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Exploring the Adoption of Blended Learning in Physical Education: A Study in Southwest China's Higher Education Institutions

Jing Fu[1], Songyu Jiang[2*], Jirawan Deeprasert[3]

Rattanakosin International College of Creative Entrepreneurship, Rajamangala University of Technology Rattanakosin, Nakhon Pathom 73170, Thailand

Email：jiang.song@rmutr.ac.th

Abstract: This study delves into the adoption of Blended Learning in Physical Education (BLPE) within higher education institutions in Southwest China. Employing structural equation modeling (SEM) on data from 654 respondents, which are higher education students major in physical education in southwest China. The research comprehensively examines both direct and indirect effects among the Information Quality (IQB), System Quality (SQB), Satisfaction (SAB), Perceived Ease of Use (PEB), Perceived Usefulness (PUB), Attitude Towards BLPE (ATB), Hedonic Motivation (HM), Price Value (PV), Habit (HT), Intention to Use BLPE (IUB), Facilitating Conditions (FC), Performance Expectance (PE), Effort Expectance (EE), and Social Influence (SI). Significant direct relationships were identified, including IQB's and SQB's positive effects on SAB ($\beta = 0.358$ and $\beta = 0.505$, respectively), and SAB's influence on PEB ($\beta = 0.597$) and PUB ($\beta = 0.384$). Additionally, mediation analysis revealed key indirect effects, such as SAB mediating the relationship between IQB and PEB (effect size = 0.206), and between SQB and PUB (effect size = 0.185). