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Article

Factor Effecting to Metaverse Information System through Student's Satisfaction: A Cross-Sectional Study on University Students

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Abstract

The research aimed to test the impact of perceived ease of use, perceived usefulness, personal innovativeness, usability, perceived trialability, system quality, and service quality on metaverse information systems through Saudi Arabian university students' satisfaction. For this purpose, data were collected from 320 students of Saudi Arabian universities by employing a self-administered survey instrument. Using a cross-sectional research design, and Structural Equation Modeling (SEM) technique through AMOS software. Regression results show that perceived ease of use, perceived usefulness, system quality, service quality, personal innovativeness, usability, and perceived trialability have a positive and significant impact on student satisfaction. On the other hand, student satisfaction also has a positive and significant impact on the intention of metaverse information systems of students in Saudi Arabia. The study results with these findings contributed that improving factors such as perceived ease of use, usefulness, and quality dimensions could lead to higher student satisfaction, directly influencing Saudi Arabian students' intention to use metaverse systems. Therefore, it is suggested that educational institutions should focus on optimizing these aspects to create more engaging and efficient learning environments. By doing so, they can facilitate the broader adoption of metaverse technologies to drive innovations in all institutions.

Keywords

Perceived ease of use, Metaverse information system, Student Satisfaction, Technology Adoption, Saudi Arabia.

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Metaverse information systems (MIS) show a transformative modification where represents that how digital experiences are being created and interacted with the blending of virtual and augmented realities into a unified platform (Hassanzadeh, 2022). The significance lies in its ability to provide an environment that can stimulate a real-world experience which could lead to more engagement and interactive user experience (Ritterbusch & Teichmann, 2023). In the education sector, the metaverse enabled personalized and adaptive learning which can increase students learning and understanding of their subjects (Lin et al., 2022). For instance, the immersive nature of the metaverse could enhance engagement and retention, allowing students to interact with 3D models or participate in collaborative virtual worlds (Zhou, 2022). Other authors also documented that the education sector benefits from metaverse systems by offering virtual spaces for training and real-time simulations (Classe, Castro, & Sousa, 2023). These capabilities mark the metaverse as an important component of future digital ecosystems.

Furthermore, MIS is also important for advancing collaborative technologies for creating new avenues (Hassanzadeh, 2022). In the MIS, the integration of artificial intelligence and blockchain offers innovative solutions for industries like education where virtual transactions and experiences can mimic and enhance real-world scenarios. For businesses, MIS provides new models of customer interaction, allowing brands to create virtual stores or offer strong product demonstrations that could increase customer expectations (Winarti, Sarkum, & Halim, 2021). Through merging physical and digital spaces, the MIS also increases new opportunities for remote work and global collaboration where teams can work in shared virtual environments regardless of geographical boundaries (Ahn, 2024). This is the reason, MIS importance lies in their potential to redefine how the education sector can integrate their function in a current modern digital world.

User satisfaction becomes an integral factor in increasing MIS usage. When the users finds a system that is easy to use and reliable than their level of satisfaction increases which in turn enhances the system adoption and continued engagement (Alkhwaldi, 2023). For instance, Alkhwaldi (2023) also found that immersive and interactive features enhance user satisfaction and could lead to greater participation in MIS. Similarly, Jeong, Kim and Yoon (2023) also demonstrated that satisfaction with perceived usefulness and ease of use positively impacts users' continuous intention to engage in virtual systems. The Technology Acceptance Model (TAM) suggests that user satisfaction is often driven by perceived usefulness and perceived ease of use which can directly affect users' intention to continue using the system (Çelik & Ayaz, 2024). Additionally, service and system quality, including elements like responsiveness, interactivity, and immersive experiences, contribute to user satisfaction and system loyalty (Ahn, 2024). Furthermore, in a metaverse context, personal innovativeness, user compatibility, and perceived trialability enhance satisfaction which reinforces user intention to engage more deeply with the virtual environment (Sediyaningsih et al., 2023). Therefore, improving user satisfaction could directly support the overall success and growth of MIS in the education sector.

Different empirical studies have been conducted on the MIS but studies still have little attention on personal innovativeness, perceived observability, user compatibility, perceived trialability, and perceived ease of use, perceived usefulness, and quality factors in the context of metaverse information systems through student's satisfaction. Firstly, Azzahra and Kusumawati (2023) and Almansour and Elkrghli (2023) have explored the relationship between perceived usefulness, perceived ease of use, and user satisfaction, and the study has little attention on MIS. Secondly, research on personal innovativeness was conducted on satisfaction (Patrick Alexander Wilhelm & Pantri, 2023) but paid limited attention to metaverse information which highlighted that further research could be explored on MIS. Thirdly, variables such as user compatibility and perceived observability have received even less empirical attention to improving MIS through satisfaction (Sidharta & Rahmahwati, 2023). These gaps reflect the focus of existing research which has not fully examined these factors together in the context of the MIS. Fourthly, extant studies also pay little attention to these variables in the combined model. Fifthly, previous studies also have inconsistent findings (Pramudito et al., 2023) and therefore these inconsistent findings further highlight the need for a comprehensive approach. Lastly, existent studies also have majorly focused on other countries and other sectors while having limited attention to university students in the Saudi Arabian context. Thus, based on previous gaps, research aimed to test the impact of perceived ease of use empirically, perceived usefulness, personal innovativeness, usability, perceived trialability, system quality, and service quality on intention towards utilizing MIS through Saudi Arabian university students' satisfaction.

