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Investigating the Acceptance of Meta-Universe Technology for Football Course Training among University Physical Education Teachers: A UTAUT2 and TTF Model Approach

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Abstract

This academic paper explores the integration of artificial intelligence (AI) and virtual reality (VR) in the sports industry, specifically in the context of improving the quality of football teaching in universities. The growing impact of the metaverse concept on science and technology necessitates the utilization of AI as a critical technology in virtual worlds. Furthermore, the success of AI in various fields, coupled with the advancements in information technology, underscores the inevitability of integrating AI and sports. As traditional sports undergo a quality revolution, the integration of AI and virtual reality becomes increasingly crucial. Therefore, this study focuses on the use of VR to enhance the quality of football teaching at the university level.Virtual reality, characterized by its immersive, interactive, and imaginative features, is deemed suitable for constructing physical education courses. This paper explores the strategies for improving the quality of university football courses within the context of the mobile Internet era. By combining physical education with virtual reality technology, the effects of virtual reality-based physical education curriculum and the factors influencing the willingness of physical education teachers to adopt virtual reality technology are examined. To enhance the interpretation of acceptance intentions, this study integrates the Unified Theory of Acceptance and Use of Technology 2 (UTAUT2) model with the Task-Technology Fit Theory (TTF), resulting in a novel conceptual framework. Moreover, quantitative research based on collected data is conducted. The findings demonstrate that performance expectation, promotion conditions, hedonic motivation, price value, and individual innovation ability serve as significant predictors of acceptance intentions towards virtual reality technology.

Keywords:Metaverse, University football teaching, Virtual space, UTAUT2, TFF

1 INTRODUCTION

Due to the epidemic's long-term impact, physical education has gradually shifted from offline to online. To overcome time and space constraints, we see digital technology enabling online physical education courses (Faqih,2021). Due to the large number of physical education teachers in universities and universities affected by the epidemic, the online course model is increasingly popular (Sukendro et al., 2020). At the 2022 Winter Olympics in Beijing, multi-element space technology was used. 3D data of the whole area is captured by 360°VR for 360° playback. The use of VR virtual reality technology on the training ground for the Winter Olympics has led to the development of "invisible coaches" on the training ground. The five-axis and six-degree-of-freedom electric simulation sports training system introduces the concept of aviation simulation training in sports. Virtual reality technology, digital simulation technology of sports items, and other meta-universe platform technologies provide athletes with a realistic training environment like the competition scene. The system can help athletes increase training frequency by several orders of magnitude and develop muscle memory for the course. According to simulator monitoring data, coaches can judge the time and amplitude of athletes' strength output to formulate more targeted training plans (China Electronic News, 2022). At the 2022 World Cup in Qatar, VR/AR, artificial intelligence, big data, and other virtual reality technologies are everywhere. While other industries are exploring the path to "virtual worlds," European elite football has begun using VR virtual reality devices to help players recover from injuries and "recreate" game scenes during daily training sessions to help players adapt to immersive gaming scenarios and psychological pressures. Half of Premier League clubs now use VR to help players improve their fitness and performance.

Research has shown that interactive electronic content modules are more effective for mathematical calculation and information retention than the traditional methods used by university teachers in football courses (Prabakaran & Saravanakumar, 2020). Online courses may be the future trend, as they are convenient for everyone and allow users to adjust their schedule according to their own time, provide the latest content at any time, and maximize their potential (Radha et al., 2020). Combining online courses and artificial intelligence promotes user personalization and provides the best learning experience (Mansor et al., 2020). Virtual world tools have entered the sports industry to expand the scene. It is widely recognized for its ability to be used in online courses and its potential for future research (Wang & Burton, 2013). The metaverse (VoRetx) platform allows users to create virtual worlds. Users can explore virtual worlds and interact with people (avatars). All kinds of social activities in the virtual world mimic the real world. By using a virtual 3D environment, teachers can interact with experts in real-time through the platform (jovanoviz&milosavljevizi, 2022).

