Furthermore, randomized or quasi-experimental classroom deployments could be employed to isolate the effects of onboarding strategies, interface designs, and curricular integration on students' performance and effort expectancies. Finally, technical standardization or systematic variation of VR hardware and locomotion pipelines is essential to disentangle the causal pathways linking system performance, user comfort, and technology acceptance—particularly for enhancing accessibility and inclusion across diverse learner populations.

Author Contributions: Conceptualization, N.M.and A.H.; methodology, N.M.and A.H.; software, N.M.; validation, N.M.and A.H.; formal analysis, N.M.and A.H.; investigation, N.M.and A.H.; data curation, N.M.and A.H.; writing—original draft preparation, N.M.; writing—review and editing, A.H.; visualization, N.M.and A.H.; supervision, A.H.; project administration, N.M. All authors have read and agreed to the published version of the manuscript.

Funding: This work was supported by the Deanship of Scientific Research, Vice Presidency for Graduate Studies and Scientific Research, King Faisal University, Saudi Arabia [Grant No. KFU253523].

Institutional Review Board Statement: Not applicable.

Informed Consent Statement: Not applicable.

Data Availability Statement: The data presented in this study may be obtained on request from the corresponding author.

Acknowledgements: The research undertaken was made possible by the equal scientific involvement of all the authors concerned.

Conflicts of Interest: The authors declare no conflict of interest.

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Article history: Received: 06.10.2025 Revised: 21.01.2026 Accepted: 07.04.2026 Available online: 22.05.2026