This research fills the knowledge gap in several ways, by examining the MIS in the context of Saudi Arabian through university student satisfaction. The study of the model contributed to a body of literature in the

extant literature where studies have limited attention on MIS intention in the context of Saudi Arabia. Further, the study also contributed to providing a more persuasive model. Previous studies have limited attention to the combined model because extant studies have majorly focused on unified effect on MIS and student satisfaction. The study also helped policymakers and educationists to focus on study variables to improve the MIS system of universities. The study is further divided into four chapters, literature review, research methodology, data analysis and results, and discussion and future directions.

Literature Review

Theoretical Framework

A Metaverse Information System (MIS) refers to a virtual, immersive environment enabled by advanced technologies such as augmented reality (AR), virtual reality (VR), and blockchain, where users can interact with digital content and each other in real-time (Classe et al., 2023). Such a system incorporates multiple communication, collaboration, and transaction systems in 3D environments to enhance the interaction between virtual and real domains (Alfaisal, Hashim, & Azizan, 2024). They also further emphasized that MIS offers a new way to learn, work, and play together. It is being applicable across different fields also makes it possible to conduct real-life drills that can enhance decision-making and enhance creativity (Lin et al., 2022). Additionally, perceived ease of use and perceived usefulness are the two most important factors that can impact positively on user satisfaction in the Metaverse environment. Originally, these two factors were from the selected Technology Acceptance Model (TAM), which is further used to explain users' willingness to adopt new technologies (Davis, 1989; Wilson, Alvita, & Wibisono, 2021). Perceived ease of use captures how much the users believe that engaging with the MIS will not require much effort while perceived usefulness establishes how much the users felt that the system would help them improve their performance or was beneficial to them in some way (da Conceição dos Santos et al., 2023; Keni, 2020).

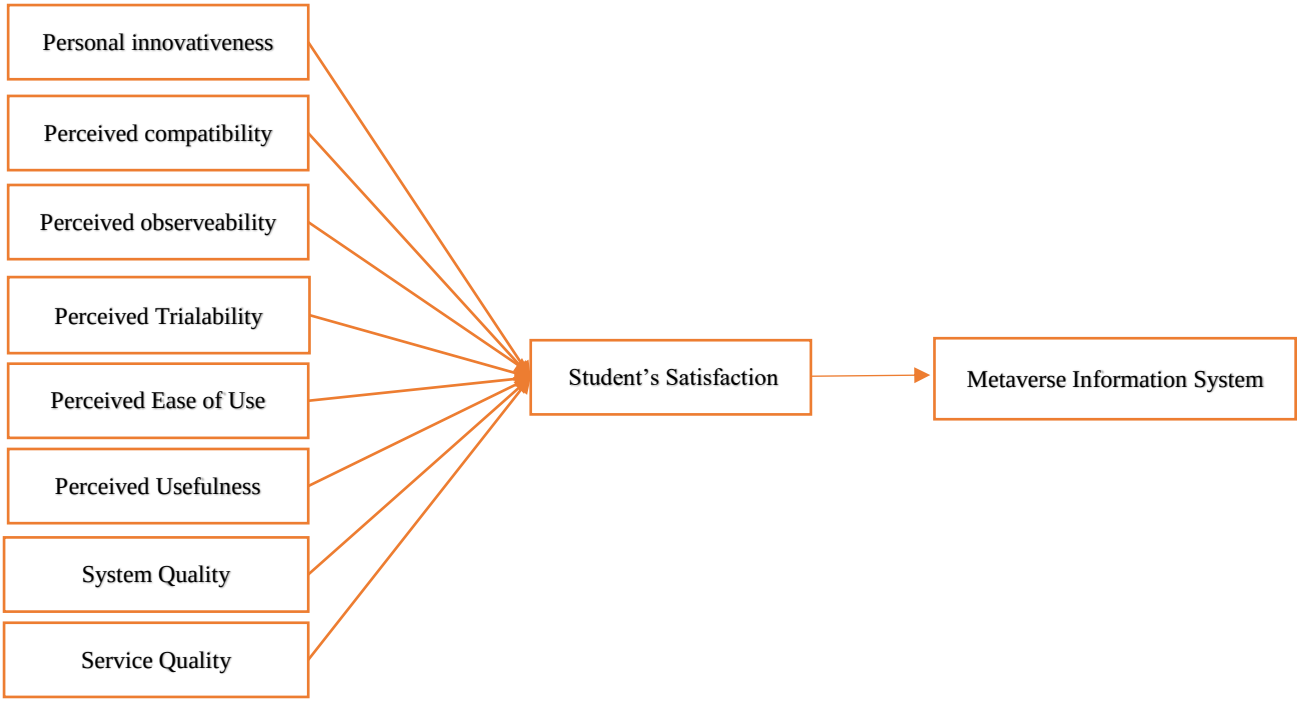

Figure 1: *Research Framework.*

In addition to ease of use and usefulness that are influenced by information and system quality factors. DeLone and McLean (2003) defined that information quality, system quality, and service quality are perceived to be the more significant predictors of information system success and, consequently, user satisfaction and usage intentions. These dimensions ensure that the user has smooth flows of transactions, relevant and timely information, and good response to technical issues respectively, and therefore leads to a high level of satisfaction.

As another source of personal innovativeness, there is Daellenbach's (1994) discussion of the Diffusion of Innovations theory, according to which, those individuals who are ready to accept innovative technologies are more open to risk and new and unconventional systems. As for determinants affecting overall satisfaction – although users with low personal innovativeness were reluctant to experiment with features within the metaverse, they were satisfied with a broader range of features, and as with more content, more satisfaction was achieved the same logic applies to experimentation with advanced features as they report more enjoyment from the system (Alkhafagy et al., 2023; Rakhimova et al., 2023; Sahin, 2006). Taken together these theoretical models emphasize the system-related factors and the characteristics of the users that form user satisfaction (Sahin, 2006) to increase metaverse Information System. Based on previous literature, a theoretical framework is formulated in Figure 1 below.

