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ORIGINAL RESEARCH

Factors Affecting Medical Students' Acceptance of the Metaverse System in Medical Training in the United Arab Emirates

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Abstract

Aim: Medical training activities have been disrupted in many regions following the outbreak and rapid spread of the coronavirus disease 2019 (COVID-19) across the globe. The most affected areas include organizations' process of leveraging high-tech medical equipment from abroad to facilitate a practical approach to learning. Also, as countries implemented COVID-19 safety regulations, it became difficult for organizations to conduct face-to-face training. Consequently, non-face-to-face learning methods have been introduced in the medical field to enable instructors to remotely engage with learners. The current research investigated the students' perceptions of the use of metaverse systems in medical training within the medical community of the United Arab Emirates (UAE).

Methods: A conceptual model comprising the adoption properties of personal innovativeness, perceived enjoyment, and Technology Acceptance Model concepts was utilised. The current research targeted students in UAE medical universities. Data was obtained by conducting online surveys that were implemented in the winter semester of 2021/2022 between 15th February and 15th May 2022. 500 questionnaires were issued to students following their voluntary participation and 435 questionnaire responses were obtained i.e. an 87% response rate. The research team tested the measurement model employing Structural Equation Modeling using Smart Partial Least Squares Version (3.2.7).

Results: Statistically significant associations were confirmed to exist between Personal Innovativeness (PI) influenced by both the Perceived Ease of Use (PEOU), and Perceived Usefulness (PU) (β= 0.456) and (β= 0.563) at $P<0.001$. The statistically significant associations involving Perceived Enjoyment (EJ) and PEOU and PU (β= 0.554, $P<0.05$), (β= 0.571, $P<0.05$) were further confirmed. Additionally, PEOU had a relationship with PU (β= 0.863, $P<0.001$). Eventually, PEOU and PU significantly influenced the participants' inclination to use the metaverse technology with (β= 0.745, $P<0.001$) and (β= 0.416, $P<0.001$), respectively.

Conclusion: Conclusions made during the research add to the existing literature regarding technology adoption by demonstrating how adoption properties, perceived enjoyment, and personal innovativeness influence students' perceptions concerning innovational technologies used in education.

Keywords: Metaverse; COVID-19 pandemic; Medical Training; Medical Students; Technology Acceptance Model; SEM Based Analysis.

Conflicts of interest: None declared.

Introduction

With the rapidly increasing demand for digital products and services in the contemporary world, computer scientists and researchers develop ideas to improve the experiences of computer users. Among the most recent innovations in the digital world is the use of three-dimensional virtual environments (1,2). Metaverse is a term commonly used to refer to virtual and augmented reality. The term was invented in 1992 (3) where a science fiction novel was composed to describe the future of immersive 3-dimensional virtual reality technologies. Virtual reality allows users to experience diverse digital mirrors of their world and aspects that do not exist in the real world (1,4–6). Multiple research studies have been conducted in universities and other learning institutions to investigate the effectiveness of metaverse as a learning tool. Such studies focus on the implementation of metaverse through a problem-based approach where different stakeholders in the learning environment can submit queries and obtain feasible solutions to diverse problems using the three-dimensional classes and the avatar (7–10). Similarly, a study (11) confirmed that a metaverse platform constitutes a useful tool for increasing motivation and immersion among learners. Through such a learning platform, students develop real feelings toward the innovative learning strategy and benefit from self-guided learning experiences. Therefore, the metaverse has been praised to contribute to a positive learning experience.

Metaverse has also been observed to contribute to research in diverse fields. Multiple studies (7,8,12) investigate key benefits of using metaverse systems in diverse fields of research. The studies predominantly focused on real-life experiments where virtual or augmented reality is used to develop solutions to various problems. With respect to inferences from the various studies, it is important to develop a conceptual framework that takes into consideration the influential role of metaverse systems in education. Adopting such a conceptual framework could help to determine the effectiveness of the metaverse system by studying how students perceive it. Through this study, a model will be developed to describe the crucial factors for an effective learning strategy, which include Perceived Enjoyment (EJ) and Personal Innovativeness (PI). PI is influenced by two factors that include Perceived Usefulness (PU) and its Perceived Ease of Use (PEOU) (13,14). Therefore, this study will investigate how innovativeness of medical students who use the metaverse system is influenced by PEOU and PU of the technology.