With the continuous development of metauniverse technology, more and more scholars have begun to study the technology related to the metauniverse. Compared with the traditional physical education curriculum, the use of met spatial technology in physical education has overcome space limitations and other aspects. Online courses can benefit from real engagement by providing an interactive experience similar to traditional courses. Course resources can be quickly mobilized through the Internet, and its form and participation experience are more attractive than the traditional boring course way. It differs from sports video games because it focuses more on natural physical movement and real-time virtual interaction than simple controller or button operations. Although the traditional curriculum method is still dominant, it obviously cannot meet the curriculum needs of today's university teachers. This paper discusses the willingness of physical education teachers in universities and universities to use virtual reality technology in curriculum training. A feasibility study is underway to assess whether meta comes can be used in football lessons and to determine the intentions of university faculty using the technology. This study explores the feasibility of integrating meta-cosmic technology into the physical education curriculum. It can guide other scholars who intend to integrate meta-cosmic technology into physical education teaching. There is ample evidence that in the context of COVID-19, online courses should be combined to accelerate the pace of class. Metaverse technology has a positive impact on course participants. Through the use of virtual world technology, participants will be immersed in a virtual environment, combined with VR, AR, and other technologies, so that participants feel there, increasing the sense of the reality of participants in online courses. Due to the complexity of technical movements, tactics, and coordination, by combining virtual technology with physical education courses, participants can learn training techniques, tactics, and refereeing knowledge through a virtual environment, combined with scientific real-time guidance and analysis from experts. The most probable calculation method is used to analyze the collected data, and some suggestions are put forward to apply the meta-universe technology in physical education teaching to promote the improvement of physical education curriculum methods.

2 LITERATURE REVIEW

2.1 Metaverse

What is a metaverse? Neil Stephenson coined the term Hyperspace in his 1992 science fiction novel Avalanche. The novel envisions realistic avatars meeting in 3D buildings and other virtual reality environments that coexist with the real world. However, the idea of virtual worlds can be traced back to E.M. Forster's 1909 novel The Machine Stops. This short science fiction novel depicts a world where an environmental disaster has rendered Earth uninhabitable, forcing nearly all humanity to live in separate pods. In Foster's fictional world, a highly sophisticated global machine provides all human needs - from clean air, light, nutrition, and shelter to higher needs such as entertainment, literature, music, and social interaction. Metaverse piqued interest again more than a century after The Machine Stops was published when Facebook rebranded itself as "Meta" (Metaverse, Inc., Jin, 2021). While Foster's concept of a virtual world in the book refers to a society that lives off a global machine, the concept of a virtual world we are discussing - a parallel digital world where realistic avatars meet in a 3D virtual reality environment - is more in line with the concept of Stephenson's novel (Ball, 2021; · Caulfield,2021).

In short, a virtual world is a collective, persistent, interactive parallel reality formed by synthesizing all virtual worlds into one universe that an individual can traverse seamlessly. People can use digital avatars to inhabit virtual worlds and experience them in various forms, including augmented reality (AR), virtual reality, and mixed reality (XR; Ball,2021). A virtual world is a parallel reality in which humans can work, play and communicate. However, it is essential to note that virtual worlds are not just virtual versions of the Internet as we know it today; Instead, virtual worlds completely replaced the Internet as we know it today and allowed its users to reside on the Internet (Herrman & Browning, 2021). Although the concept of parallel virtual worlds has been seriously discussed for more than two decades, the collective experience of lockdown and social distancing requirements associated with covid-19, and the resulting disconnect and isolation, has accelerated the collective imagination of creating alternative realities. In this reality, individuals can indeed interact with others and share experiences in real-time with thousands or even millions of people at any time. The metaverse is a world where individuals can travel freely whenever and wherever they want. In this world, any experience is possible and easily accessible.

2.2 Virtual Reality Technology

Virtual reality technology (VR), a virtual mirror or soul mirror technology, is a new practical technology developed in the 20th century. Virtual reality technology includes computers, electronic information, simulation, and other technologies. Its primary realization method is mainly based on the computer, the use and integration of three-dimensional graphics technology, multimedia technology, simulation technology, display technology, servo technology, and other latest high-tech achievements, with the help of computers and other equipment, the generation of visual, tactile, olfactory and other sensory experience of the realistic virtual world, so that people in the virtual world have an immersive experience. With the continuous development of social productivity and science and technology, the demand for VR technology is increasing in various industries.