Hypothesis Development

Personal innovativeness shows the individual willingness to grasp innovations and technologies (Agarwal & Prasad, 1998). The author argued that when there is personal innovativeness then there is more user satisfaction (Patrick Alexander Wilhelm & Pantri, 2023). This is further supported by Ali and Warraich (2023) who also highlighted that more innovative individuals tend to explore and utilize technology features more effectively, which enhances their overall satisfaction. They also argued that innovativeness increases the positive attitude towards the technology which helps them to navigate new technologies (Ali & Warraich, 2023). Similarly, Minakan and Chaipoopirutana (2024) found that innovative users exhibit higher satisfaction levels with wireless internet services due to their eagerness to adopt new functionalities, demonstrating the essential role of personal innovativeness in technology acceptance. Furthermore, Zhang, Park and Park (2024) established that personal innovativeness influences the adoption of e-government services which emphasizes its impact on user satisfaction across various domains. Previous discussions showed the importance of personal innovativeness for user satisfaction. Therefore, the study has the following research hypothesis below,

H1: Personal innovativeness significantly impacts student satisfaction.

Perceived observability shows the extent to which the results of using technology can be seen and evaluated by others (Alghazali et al., 2022; Winarti et al., 2021). Perceived observability significantly increases the user's satisfaction (Lu, 2021) because when the users can observe the benefits derived from a technology then their level of satisfaction increases. This was further noted by Kadir and Tricahyono (2024), who found that higher observability led to a positive user experience in technology adoption, as users feel more confident in their decisions. Luo and Cao (2024) showed that perceived observability of e-government services directly affects user satisfaction by fostering trust in the system, reinforcing the importance of transparency. Moreover, Salloum Sr et al. (2024) noted that effective learning environments that allow for the visibility of outcomes enhance user satisfaction, emphasizing the importance of observability in user experiences. In another study, it was further found a positive and significant impact of perceived usability on user satisfaction (Jiayi & Chunfeng, 2024; Winarti et al., 2021). They further argued that further research could be explored on other developing nations. Thus, based on previous discussion, it is hypothesized that,

H2: Perceived observability significantly impacts student satisfaction.

Furthermore, user compatibility refers to how well a new technology is aligned with the user's existing experiences and experiences (Lu, 2021; Mernissi, 2023). Venkatesh et al. (2003) highlighted that if the users have more compatibility in their use of technology then have more satisfaction levels because they found that technology has more integration with user lives. Yang and Tasi (2024) conducted a study and confirmed the positive relationship between compatibility and satisfaction, suggesting that technologies that resonate with users' pre-existing values are more readily accepted. Additionally, Nel and Boshoff (2023) found that task-technology fit, which includes compatibility aspects, directly influences user satisfaction, indicating that a good fit between tasks and technology enhances usability. Alam and Mezbah-ul-Islam (2023) reinforced that compatible technologies lead to increased user acceptance and satisfaction, while Kumar et al. (2024) showed how compatibility with personal values enhances overall contentment with technological tools. Furthermore, it has also found a positive and significant impact of user compatibility on user satisfaction (Simovic et al., 2024). Based on previous discussion, it is hypothesized that,

H3: User compatibility significantly impacts student satisfaction.

Perceived trialability indicates the ability to experiment with the latest technology before moving toward the commitment. Caoili-Tayuan and Ramos (2024) highlighted that technologies allowing for trial use could reduce user anxiety and enhance satisfaction because when users feel more empowered to make informed choices. This is further aligned with the study of Yu, Yan and Cai (2024) who also elaborated that trialability could increase users' confidence in a technology which leads to a more favorable assessment of its benefits and usability. Another study, Park (2024) noted that trialability directly contributes to user satisfaction because it allows potential users to evaluate a technology's benefits firsthand which reduces the perceived risk. Kumar et al. (2024) supported this notion by showing that trialable e-government services significantly enhance user satisfaction levels, providing users with an opportunity to test functionality before full adoption. Further study also concluded that when perceived trialability increases then user satisfaction toward using technology also increases (Shaban & Abdulhaleem, 2023; Wandira, Fauzi, & Nurahim, 2024). Keeping in view previous empirical studies, it is hypothesized that,

H4: Perceived trialability significantly impacts student satisfaction.

Perceived usefulness is also an important determinant for increasing the user's satisfaction because it provides a degree to which technology enhances performance (Azzahra & Kusumawati, 2023). This is further supported by the study of Nuryakin, Rakotoarizaka and Musa (2023) who also identified that perceived usefulness is an important factor that increases user satisfaction in the acceptance of the technology model which asserts that users need to perceive clear benefits to be satisfied. Elias and Lubua (2024) also found that perceived usefulness significantly correlates with user satisfaction in collaborative technologies, emphasizing its vital role in enhancing user experiences. Additionally, Ngo et al. (2024) added that users' perceptions of usefulness are crucial in the context of e-government services, directly affecting their satisfaction and willingness to engage further. Furthermore, Tavitiyaman et al. (2024) also conducted a study to test the impact of perceived usefulness on user satisfaction. They found the positive and significant impact of perceived usefulness on user satisfaction and they also argued further research could be explored in other countries to increase the generalizability of the findings. Therefore, a study has formulated the following research hypothesis below,

H5: Perceived usefulness significantly impacts student satisfaction.