The general objective is to study key factors that determine the implementation of the metaverse in the United Arab Emirates (UAE) medical education system and establish whether the PEOU and PU are depicted in the current metaverse system. The study will also describe how the technology impacts an individual's enjoyment and PI following the implementation of the metaverse system. Consequently, findings from the current study will summarise the key factors surrounding students' perceptions regarding the implementation of metaverse systems. Unlike similar past studies that have utilised the Structural Equation Modeling (SEM) strategy to develop theoretical models, the current study will integrate Technology Acceptance Model (TAM) to examine learners' inclination to adopt metaverse as a learning tool (15). Eventually, the study will validate the developed theoretical model by utilizing the Partial Least Squares -SEM (PLS-SEM) approach.

The innovation theory will be used to guide the research methodology. The theory classifies consumers of technological innovations as innovative members of society who actively seek information and innovational ideas (16,17). Users of technology are often forced to overcome their uncertainty and develop a positive inclination to use technology. Their innovativeness helps them to shape their beliefs and attitudes towards achieving greater innovation through the use of technology. PI has been observed to cause a substantial impact on a person's ability to cognitively interpret information technology which symbolises the risk-taking inclination to use technology (18,19). TAM describes how individuals' innovativeness in the use of technology is influenced their perceptions regarding its usefulness and user-friendliness (15). Therefore, the basic aspects of the proposed model comprise the perceived user-friendliness and the PU of the system. PU refers to the extent to which a user of technology believes that it will positively influence their ability to compete certain tasks. On the other hand, PEOU refers to how much a person is convinced that a technology would improve their experiences by reducing the effort required to complete certain tasks. Significant associations have been confirmed to exist involving an individual's behavioral intentions and the level of satisfaction with their use of the technology. Therefore, the conceptual model suggests that the PU and perceived user-friendliness of technology are dependent on PI, which indicates the need to leverage the metaverse system in medical education (20,21). Considering the identified assumptions, the current study theorises that:

H1: PU is positively affected by PI.
H2: PEOU is positively affected by PI.
The study defines EJ as the degree to which an individual feels enjoyment and is satisfied by their performance in certain tasks. It is often perceived as the extent to which consumers of technology gain satisfaction with the virtual reality technology. Past studies have evaluated EJ as a qualitative factor that influences the users' sense of pleasure, disgust, or hate resulting from the use of technology, which further influences their behavior (22–24). As convenience and enjoyment enable users to develop positive perceptions, the EJ of technology influences a user's inclination to use technology, which determines their level of comfort in the long run (24,25). As such, the current study hypothesises that;
H3: PU is positively affected by EJ.
H4: PEOU is positively affected by EJ.
The TAM theory describes how the perceived user-friendliness and usefulness of technology influences the users' inclination to accept and adopt it. The perceived user-friendliness is considered to be level of effectiveness and comfort that individuals experience after using an innovative technology. In contrast, PU refers to the effort-free experience that positively impacts the user's performance (26). The current study theorises that;
H5: PU is positively affected by the PEOU.
H6: An individual's intention to use metaverse system in medical training (IN) is positively affected by the PU of the technology.
H7: An individual's intention to use metaverse system in medical training (IN) is positively affected by the PEOU of the technology.
Based on the above, the study seeks to measure the acceptance and implementation of the metaverse system by analyzing the EJ and PI relative to other independent variables. The proposed research model relies on the earlier identified hypotheses as depicted in figure 1 below.