3 THEORETICAL BACKGROUND AND HYPOTHSES

3.1 Task-Technology Fit

Although metaverse technology has unique capabilities, users will only use it if its functions meet their specific needs and help improve their work abilities. The ability of technology to support tasks can be explained by the Task-Technology Fit (TTF) model. Goodhue and Thompson (1995) conceptualized TTF as the degree of match between current technological capabilities and given task requirements. In other words, TTF is directly related to performance outcomes (Wu & Chen, 2017). Physical education courses require demonstrations, teaching, and interpersonal interaction. In this context, university physical education teachers can use metaverse technology to provide better courses. New technologies, such as the metaverse in the sports industry, depend on individual, technological, and personal characteristics. Therefore, TTF is a crucial variable that can be combined with the UTAUT2 framework to make the model of metaverse acceptance more complete. Although researchers have widely applied TTF to mobile technology, it is rarely used in sports-related applications. As previous studies have shown that the perceived task-technology fit is positively related to individuals' willingness to accept technology (Chang et al., 2023; Faqih & Jaradat, 2021; Lin et al., 2020; Wu & Chen, 2017), we integrate TTF into the UTAUT2 framework and propose the following research hypotheses:

H1: Technology Characteristics has a significant positive effect on Task Technology Fit.

H2: Task Characteristics has a significant positive effect on Task Technology Fit.

H3: Technology Characteristics has a significant positive effect on Effort expectancy.

H4: Task Technology Fit has a significant positive effect on Performance expectancy.

H5: Task Technology Fit has a significant positive effect on Adoption Intention to the metaverse.

3.2 UTAUT2

The most commonly used theories in technology acceptance are TAM, TPB, UTAUT, DOI, and TOE. DOI and TOE frameworks operate at the company level, while TAM, TPB, and UTAUT operate at the individual level (Al-Mamary et al., 2016). Venkatesh et al. (2012) extended the UTAUT theory by adding the factors of hedonic motivation, price value, and habitual behavior to the original UTAUT. UTAUT2 thus became a more robust predictive framework. As a technology acceptance framework, UTAUT2 is a valuable model for investigating the acceptance of innovative new technologies in various cultural and social backgrounds (Arain et al., 2019; García de Blanes Sebastián et al., 2022; Gupta & Dogra, 2017; Schmitz et al., 2022; Schomakers et al., 2022). Since its introduction in 2012, UTAUT2 has attracted the attention of many researchers studying the acceptance of innovative technologies in different environments and fields (Tamilmani et al., 2021).Arpaci et al. (2022) investigated the social sustainability issues of Metaverse by integrating UTAUT2 and the Big Five personality traits. Based on the actual environment of the sports industry, this study selected effort expectancy, performance expectancy, social influence, facilitating conditions, hedonic motivation, and price value from the UTAUT2 framework as predictive variables and proposed the following hypotheses based on the UTAUT2 theoretical framework:

H6: Effort expectancy has a significant positive effect on Adoption Intention to the metaverse.

H7: Performance expectancy has a significant positive effect on Adoption Intention to the metaverse.

H8: Social influence has a significant positive effect on Adoption Intention to the metaverse.

H9: Facilitating conditions has a significant positive effect on Adoption Intention to the metaverse.

H10: Hedonic motivation has a significant positive effect on Adoption Intention to the metaverse.

H11: Price value has a significant positive effect on Adoption Intention to the metaverse.

3.3 Personal Innovativeness

Personal innovation is "an individual's willingness to try out any new technology" (Agarwal & Prasad, 1998). Some studies have found that personal innovation ability directly affects users' acceptance of new technology (Girod et al., 2017; Mazman Akar, 2019; Sagnier et al., 2020). Cheng and Huang (2013) indicate that individuals with higher levels of personal innovation tend to focus more on the advantages of innovative technology rather than the risks. In addition, the diffusion of innovation theory suggests that people with high innovation ability are more likely to adopt new technology and services, better deal with uncertainty, and underestimate the impact of risks (Agag & El-Masry, 2016). Given these studies indicating the direct impact of personal innovation on users' acceptance of technology, we propose the following hypothesis:

H12: Personal Innovativeness has a significant positive effect on Adoption Intention to the metaverse.

3.4 Conceptual Framework

As shown in Figure 1, in order to enhance the explanatory power of the UTAUT2 model for the acceptance of metaverse technology by university sports teachers, the UTAUT2 model was combined with the task-technology fit theory (TTF) to generate a more robust conceptual framework that can enhance the explanation of acceptance intention. At the same time, considering that individual innovativeness may be an essential predictor variable, it was also incorporated into the conceptual framework.