Perceived ease of use shows the degree to which using technology is to be perceived as free of effort (Tavitiyaman et al., 2024). Tavitiyaman et al. (2024) further emphasized the importance of perceived ease of use in enhancing user satisfaction which is establishing it as a foundational element in technology acceptance. Nuryakin et al. (2023) showed that ease of use significantly affects user satisfaction in mobile commerce environments, indicating that simpler interfaces foster greater engagement. Loh et al. (2024) also highlighted that a positive perception of ease of use is crucial for user acceptance and satisfaction in online information systems, reinforcing the importance of intuitive design. Harianto and Ellyawati (2023) also demonstrated that perceived ease of use directly impacts user satisfaction in online learning environments, as users prefer systems that facilitate easy interactions. In other study, it was also found that perceived ease of uses also has positive and significant impact of perceived ease of uses on user's satisfaction (Gascón-Vera & Marta-Lazo, 2023; Siemon, 2024). Thus, based on previous, it is hypothesized that,

H6: Perceived ease of use significantly impacts student satisfaction.

Service quality provided by a technology, is crucial for user satisfaction. Research shows that higher service quality enhances user satisfaction (Christanto, Sutresno, & Karolen, 2024). Alam and Mezbah-ul-Islam (2023) highlighting dimensions such as reliability and responsiveness that significantly correlate with user satisfaction, asserting that quality perceptions shape user expectations. Pramudito et al. (2023) also emphasized that service quality is a vital component of information system success, directly affecting user satisfaction by ensuring that user needs are met consistently. Malaver, Claudio and Ruiz (2024) demonstrated that high service quality in e-commerce platforms leads to increased user satisfaction levels, particularly in customer support. Furthermore, Rahayu, Dhiaullah and Marsha (2023) found that service quality positively influences user satisfaction in various online services, reinforcing the importance of service quality in enhancing user experiences across different contexts. Thus, based on previous discussion, it is hypothesized that,

H7: Service quality significantly impacts student satisfaction.

System quality refers to the overall performance and reliability of a technology, which is critical for user satisfaction (Pramudito et al., 2023). Research consistently shows that higher system quality results in increased user satisfaction. Pramudito et al. (2023) highlighted that system quality is a key determinant of user satisfaction in information systems, stating that reliable performance fosters user trust. Ekasari, Arif and Nurcholis (2023) found that improved system quality positively affects user satisfaction in e-learning environments, emphasizing the role of technology reliability in educational settings. He, Liu and Jung (2024) demonstrated that system quality contributes to enhanced user satisfaction in online service contexts, as users prefer systems that perform consistently. Furthermore, Widiantari et al. (2024) emphasized that system quality impacts user satisfaction across various service industries, highlighting its critical role in user experiences and long-term engagement.
H8: System quality significantly impacts student satisfaction.

A number of empirical works have supported this assertion. For instance, Schillaci et al. (2024) stated that user satisfaction is positively related with the intention to continue using the information system which duly stated that users who are satisfied are more willing to continue using the Information System. According to a study done by AL-Hawamleh (2024), the findings showed that compliant users were likely to report positive attitudes on the use of a system hence stressing the influence of user perception on technology acceptance. Fu et al. (2023) supports this relationship in a way that satisfied users are more likely to adopt new technologies, thus pointing out that user satisfaction is a compulsory motive for the consistent use of new platforms. In another study, it is also supported that user satisfaction played an important role in increasing the intention toward intention in education (Idkhan & Idris, 2023), Based on previous studies, it is evident that user satisfaction is a key determinant for the continuity of the Metaverse Information System. Therefore, a study has formulated the following research hypothesis,
H9: Student satisfaction significantly affects student' intention to use the metaverse information system.

Research Design

The research aimed to test the impact of perceived ease of use empirically, perceived usefulness, personal innovativeness, usability, perceived trialability, system quality, and service quality on intention towards metaverse through Saudi Arabian students' satisfaction. For this purpose, the research employed the quantitative research approach. This approach offers various strengths as compared to qualitative methods, especially in analysis reliability. This objectivity is often achieved through structured data collection methods, such as surveys or experiments, which minimize biases associated with subjective interpretations (Gelo, Braakmann, & Benetka, 2008). Furthermore, the authors used a cross-sectional research design. When comparing cross-sectional and longitudinal research designs, cross-sectional studies excel in providing a snapshot of a population at a specific point in time which makes a cost-effective data collection as compared to longitudinal designs (Rindfleisch et al., 2008). Therefore, the research used the cross-sectional research design.

Research Instrument Measurement

The research instrument was adopted from the previous literature where it was already tested. Perceived trialability was measured by 3 items, three items measured personal innovativeness, user satisfaction was measured by 3 items, perceived ease of use was measured by 3 items, perceived usefulness was also measured by 3 items, 3 items measured user's compatibility, and perceived observe ability measured by 3 items. These items were taken from the study of Almarzouqi, Aburayya and Salloum (2022). Furthermore, system quality is measured by 3 items, and 5 items measure service quality. These items were adopted from the study of Gorla, Somers and Wong (2010). Lastly, the metaverse information system was measured by 3 items, which were adopted from the study of Almarzouqi et al. (2022). The adopted items were measured on a point Likert Scale which ranked on 1 for strongly disagree and 5 for strongly agree.

Sampling Technique and Data Collection

The population of the current study was the students who were selected through the convenient sampling technique. This technique provides a significant strength by enabling the selection of respondents which ensures that the data collected is relevant and insightful (Suen, Huang, & Lee, 2014). With 320 valid responses collected data from a total population of 450 students which represents approximately 71% of the target sample size, it enhances the reliability and generalizability of the findings (Hertzog, 2008). Additionally, this high response rate reflects strong engagement and interest among participants which contributes to the study's credibility and reliability of the data (Hertzog, 2008).