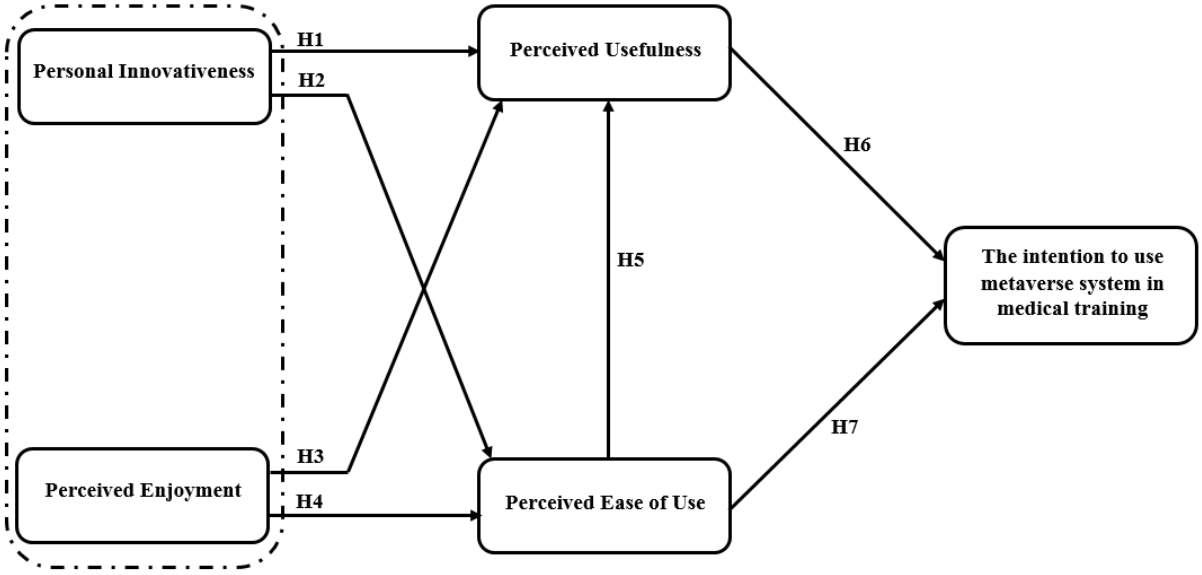

Figure 1. Research Model.

Methodology

The current research targeted learners in UAE universities. Data was obtained by conducting online surveys that were conducted in the winter semester of 2021/2022 between 15th February and 15th May 2022. A link to the survey as well as details regarding the research objectives were emailed to members of the target population. The information was also shared across the students' social media groups to maximise the response rate and gather a sufficient number of individuals to participate in the study. 500 questionnaires were issued to students following their voluntary participation and 435 questionnaire responses were obtained, which constituted an 87% response rate. The exclusive inclusion of students was since students are the most affected group of stakeholders who use the metaverse systems in the university setting. Whenever technology presents challenges to students, universities consider leveraging more efficient tools to stimulate students' performance. As instructors possess vast experience and diverse competencies, they can contribute to the university's process of leveraging new technologies that could provide better user experiences to students. The selected sample size was sufficient enough to provide the desired information during the study. As (27) suggests, a population of 1500 members ought to have an estimated number of at least 306 respondents taking part in a study. On that account, a sample size of 435 is considered large enough to meet the current research objectives. To validate its hypotheses, the study utilised a survey to collect the desired information. The survey comprised 14 items that helped to evaluate the five major constructs that the research sought to analyse. Questions used in preceding studies were restructured to concur with the needs of the current study and facilitate the applicability of conclusions. The collected data was assessed using a five-point Likert Scale based on 5 statistics that ranged between strongly agreed (5) and strongly disagree (1). An evaluation using a

SEM is efficient for the current study's sample size, which would help to test the study hypotheses (28). Although pre-established theories were used to develop the hypotheses, they focused on the implementation of the metaverse systems in the medical education setting. The research team tested the measurement model using SmartPLS Version (3.2.7) while further assessments were conducted using the path model. The construct of reliability and validity was considered when assessing the measurement model. The strategy was recommended by (29) where construct reliability was confirmed by assessing composite reliability (CR), Dijkstra-Henseler's alpha (PA), and Cronbach's alpha (CA). Additionally, validity was determined by establishing both the discriminant and convergent cogency.

Results

Participants' Description

As demonstrated in table 1, the proportion of male and female participants was 53% and 47% respectively. The age distribution of the participants was generally even with 72% of the respondents ranging between 18 years and 29 years while 28% had surpassed the age of 29. A larger proportion of the respondents were seeking university degrees with 11% having doctoral degrees, 33% having master's degrees, and 56% of them having bachelor's degrees. A purposive sampling strategy was utilised in the study due to its effectiveness in studies where respondents are willing to volunteer (30).

Table 1 . Demographic data of the respondents.

Criterion	Factor	Frequency	Percentage
Gender	Male	232	53%
	Female	203	47%
Age	Between 18 to 29	314	72%
	Between 30 to 39	78	18%
	Between 40 to 49	35	8%
	Between 50 to 59	8	2%
Education qualification	Bachelor	244	56%
	Master	145	33%
	Doctorate	46	11%

Convergent and Discriminant Validity

As demonstrated in table 2, construct reliability was confirmed as CA ranged between 0.801 and 0.857, which were higher than the standard value of 0.7 (31). The assessment also revealed that the CR ranged between 0.812 and 0.859, which is greater than the standard threshold of 0.7 (32). Therefore, it was necessary to consider evaluating and reporting CR using PA to check for the reliability of the research data (33). Dijkstra-Henseler's alpha ought to present values greater than 0.07 in investigative studies and values that exceed 0.8 for other types of research (31,34). As depicted in Table 2 below, the reliability coefficients for all measurements exceed 0.70, which confirms the construct reliability. Consequently, the constructs considered in the study were reported to be unbiased by the end of the study. The Average Extracted Value (AVE) and factor loading were also

tested during the study. Such analyses facilitate the confirmation of convergent validity, which determines the overall reliability of research conclusions (29). As depicted in Table 2, the factor loadings exceeded the standard value of 0.7 while AVE values ranged between 0.625 and 0.755, which exceeds the standard value of 0.5. Therefore, convergent validity was confirmed for all constructs.

The Heterotrait-Monotrait ratio (HTMT) is measured as the primary strategy to determine Discriminant validity (29). The HTMT values for all constructs were less than the standard value of 0.85 (35), which indicates the conformity of the HTMT ratio as presented in Table 3. As such, the discriminant validity was confirmed. As such, no significant inconsistencies related to validity and reliability were observed when conducting the assessment. Findings from the analysis confirmed feasibility of the structural model in analyzing the research data.

Table 2. Convergent Validity Results (Factor Loading & Cronbach's Alpha,).

Constructs	Items	Factor Loading	Cronbach's Alpha	CR	PA	AVE
Perceived Enjoyment	EJ1	0.815	0.851	0.853	0.850	0.625
	EJ2	0.829				
	EJ3	0.836				
Personal Innovativeness	PI1	0.854	0.857	0.859	0.853	0.705
	PI2	0.798				
	PI3	0.792				
Perceived Ease of Use	PEOU1	0.841	0.826	0.832	0.821	0.659
	PEOU2	0.836				
	PEOU3	0.856				
Perceived Usefulness	PU1	0.790	0.825	0.819	0.823	0.755
	PU2	0.799				
	PU3	0.810				
Users' Intention to Use the MS	IN1	0.822	0.801	0.812	0.802	0.702
	IN2	0.840				

Table 3. Heterotrait-Monotrait Ratio (HTMT).

	EJ	PI	PEOU	PU	IN
EJ					
PI	0.765				
PEOU	0.369	0.632			
PU	0.756	0.619	0.531		
IN	0.335	0.577	0.605	0.768	

Hypotheses Testing Results

Key variables of the study had percentages of variance of 72%, 76%, and 70% respectively as presented in Figure 2 and Table 4. Beta (β) values, t-values, and p-values presented in Table 5. The empirical data used in the study confirmed the hypotheses H1, H2, H3, H4, H5, H6, and H7. Statistically significant associations were confirmed to exist between PI was observed to be influenced by both the PEOU and PU (β= 0.456) and (β= 0.563) at P<0.001, which confirms hypotheses H1 and H2. The statistically significant associations involving EJ, PEOU and PU (β= 0.554, P<0.05), (β= 0.571, P<0.05) confirmed the hypotheses H3 and H4. Additionally, PEOU had a considerable relationship with PU (β= 0.863, P<0.001), which confirmed the validity of hypothesis H5. Eventually, PEOU and PU significantly influenced the participants' inclination to use the technology with (β= 0.745, P<0.001) and (β= 0.416, P<0.001), respectively, which confirmed the hypotheses H6 and H7.

Table 4. R^2 of the Endogenous Latent Variables.

Constructs	R^2	Results
IN	0.698	High
PEOU	0.724	High
PU	0.762	High

Table 5. Hypotheses-Testing of the Research Model (Significant at p** < = 0.01, p* < 0.05).

H	Relationship	Path	*t*-value	*p*-value	Direction	Decision
H1	PI -> PU	0.563	10.217	0.002	Positive	Supported**
H2	PI -> PEOU	0.456	8.302	0.005	Positive	Supported**
H3	EJ -> PU	0.571	6.557	0.015	Positive	Supported*
H4	EJ -> PEOU	0.554	5.689	0.018	Positive	Supported*
H5	PEOU -> PU	0.863	15.083	0.000	Positive	Supported**
H6	PU -> IN	0.416	18.226	0.000	Positive	Supported**
H7	PEOU -> IN	0.745	17.119	0.000	Positive	Supported**

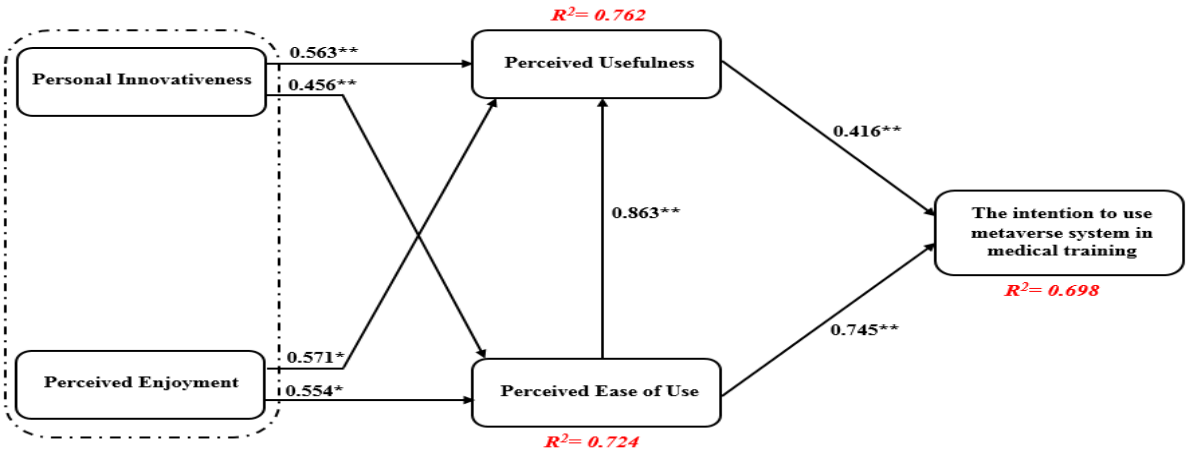

Figure 2. Path Coefficient of the Model (Significant at p** < = 0.01, p* < 0.05).

Discussion and Conclusion

This study investigated the students' perceptions of the use of metaverse systems in medical training within the medical community in the UAE. In essence, the metaverse system constitutes one of the technologies that will cause a meaningful impact on medical education. The innovative technology facilitates various educational practices in the contemporary world. The technology is likely to replace the internet and introduce greater innovation to transform teaching and learning. Having investigated the perceptions among university students regarding the implementation of the metaverse technology in education within the UAE, the current study found that PI, EJ, PU, and PEOU factors are significantly affecting the learners' perceptions concerning the use of metaverse in medical education at P<0.001.

The current study found that there exists a close association between the learners' perceptions concerning the use metaverse and their levels of innovativeness. Indeed, this finding from the study concurred with past research works (15,18-21). Users of technology are often forced to overcome their uncertainty and develop a positive inclination to use technology. Their innovativeness helps them to shape their beliefs and attitudes towards achieving greater innovation through the use of technology. PI has been observed to cause a substantial impact on a person's ability to cognitively interpret information technology which symbolises the risk-taking inclination to use technology (18,19). Furthermore, the basic aspects of the TAM model comprise the perceived user-friendliness and the PU of the system. In addition, the study findings revealed the EJ factor has positive effects on PU and PEOU (P<0.001). Past studies have evaluated EJ as a qualitative factor that influences the users' sense of pleasure, disgust, or hate resulting from the use of technology, which further influences their behavior (22–24). As convenience and enjoyment enable users to develop positive perceptions, the EJ of technology influences a user's inclination to use technology, which determines their level of comfort in the long run (24,25). The students' perceptions regarding the technology were further influenced by

perceptions regarding the PEOU and eventual PU of the metaverse system in the education setting. Findings from the study concurred with past research works as it describes students' experiences with innovational technology used in the contemporary education sector. Certainly, several technology theories describe how the perceived user-friendliness and usefulness of technology influences the users' inclination to accept and adopt it. The perceived user-friendliness is considered to be level of effectiveness and comfort that individuals experience after using an innovative technology. In contrast, PU refers to the effort-free experience that positively impacts the user's performance (26).