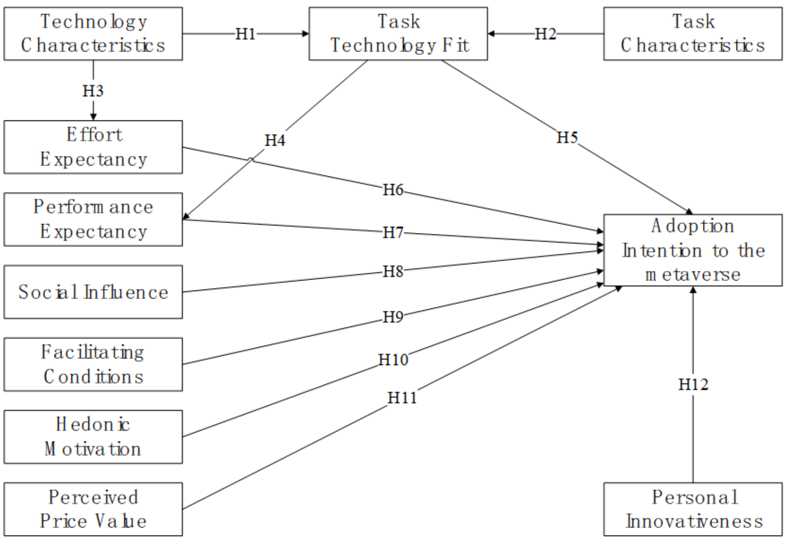

Figure 1 Conceptual Framework

4 MATERIALS AND METHODS

4.1 Participants

A total of 295 Chinese university football teachers participated in this study. Among them, 207 were male, accounting for 66.6%; 104 were female, accounting for 33.4%. There were 74 people aged 20-25, accounting for 25%; 97 people aged 26-30, accounting for 32.9%; 80 people aged 31-40, accounting for 27.1%; 30 people aged 41-50, accounting for 10.2%; and 14 people aged 51-60, accounting for 4.7%. Of these, 260 people (88.1%) have used or experienced VR, AR, or relevant technologies in the metaverse, while the remaining 57 people (19.3%) have not used or experienced relevant technologies. Since the efficacy analysis of PLS-SEM is equivalent to the efficacy analysis of the most complex multiple regression model in the model, the most complex regression model has eight predictive variables in this study. Based on previous similar studies (Faqih & Jaradat, 2021), it is assumed here that the minimum value of representing model effect size is 0.10. The statistical power is set to 0.8, and the confidence level is set to 0.05. The minimum required sample size was calculated using G*Power 3.1.9.7 and the result was 159. This study has 295 research subjects, far more than the required sample size.

4.2 Measures

The scales for the three latent variables Task Characteristics, Technology Characteristics, and Task Technology Fit involved in the Task Technology Acceptance Model were adapted from other studies on the willingness to accept augmented reality technology by scholars (Paulo et al., 2018). After reading questions similar to “In the metaverse, virtual reality technology can be used for sports actions,” participants rated the description content such as “showing sports actions at any time,” with each question having a 5-point scale ranging from 1 (very inconsistent) to 5 (very consistent). The scales for the six latent variables involved in the Unified Theory of Acceptance and Use of Technology 2 (UTAUT2) model, which studies people’s willingness to accept augmented reality and metaverse technology, were adapted from other scholars’ studies using the UTAUT2 model. After reading questions similar to “For your sports work, what is your performance expectation for the metaverse and other virtual reality technologies?” participants rated the description content such as “the metaverse is very helpful for me to do sports work,” with each question having a 5-point scale ranging from 1 (very inconsistent) to 5 (very consistent). The measurement scale for Personal Innovativeness was adapted from a study by Seong and Hong (2022) on the willingness to use the virtual reality sports game “Screen Golf.” After reading questions similar to “For some new technologies encountered in life and work, my attitude is usually...” participants rated the description content such as “I tend to use new technologies in front of friends and family,” with each question having a 5-point scale ranging from 1 (very inconsistent) to 5 (very consistent). The specific questions of the measurement scale are provided in Appendix 1.

4.3 Data analysis

In this study, the data was processed and analyzed using SPSS26.0 and Smart PLS 3.2.9 software. SPSS26.0 was used for descriptive statistical analysis of the data and Harman single factor test based on exploratory factor analysis. Smart PLS 3.2.9 was used to evaluate the measurement model and to test the significance of the hypothesis.