Reliability and Validity

The study tested the study hypothesis in two models. The first model was the measurement model and the second model was the structural model. These models were tested through Structural Equation Modeling (SEM) using AMOS software. The first measurement model was tested through factor loadings, alpha, composite reliability (CR), and average variance extracted (AVE). Among these criteria, Cronbach's Alpha assesses internal consistency, with values above 0.7 indicating satisfactory reliability (Hair Jr, Howard, & Nitzl, 2020). Composite Reliability (CR) also examines construct reliability, where values exceeding 0.7 are deemed acceptable (Hair Jr et al., 2020). The AVE reflects the amount of variance captured by the construct about the variance due to measurement error, with a threshold of 0.5 or higher indicating good convergent validity (Sujati & Akhyar, 2020). Factor loadings further confirm the strength of the relationship between observed variables and their constructs, with loadings above 0.7 considered satisfactory (Hair Jr et al., 2020). Table 1 predicted values show that all values are greater than the threshold values, which shows that the construct fulfills the measurement model requirement.

Table 1: *Reliability Results.*

Variable	Item	Mean	Std. Dev.	Factor Loading	Cronbach's Alpha	AVE	CR
	SQ1	3.675	1.352	0.846			
	SQ2	3.724	1.367	0.832			
Service Quality	SQ3	3.69	1.456	0.821	0.908	0.723	0.887
	SQ4	3.695	1.389	0.811			
	SQ5	3.648	1.431	0.825			
	SY1	3.851	1.359	0.91			
System Quality	SY2	3.812	1.387	0.895	0.914	0.748	0.895
	SY3	3.789	1.474	0.876			
	US1	3.612	1.528	0.855			
User Satisfaction	US2	3.621	1.452	0.841	0.903	0.711	0.879
	US3	3.645	1.473	0.835			
	PI1	3.823	1.364	0.87			
Personal Innovativeness	PI2	3.751	1.312	0.855	0.912	0.732	0.89
	PI3	3.785	1.405	0.86			
	PU1	3.912	1.256	0.895			
Perceived Usefulness	PU2	3.875	1.312	0.89	0.901	0.719	0.882
	PU3	3.882	1.235	0.887			
	PEU1	3.743	1.442	0.87			
Perceived Ease of Use	PEU2	3.652	1.382	0.86	0.895	0.714	0.875
	PEU3	3.622	1.432	0.855			
	PO1	3.753	1.343	0.835			
Perceived Observability	PO2	3.832	1.252	0.828	0.889	0.694	0.87
	PO3	3.782	1.275	0.84			
	UC1	3.654	1.33	0.845			
User Compatibility	UC2	3.674	1.35	0.842	0.895	0.707	0.882
	UC3	3.692	1.32	0.838			
	PT1	3.624	1.34	0.86			
Perceived Trialability	PT2	3.642	1.36	0.855	0.887	0.716	0.872
	PT3	3.631	1.33	0.852			
	MIS1	3.851	1.28	0.89			
Metaverse Information System	MIS2	3.873	1.3	0.895	0.903	0.725	0.895
	MIS3	3.861	1.31	0.892			

Source: Author's Estimation.

Discriminant Validity

The discriminant validity ensures that each construct in a model is distinct and captures phenomena not reflected by other constructs (Hair Jr et al., 2020). Discriminant validity could be achieved from the square root of the AVE of the construct which should be greater than the correlations between that construct and any other construct in the model (Henseler, Ringle, & Sarstedt, 2015). All the diagonal values show that each construct shares more variance with its items than with items of other constructs. This confirms that the constructs exhibit strong discriminant validity because the square roots of the AVE values for each construct exceed the corresponding inter-construct correlations (Hair Jr et al., 2020). The above results are predicted in Table 2 below,

Table 2: *Fornell and Larcker.*

Constructs	SQ	SY	US	PI	PU	PEU	PO	UC	PT	MIS
SQ	**0.851**									
SY	0.681	**0.865**								
US	0.471	0.621	**0.843**							
PI	0.312	0.241	0.571	**0.855**						
PU	0.359	0.481	0.212	0.551	**0.848**					
PEU	0.621	0.382	0.472	0.512	0.613	**0.856**				
PO	0.342	0.322	0.252	0.563	0.232	0.541	**0.833**			
UC	0.231	0.483	0.413	0.5742	0.392	0.593	0.255	**0.840**		
PT	0.691	0.261	0.321	0.582	0.312	0.621	0.356	0.258	**0.845**	
MIS	0.612	0.421	0.432	0.591	0.223	0.612	0.566	0.158	0.161	**0.851**

Source: Author's Estimation, Note: Service Quality (SQ), System Quality (SY), User Satisfaction (US), Personal Innovativeness (PI), Perceived Usefulness (PU), Perceived Ease of Use (PEU), Perceived Observability (PO), User Compatibility (UC), Perceived Trialability (PT), Metaverse Information System (MIS).