However, the study had several limitations that included its exclusive reliance on two variables that include PI and EJ. Additionally, the TAM constructs only used two constructs of PEOU and PU to make the process of measurement easier and focus the research process on the key factors that influence the participants' innovativeness. As the survey link was shared on social media, there was a possibility of submission of biased information from the respondents. Despite the various limitations, the study concludes that the metaverse system can be used to facilitate different activities and processes in the contemporary world. Metaverse was found to be particularly influential in the educational setting. Therefore, the study restricted its focus to the education setting in which the metaverse technology will cause meaningful impacts on teaching and learning.

References

1. Collins C. Looking to the future: Higher education in the Metaverse. Educ Rev. 2008;43(5):51–63.
2. Maccallum K, Parsons D. Teacher perspectives on mobile augmented reality: The potential of metaverse for learning. In: World Conference on Mobile and Contextual Learning. 2019. p. 21–8.
3. Stephenson N. Snowcrash. London: ROC. Penguin; 1992.
4. Díaz J, Saldaña C, Avila C. Virtual World as a Resource for Hybrid Education. Int J Emerg Technol Learn. 2020;15(15):94–109.
5. Arcila JBP. Metaversos Para el máster iberoamericano en educación en entornos virtuales. Etic@ net Rev científica electrónica Educ y Comun en la Soc del Conoc. 2014;14(2):227–48.
6. Márquez I. Metaversos y educación: Second Life como plataforma educativa. Rev ICONO14 Rev científica Comun y Tecnol emergentes. 2011;9(2):151–66.
7. Farjami S, Taguchi R, Nakahira KT, Fukumura Y, Kanematsu H. W-02 Problem Based Learning for Materials Science Education in Metaverse. In: JSEE Annual Conference International Session Proceedings 2011 JSEE Annual Conference. Japanese Society for Engineering Education; 2011. p. 20–3.
8. Kanematsu H, Kobayashi T, Ogawa N, Barry DM, Fukumura Y, Nagai H. Eco car project for japan students as a virtual PBL class. Procedia Comput Sci [Internet]. 2013;22:828–35. Available from: http://dx.doi.org/10.1016/j.procs.

2013.09.165
9. Kanematsu H, Kobayashi T, Ogawa N, Fukumura Y, Barry DM, Nagai H. Nuclear energy safety project in metaverse. In: Intelligent Interactive Multimedia: Systems and Services. Berlin, Heidelberg: Springer Berlin Heidelberg; 2012. p. 411–8.
10. Barry DM, Kanematsu H, Fukumura Y, Ogawa N, Okuda A, Taguchi R. International comparison for problem based learning in metaverse. ICEE ICEER. 2009;6066.
11. Go SY, Jeong HG, Kim JI, Sin YT. Concept and developmental direction of metaverse. Korea Inf Process Soc Rev. 28:7–16.
12. Han H-C "sandrine." From visual culture in the immersive metaverse to visual cognition in education. In: Cognitive and Affective Perspectives on Immersive Technology in Education. IGI Global; 2020. p. 67–84.
13. Wu J-H, Wang S-C. What drives mobile commerce?: An empirical evaluation of the revised technology acceptance model. Inf Manag. 2005;42(5):719–29.
14. Chang S-C, Tung F-C. An empirical investigation of students' behavioural intentions to use the online learning course websites. Br J Educ Technol [Internet]. 2007;0(0):070625111823003-??? Available from: http://dx.doi.org/10.1111/j.1467-8535.2007.00742.x
15. Davis FD. Perceived usefulness, perceived ease of use, and user acceptance of information technology. MIS Q [Internet]. 1989;13(3):319. Available from: http://dx.doi.org/10.2307/249008
16. Al-Maroof R, Akour I, Aljanada R, Alfaisal A, Alfaisal R, Aburayya A, et al. Acceptance determinants of 5G services. International Journal of Data and Network Science. 2021;5:613–628.
17. Taryam M, Alawadhi D, Al Marzouqi A, Aburayya A, Albaqa'een A, Alfarsi A, et al. The impact of the covid-19 pandemic on the mental health status of healthcare providers in the primary health care sector in Dubai. Linguistica Antverpiensia. 2021;2995–3015.
18. Rogers EM. Diffusion of innovations. Free Press. New York. 2003;551.
19. Alaali N, Al Marzouqi A, Albaqaeen A, Dahabreh F, Alshurideh M, Mouzaek E, et al. The impact of adopting corporate governance strategic performance in the tourism sector: A case study in the Kingdom of Bahrain. J Leg Ethical Regul Issues. 2021;24(1):1–18.
20. Lee Y-H, Hsieh Y-C, Hsu C-N. Adding innovation diffusion theory to the technology acceptance model: Supporting employees' intentions to use e-learning systems. J Educ Technol Soc. 2011;14(4).
21. Gor K. Factors Influencing the Adoption of Online Tax Filing systems in Nairobi, Kenya. Strateg J Bus Chang Manag. 2015;2(77):906–20.