4.4 Transparency and Openness

All data, program code and other methods developed by others in this study have been appropriately cited in the text and are listed in the References section. The data on which the study conclusions are based are available and can be accessed in the supplementary information on the website. In this study, the authors abide by the transparency and openness of the journal and can ensure the credibility and quality of this academic research. The authors allow other researchers to replicate and build on the study with the promise that there will be no fraud or misconduct. The authors will provide detailed information about the methodology and data of this study. By promoting transparency and openness, we advance the scientific field and ensure the integrity of the results of this research.

5 RESULTS AND DISCUSSION

5.1 Test for common method deviation

Firstly, the Harman single-factor test based on exploratory factor analysis was used for standard method deviation. Exploratory factor analysis was performed on all measurement items corresponding to latent variables using SPSS, with principal component analysis for extraction and no rotation. The results obtained are shown in Table 1. If only one factor with an eigenvalue more significant than one is obtained, or if the first factor explains more than 50% of the variance, it indicates a severe issue of standard method variance. However, if multiple factors are obtained, and the variance of the first factor is less than 50%, it indicates that the issue of standard method variance is mild (Podsakoff & Organ, 1986). In this study, ten factors with an eigenvalue more significant than one were obtained, and the variance contribution rate of the first factor was 25.071%, far less than the critical value of 50%.

This article also tested for typical variance deviation using the Full Collinearity Assessment Approach. According to the recommendation of Kock and Lynn (2012), a column was added to the dataset analyzed in this study, and random numbers generated by the function in SPSS for uniform distribution were used to fill it. Then, the data was imported into Smart PLS, and a multiple regression model was constructed with the generated random variable as the dependent variable and other latent variables in this study as independent variables. After model construction, the PLS-SEM algorithm in Smart PLS software was used for estimation, and the obtained Variance Inflation Factor (VIF) indicators are shown in Table 2. Kock (2015) suggests that there may be collinearity issues if VIF is more significant than 3.3, indicating that the standard method deviation may affect the model. Therefore, if all VIFs generated by the Full Collinearity Assessment Approach are equal to or less than 3.3, it can be concluded that the model has no issue with standard method deviation. In this study, the maximum VIF value obtained was 1.59.

In summary, the statistical results of the two standard method deviation tests demonstrate that this study's typical method deviation is not severe and will not affect the subsequent model construction.

Table 1 Total Variance Explained

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	9.026	25.071	25.071	9.026	25.071	25.071
2	2.298	6.385	31.456	2.298	6.385	31.456
3	2.089	5.803	37.258	2.089	5.803	37.258
4	1.962	5.450	42.709	1.962	5.450	42.709
5	1.730	4.805	47.513	1.730	4.805	47.513
6	1.596	4.432	51.946	1.596	4.432	51.946
7	1.490	4.138	56.084	1.490	4.138	56.084
8	1.415	3.930	60.013	1.415	3.930	60.013
9	1.368	3.799	63.813	1.368	3.799	63.813
10	1.304	3.621	67.434	1.304	3.621	67.434
11	0.997	2.769	70.203			
……						
36	0.202	0.562	100.000			

Table 2 Variance inflation factor (VIF) for all constructs

Research Variables	Random Variable as a Dependent Variable
Adoption Intention to metaverse	1.59
Effort Expectancy	1.12
Facilitating conditions	1.06
Hedonic Motivation	1.05
Performance Expectancy	1.28
Personal Innovativeness	1.29
Price Value	1.07
Social Influence	1.25
Task Characteristics	1.18
Task Technology Fit	1.14
Technology Characteristics	1.04

5.2 Measurement Model Analysis

According to the recommendations of Hair et al. (2016), the evaluation of reflective measurement models includes internal consistency reliability, indicator reliability, convergent validity, and discriminant validity. Internal consistency reliability is evaluated using Cronbach's alpha and composite reliability. Cronbach's alpha is the lower limit of internal consistency reliability, while composite reliability is the upper limit. Both Cronbach's alpha and composite reliability should be above 0.7. Convergent validity is evaluated using the average variance extracted (AVE), which should be above 0.5. Indicator reliability is evaluated using outer loadings, which should be above 0.7. If the composite reliability (CR) is above 0.7 and the AVE is above 0.5, then outer loadings between 0.4 and 0.7 are also acceptable. Discriminant validity can be evaluated using the HTMT criterion or the Fornell-Larcker criterion. The HTMT criterion suggests that the value should be below 0.85 or 0.9. In contrast, the Fornell-Larcker criterion suggests that the square root of AVE should be greater than the maximum correlation with any other latent variable.