Empirical Findings

After the measurement model, the next step is to test the study hypothesis. The structural model results show that perceived innovativeness has a positive and significant (b=0.451, t=3.442) impact on user satisfaction which supports hypothesis one. Furthermore, results show that perceived observability has a positive and significant impact on user satisfaction ($\beta = 0.353$, $t = 3.793$, $p < 0.001$), supporting hypothesis two. This suggests that users who can easily observe the outcomes of the metaverse information system are more satisfied with the system. In the same vein, user compatibility has a significant positive effect on user satisfaction ($\beta = 0.442$, $t = 3.946$, $p < 0.001$), confirming hypothesis three. This implies that the more compatible users feel the metaverse system is with their needs and experiences, the more satisfied they are. In addition, perceived trialability also positively influences user satisfaction ($\beta = 0.342$, $t = 4.072$, $p < 0.001$), supporting hypothesis four. This highlights the importance of users being able to try out the system before full adoption, leading to higher satisfaction. In other contexts, perceived usefulness also has a positive and significant impact on user satisfaction ($\beta = 0.541$, $t = 4.434$, $p < 0.001$), validating hypothesis five. Users who find the system useful are more likely to be satisfied. The perceived ease of use also positively and significantly impacts to user satisfaction ($\beta = 0.553$, $t = 4.157$, $p < 0.001$), supporting hypothesis six. On the other hand, service quality also has a significant and positive impact on user satisfaction ($\beta = 0.642$, $t = 5.177$, $p < 0.001$), which supports hypothesis seven. System quality shows the strongest positive relationship with user satisfaction ($\beta = 0.651$, $t = 5.811$, $p < 0.001$), confirming hypothesis eight. This result highlights that the reliability and functionality of the metaverse system contribute significantly to user satisfaction. At last, user satisfaction also positively and significantly influences the intention to use the Metaverse information system ($\beta = 0.742$, $t = 5.153$, $p < 0.001$), supporting hypothesis nine. This indicates that higher user satisfaction translates into a stronger intention to use the system. The above results are predicted in Table 3.

Table 3: *Hypothesis Results.*

	Coefficient	Standard Error	t-value	Decision
PI->US	0.451	0.131	3.442	Supported
PO->US	0.353	0.093	3.793	Supported
UC->US	0.442	0.112	3.946	Supported
PT->US	0.342	0.084	4.072	Supported
PU-> US	0.541	0.122	4.434	Supported
PEU-> US	0.553	0.133	4.157	Supported
SQ-> US	0.642	0.124	5.177	Supported
SY-> US	0.651	0.112	5.811	Supported
US->MIS	0.742	0.144	5.153	Supported

Source: Author's Estimation, P<0.05.