22. So KKF, Kim H, Oh H. What makes Airbnb experiences enjoyable? The effects of environmental stimuli on perceived enjoyment and repurchase intention. J Travel Res [Internet]. 2021;60(5):1018–38. Available from: http://dx.doi.org/10.1177/0047287520921241
23. Liu Z, Park S. What makes a useful online review? Implication for travel product websites. Tour Manag [Internet]. 2015;47:140–51. Available from: http://dx.doi.org/10.1016/j.tourman.2014.09.020
24. Mohamad MA, Universiti Teknologi Mara Cawangan Terengganu, Malaysia, Radzi SM, Hanafiah MH, Universiti Teknologi MARA, 42300 Puncak Alam, Selangor, Malaysia, Universiti Teknologi MARA, 42300 Puncak Alam, Selangor, Malaysia. Understanding tourist mobile hotel booking behaviour: Incorporating perceived enjoyment and perceived price value in the modified Technology Acceptance Model. Tour manag stud [Internet]. 2021;17(1):19–30. Available from: http://dx.doi.org/10.18089/tms.2021.170102
25. Venkatesh V, Bala H. Technology acceptance model 3 and a research agenda on interventions. Decis sci [Internet]. 2008;39(2):273–315. Available from: http://dx.doi.org/10.1111/j.1540-5915.2008.00192.x
26. Davis FD. A technology acceptance model for empirically testing new end-user information systems: Theory and results. Massachusetts Institute of Technology; 1985.
27. Krejcie R V, Morgan DW. Determining sample size for research activities. Educ Psychol Meas. 1970;30(3):607–10.
28. Chuan CL, Penyelidikan J. Sample size estimation using Krejcie and Morgan and Cohen statistical power analysis: A comparison. J Penyelid IPBL. 2006;7:78–86.
29. Hair J, Hollingsworth CL, Randolph AB, Chong AYL. An updated and expanded assessment of PLS-SEM in information systems research. Ind manag data syst [Internet]. 2017;117(3):442–58. Available from: http://dx.doi.org/10.1108/imds-04-2016-0130
30. Hamadneh S, Hassan J, Alshurideh M, Al Kurdi B, Aburayya A. The effect of brand personality on consumer self-identity: the moderation effect of cultural orientations among British and Chinese consumers. Journal of Legal, Ethical and Regulatory Issues. 2021;24:1-14.
31. Nunnally JC, Bernstein IH. Psychometric theory. McGraw-Hill, New York. 1994.
32. Kline RB. Principles and practice of structural equation modeling. Guilford publications; 2015.
33. Dijkstra TK, Henseler J. Consistent and asymptotically normal PLS estimators for linear

structural equations. Comput Stat Data Anal [Internet]. 2015;81:10–23. Available from: http://dx.doi.org/10.1016/j.csda.2014.07.008

34. Hair JF, Ringle CM, Sarstedt M. PLS-SEM: Indeed a silver bullet. J Mark Theory Pract [Internet]. 2011;19(2):139–52. Available from: http://dx.doi.org/10.2753/mtp1069-6679190202
35. Henseler J, Ringle CM, Sarstedt M. A new criterion for assessing discriminant validity in variance-based structural equation modeling. J Acad Mark Sci [Internet]. 2015;43(1):115–35. Available from: http://dx.doi.org/10.1007/s11747-014-0403-8