As shown in Table 3, Cronbach's alpha values in this study fall between 0.749 and 0.868, which exceed the recommended value of 0.7. The CR values of composite reliability range between 0.857 and 0.910, exceeding the recommended value. The AVE values of convergent validity range between 0.629 and 0.765, which are all above 0.5. The outer loading values range between 0.784 and 0.882, all above 0.7. Table 4 shows the results of the Fornell-Larcker criterion, indicating that the square root of AVE (in bold) is greater than the correlation between latent variables. This indicates that the measurement model has reached a good standard of reliability and validity and can be used for subsequent structural model analysis.

Table 3 Reliability and validities

Latent Variables	Items	Loadings	Cronbach's Alpha	CR	AVE
Task Characteristics(TaC)	TaC1	0.840	0.772	0.868	0.687
	TaC2	0.833			
	TaC3	0.812			
Technology Characteristics(TeC)	TeC1	0.792	0.804	0.871	0.629
	TeC2	0.791			
	TeC3	0.784			
	TeC4	0.806			
Task Technology Fit (TTF)	TTF1	0.817	0.772	0.868	0.687
	TTF2	0.852			
	TTF3	0.816			
Performance expectancy (PE)	PE1	0.841	0.809	0.887	0.724
	PE2	0.869			
	PE3	0.843			
Effort expectancy (EE)	EE1	0.845	0.770	0.867	0.685
	EE2	0.821			
	EE3	0.816			
Social influence (SI)	SI1	0.845	0.769	0.865	0.682
	SI2	0.832			
	SI3	0.800			
Facilitating conditions (FC)	FC1	0.804	0.825	0.884	0.656
	FC2	0.813			
	FC3	0.822			
	FC4	0.800			
Hedonic motivation (HM)	HM1	0.836	0.749	0.857	0.666
	HM2	0.814			
	HM3	0.797			
Price value(PV)	PV1	0.882	0.847	0.907	0.765
	PV2	0.874			
	PV3	0.869			
Personal Innovativeness (Inno)	Inno1	0.829	0.868	0.910	0.716
	Inno2	0.830			
	Inno3	0.863			
	Inno4	0.862			
Adoption Intention to the metaverse(AI)	AI1	0.822	0.786	0.875	0.700
	AI2	0.830			
	AI3	0.858			

Note: CR = Composite Reliability, AVE = Average Variance Extracted

Table 4 AVE, and correlation of constructs values

	AI	EE	FC	HM	PE	Inno	PV	SI	TaC	TTF	TeC
AI	**0.837**										
EE	0.359	**0.827**									
FC	0.418	0.288	**0.810**								
HM	0.410	0.244	0.257	**0.816**							
PE	0.407	0.312	0.285	0.335	**0.851**						
Inno	0.417	0.290	0.283	0.284	0.301	**0.846**					
PV	0.424	0.226	0.300	0.239	0.286	0.327	**0.875**				
SI	0.386	0.323	0.358	0.242	0.282	0.323	0.309	**0.826**			
TaC	0.407	0.203	0.204	0.311	0.269	0.267	0.158	0.176	**0.829**		
TTF	0.338	0.326	0.215	0.230	0.240	0.296	0.228	0.254	0.264	**0.829**	
TeC	0.396	0.367	0.264	0.212	0.236	0.375	0.203	0.264	0.261	0.354	**0.793**

Note: Square roots of the AVE are the bolded diagonal values.

5.3 Structural Model Analysis

The measurement model analysis has confirmed that the measurement scales used in this study are valid and reliable, which forms the basis for evaluating the structural model. The evaluation of the structural model includes the assessment of the model's predictive power and the relationships between different latent variables. According to the recommendation of Hair et al. (2016), the evaluation of the structural model should include the following aspects: 1) evaluation of collinearity in the structural model, 2) evaluation of the significance of the path coefficients in the structural model, and 3) evaluation of the statistical measures and .