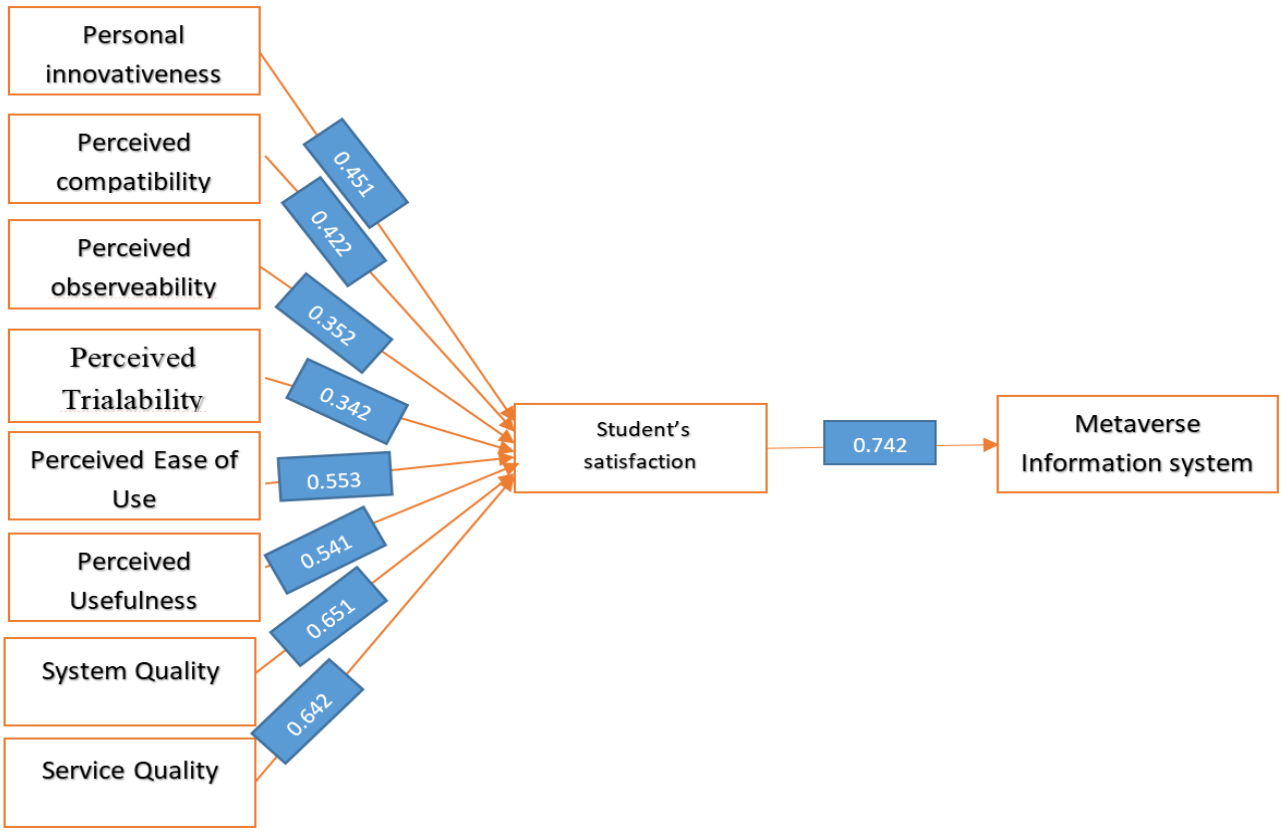

Figure 2: *Beta Values.*

Discussion

The research aimed to test the impact of perceived ease of use empirically, perceived usefulness, personal innovativeness, usability, perceived trialability, system quality, and service quality on intention towards metaverse through Saudi Arabian university students' satisfaction. The objective results show that personal innovativeness has a positive and significant impact on user satisfaction. These results posited that personal innovativeness positively affects user satisfaction among the students of Saudi Arabia in using metaverse information systems. The results are in line with the findings of Al-kfairy, Ahmed and Khalil (2024) who emphasized that more innovative individuals tend to have higher satisfaction levels with technology due to their proactive engagement. The same findings are aligned with the results of Rosli and Saleh (2024), which also found that students who actively seek out new technological experiences reported enhanced learning outcomes. These results show that Saudi Arabian educational departments should focus on students' innovativeness in promoting educational programs that can increase an environment where students could feel empowered to embrace new tools and methods that could increase creative expression. Further results show that perceived observability also positively and significantly enhances the user's satisfaction. These results show that perceived observability which is derived from using a technology is considered to be critical in shaping user satisfaction among the students of Saudi Arabia. The results are further in line with the study of Alhalaybeh et al. (2023) and Hu et al. (2023) who also found that when users can observe the benefits of a technology then their satisfaction increases. These empirical studies emphasized that Saudi Arabian educational institutions should focus on positive observability because when students can observe the positive impacts of the Metaverse like enhanced collaboration and access to diverse educational resources then they are more likely to feel more satisfied. This visibility is important in a collectivist culture where shared experiences and peer feedback shape learning.

In addition, user compatibility also has a positive and significant impact on the user satisfaction of Saudi Arabian students. This result shows that Saudi Arabian students' user compatibility reflects that technology is effectively aligned with the student's existing values and experiences. The result is aligned with the following study

(Sidharta & Rahmahwati, 2023) which also demonstrated that technologies perceived as compatible with users' values lead to increased satisfaction. Further, these results are aligned with El-Masri, Al-Yafi and Kamal (2023) who found that technologies that resonate with users' cultural backgrounds are more readily accepted. Therefore, it is emphasized that Saudi Arabian educational institutions should focus on compatibility along with their educational and cultural context which could increase satisfaction with the Metaverse Information System. By ensuring that the Metaverse incorporates elements of traditional Saudi Arabian pedagogical practices, educators could improve students' willingness to engage. Furthermore, the development of a sense of cultural relevance could deepen students' emotional connections to their learning which could enhance both their satisfaction and commitment to using the technology. Perceived liability also has a positive and significant impact on user's satisfaction with the Saudi Arabian system. These results show that perceived trialability is an important factor that creates an ability to experiment with technology before full commitment, which is a crucial factor for user satisfaction. The results are similar to the findings of Alhalaybeh et al. (2023) which emphasized that trial experiences could significantly reduce apprehension about adopting new technologies. These results show that Saudi Arabian students should focus on perceived trialability which allows students to explore the Metaverse before extensive adoption which can reduce anxiety and enhance satisfaction. Furthermore, this approach not only builds confidence in using new tools but also allows for feedback that can refine the technology. Therefore, by prioritizing trialability, educational institutions could better facilitate a smoother transition into using innovative tools.

Further results show the positive and significant impact of perceived usefulness on the user satisfaction of Saudi Arabian students. These findings show that perceived usefulness is an important predictor of user satisfaction of Saudi Arabian students. The result is further in line with the findings of Rachmi, Asta and Kartiko (2023) who also found that students who believe technology enhances their learning experience report higher satisfaction. These findings emphasized that Saudi Arabian educational institutions should focus on the usefulness of the system because emphasizing practical applications of the Metaverse could help increase its perceived usefulness, ultimately driving student engagement. The perceived ease of ease also positively and significantly increases to user's satisfaction of Saudi Arabian students. This results asserts that perceived ease of use significantly affects user satisfaction. The result is further in line with the findings of Rachmi et al. (2023) who found that user-friendly systems are more likely to be adopted and lead to greater satisfaction. These findings emphasized that Saudi Arabian educational institutions should focus on a friendly metaverse information system which is important for increasing engagement and satisfaction. When the students are satisfied then educators can reduce barriers to technology adoption which ensures that students can focus on their educational development rather than grappling with technological challenges.

Further depicted findings show that service quality has a positive and significant impact on user satisfaction of Saudi Arabian students. These findings emphasized that service quality plays an important role in increasing Saudi Arabian student's satisfaction. The results are line with the study of Pramudito et al. (2023) where they highlighted that students who receive reliable support are more likely to report satisfaction. These findings emphasized the importance of maintaining strong service frameworks to support students in their use of innovative educational technologies. Besides, a strong support system can also empower students to troubleshoot issues independently which can increase a sense of ownership and confidence in their ability to navigate the technology. System quality and user satisfaction relationship also positively and significantly depicted in the current study. These findings show that system quality which is defined by performance and reliability becomes a critical factor for user satisfaction in educational contexts. These findings show that in the context of Saudi Arabian, there is a need for a well-functioning Metaverse Information System that can offer reliable access and performance for increasing student satisfaction. The results are consistent with the results of Pramudito et al. (2023) who indicated that system quality influences students' willingness to engage with technology. These findings show that Saudi Arabian educational institutions have consistent updates and improvements related to their system quality which demonstrates a commitment to user satisfaction.

The findings show a positive and significant impact of user satisfaction on the intention to use the Metaverse Information System. This result indicated that user satisfaction is a key determinant of continued intention to use technology. The results are supported by the findings of Ayinaddis, Taye and Yirsaw (2023) who also emphasized that satisfied users are more likely to continue using technology. These findings emphasized that Saudi Arabian educational institutions should focus on the enhancement of students' satisfaction level towards to metaverse which will likely translate into sustained engagement with the system. Furthermore,

satisfied users are more likely to advocate for the technology among peers, creating a community of engaged learners that can further enhance the educational landscape. This emphasized the importance of increasing positive user experiences to encourage the ongoing adoption of innovative educational technologies that can significantly enrich the learning environment for students. The findings are vital for increasing the technology integration in the Saudi Arabian system. By understanding the factors that influence user satisfaction with the Metaverse Information System, educators, and technology developers can create more effective, user-centered tools that address the specific needs and preferences of students. This approach not only improves the quality of education but also encourages the adoption of innovative teaching methods that will ultimately contribute to the advancement of Saudi Arabia.