The combination of each dependent variable and the multiple predictor variables (independent variables) that predict the dependent variable in the structural model should be considered to evaluate collinearity. The VIF value of multiple predictor variables (independent variables) that predict the same dependent variable should not exceed 5. Otherwise, it is necessary to consider deleting some of these predictor variables or merging them. In the conceptual framework of this study, only the two dependent variables, Task Technology Fit and Adoption Intention to Metaverse, have two or more predictor variables. For Task Technology Fit, the VIF values of its two predictor variables are 1.073; the VIF values of the eight predictor variables of Adoption Intention to metaverse are between 1.220 and 1.328. These VIF values are below the critical value of 5, indicating no obvious collinearity problem in this study.

Bootstrap was used to evaluate the significance of the path coefficients in the structural model, with bootstrap samples set to 5000 and 95% percentile confidence intervals selected. The analysis results are shown in Table 5 and Figure 2. At the significance level of 0.05, it can be found that all relationships in the structural model are significant except for TTF→AI（coeff = 0.097,p = 0.052）, EE→ AI（coeff = 0.086,p = 0.153）, and SI→AI（coeff = 0.096,p = 0.054）.

Table 5 Results of hypothesis testing

Hypothesis	Path	Path Coefficient	P-value	Supported
H1	TeC -> TTF	0.306	0.000	√
H2	TaC -> TTF	0.185	0.002	√
H3	TeC -> EE	0.367	0.000	√
H4	TTF -> PE	0.240	0.000	√
H5	TTF -> AI	0.097	0.052	×
H6	EE -> AI	0.086	0.153	×
H7	PE -> AI	0.132	0.008	√
H8	SI -> AI	0.096	0.054	×
H9	FC -> AI	0.163	0.002	√
H10	HM -> AI	0.175	0.000	√
H11	PV -> AI	0.179	0.001	√
H12	Inno -> AI	0.138	0.009	√

Based on experience, the of endogenous latent variables reaching 0.75, 0.50, or 0.25 correspond to strong, moderate, or weak predictive ability of the model, respectively. In this study, the for Adoption Intention to metaverse, Task Technology Fit, Effort Expectancy, and Performance Expectancy are 0.427, 0.157, 0.135, and 0.058, respectively. These are all less than 0.5, indicating weak predictive ability.

The criteria for evaluating are that values reaching 0.02, 0.15, and 0.35 represent small, moderate, and large effects, respectively, and effect values less than 0.02 indicate no effect (Cohen, 1988). Table 6 shows the of all combinations of endogenous latent variables and corresponding exogenous latent variables (i.e. predictor variables) in this study. For example, the effect sizes of PV, HM, FC, Inno, and PE on AI are 0.044, 0.044, 0.036, 0.025, and 0.023, all of which are small effect sizes. The effect sizes of TFF, SI, and EE on AI are 0.013, 0.012, and 0.010, respectively, which can be considered as having no effect.

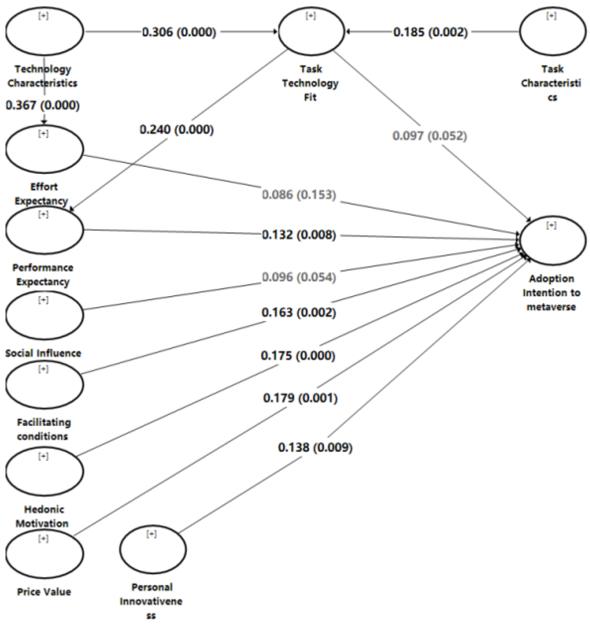

Figure 2 The results of path coefficient estimation of structural model

Table 6 AVE, and correlation of constructs values

	AI	EE	PE	TFF
PV	0.044			
HM	0.044			
FC	0.036			
Inno	0.025			
PE	0.023			
TFF	0.013		0.061	
SI	0.012			
EE	0.010			
TaC				0.038
TeC		0.156		0.104