Implications

The study contributed from theoretical and practical perspectives. Theoretically, the study with the TAM model, diffusion of Innovations theory, and system quality theory perspective contributed significant findings in the context of Saudi Arabian universities. Firstly, positive relationships that are identified among the constructs and user satisfaction contributed to a significant understanding of how these models can be effectively applied and expanded in this specific educational setting. Secondly, the significance of cultural compatibility in the adoption of technology emerges as a vital consideration which is contributing to the argument that existing theories should account for cultural contexts, especially in disciplines like where cultural heritage and values play a pivotal role in shaping learning experiences. Thirdly, the strong relationship between user satisfaction and the intention to use the Metaverse information system contributes to the need for further exploration of satisfaction as a central construct in technology adoption studies. Lastly, the findings also indicated that satisfaction not only affects influences on the metaverse information system but also has significant implications for further research to conduct their research and explore their new research area in the future.

Along with theoretical implications, the study also has some practical implications which are also significant in the context of Saudi Arabian education institutions. Firstly, the significant impact of perceived ease of use and system quality indicated that developers and educators should prioritize creating user-friendly interfaces and reliable systems for the Metaverse for where students may have varying levels of technological familiarity. Institutions can contribute to this goal by investing in training sessions that teach students how to effectively navigate these systems, thus reducing barriers to adoption and enhancing overall satisfaction. Moreover, the correlation between personal innovativeness and user satisfaction suggests that educators can increase a culture of exploration and experimentation with new technologies, contributing to innovative practices like collaborative projects in the Metaverse, which can greatly enhance learning experiences. Lastly, the study could also help to contribute to institutions should prioritize in providing providing strong technical support to improve service quality, which has a significant impact on user satisfaction. Establishing dedicated help desks, tutorial resources, and peer support groups can greatly contribute to enhancing students' confidence in using technology.

Conclusion and Future Directions

The research aimed to test the impact of perceived ease of use empirically, perceived usefulness, personal innovativeness, usability, perceived trialability, system quality, and service quality on intention towards metaverse through Saudi Arabian students' satisfaction. Cross-sectional research design, and Structural Equation modeling technique (SEM) through AMOS software were utilized. The study findings show that perceived ease of use, perceived usefulness, system quality, service quality, personal innovativeness, usability, and perceived trialability have a positive and significant impact on the user satisfaction of Saudi Arabian students. On the other hand, user satisfaction also has a positive and significant impact on the intention of metaverse information systems of students in Saudi Arabia. The study results with these findings contributed that improving factors such as perceived ease of use, usefulness, and quality dimensions could lead to higher user satisfaction, directly influencing Saudi Arabian students' intention to use metaverse systems. Therefore, it is suggested that educational institutions should focus on optimizing these aspects to create more engaging and efficient learning environments. By doing so, they can facilitate the broader adoption of metaverse technologies to drive innovations in all institutions.

The study with significant findings has several limitations that could explore new research areas in future studies. Firstly, the study was limited to direct effects while ignoring the mediating effect of student satisfaction. Therefore, future research could be explored on mediating effect to increase the predicted power of the model. Secondly, the study was limited to students in Saudi Arabian universities and findings could not be generalized to developed nations. Therefore, further research could be explored in developed nations to know the variations in the findings. Lastly, the study is limited to a quantitative research approach, while there is also a qualitative approach. In this regard, future research could be explored on mixed methods to increase the variations in the findings.

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Appendix: Survey Instrument

System Quality

1. Our information systems are easy to learn.
2. Equipped only with useful features and functions.
3. Flexible to make changes easily.

Service Quality

1. When IS promises to do something by a certain time.
2. When users have a problem, IS shows a sincere interest in solving it.
3. IS services are dependable.
4. IS provides its services at the time It promises to do so.
5. IS insists on error-free records.

Perceived Trialability

1. "Has to do with how easily users can try the MIS before the actual classes."
2. "It takes time to get used to MIS."
3. "I find the MIS useful after my trial."

Perceived Observability

1. "I think the MIS can be used in my daily classes."
2. "I think the MIS has a good value."
3. "My experience with the MIScan be applicable to all educational environments."

Personal compatibility

1. "I think the MIS is compatible with my studying purposes."
2. "I will use MIS because it satisfies my expectations."
3. "I believe that the MIS will suit my culture."

Personal Innovativeness

1. "I think I will use MIS in my study."
2. "I believe that I am ready to deal with new technology such as the MIS."
3. I believe technology takes innovations.

User's Satisfaction

1. "I believe the MIS has a great value in the educational environment."
2. "I believe the MIS has many advantages in my daily life."
3. I believe that MIS can increase the learning of students.

Perceived Ease of Use

1. I think the MIS is effortless."
2. I think I can use the MIS for different educational purposes because it is easy."
3. "I think the MIS will be difficult to use in certain circumstances."

Perceived Usefulness

1. "I think the MIS is useful for live lectures and forums.
2. I think the MIS adds many advantages to my study.
3. I think MIS is important for learning the latest material.

MetaVerse Information System

1. "I will definitely use the MIS in my education."

2. I will use the MISfor limited educational purposes."
3. "I think the MIS is worth using."