In Smart PLS, the blindfolding algorithm can be used to calculate , where a value greater than 0 indicates that the model has predictive relevance for a particular endogenous latent variable. Conversely, less than or equal to 0 indicates a lack of predictive relevance for a particular endogenous latent variable (J. Hair et al., 2016). In this study, the for the endogenous latent variables AI, TTF, EE, and PE are 0.281, 0.102, 0.089, and 0.039, respectively, all of which are greater than 0. These results provide clear support for the predictive relevance of the exogenous latent variables to the endogenous latent variables in the model.

5.4 Task Technology Fit

This study examined five hypotheses (H1, H2, H3, H4, H5) related to the Task Technology Fit (TTF) model, and empirical research results showed that, except for H5, the other four hypotheses were proven to be true. According to the TTF theory, task characteristics and technological features have a great influence on users' perception of task-technology fit. This means that the greater the fit between task characteristics and technological features, the greater the fit between task and technology, and H1 and H2 (H1: $\beta = 0.306$, $p < 0.001$; H2: $\beta = 0.185$, $p = 0.002$) proved this point. Technological features will affect users' perceived usability of technology, that is, it will have an impact on users' effort expectancy when using the technology, and H3 (H3: $\beta = 0.367$, $p < 0.001$) supports this view. The higher the perceived match between the task and technology by users, the stronger the performance expectancy of the technology to users, and H4 (H4: $\beta = 0.240$, $p < 0.001$) supports this view. H5 is not supported (H5: $\beta = 0.097$, $p = 0.052$), indicating that from the perspective of sports industry practitioners, the match between task and technology will not directly affect the acceptance of Metaverse technology.

5.5 The UTAUT2

Empirical research results confirm that performance expectations, convenience, hedonic motivation, and price value have a positive impact on the willingness to accept metaverse technology for sports industry practitioners. Specifically, the stronger the perceived performance expectations, the stronger the willingness to accept metaverse technology (H7: $\beta = 0.132$, $p = 0.008$); if users have convenient access to metaverse technology, their willingness to accept it is stronger (H9: $\beta = 0.163$, $p = 0.002$); hedonic motivation also has a significant positive effect on acceptance (H10: $\beta = 0.175$, $p < 0.001$), as a novel technology, those who like new things are more interested in it; if the price value of metaverse is higher, that is, its cost performance is better, then the willingness to accept it will be higher (H11: $\beta = 0.179$, $p < 0.001$), which shows that sports industry practitioners are sensitive to the potential cost of auxiliary tools.

Individual innovation also has a significant impact on the acceptance of metaverse technology (H12: $\beta = 0.138$, $p = 0.009$). As a new technology, general users may have resistance to such new technologies. Users who are more interested in new things are more likely to accept such emerging technologies. Therefore, the higher the user's individual innovation, the higher their willingness to accept metaverse technology.

6 CONCLUSION

The statistical results of this study support the predictive validity of some variables in the hypothesis model. Performance expectations, convenience conditions, hedonic motivation, price value, and personal innovativeness significantly predict the willingness to accept metaverse technology. At the same time, it was found that task technology fit, effort expectations, and social influence have no significant impact on the acceptance of metaverse technology.

In order to promote the application of metaverse technology in sports teaching, teachers should be trained to increase their understanding of metaverse technology, and practitioners should be made aware of the role of metaverse technology in improving work performance in the sports industry, thus improving their acceptance of metaverse technology. By introducing metaverse technology, more convenience can be brought to sports teaching. The combination of metaverse and education can make up for the actual situation that traditional classrooms cannot provide and bring a richer and more diverse learning experience. Individuals with hedonic motivation can enjoy virtual experiences for pleasure and enjoyment, allowing students to experience better the fun of learning sports. At the same time, sports have always been a testing ground for cutting-edge technology. With more sports courses moving online due to the epidemic, more opinions can be referenced for constructing metaverse platforms. This also lays the foundation for the further extension of the sports teaching and activity scenes to the metaverse space. Finally, for university teachers, continuously updating personal skills and keeping up with the latest educational concepts is the mainstream approach to adapting to the development of today's technological society. Applying metaverse technology in sports teaching undoubtedly provides teachers with more opportunities for personal value and innovation.

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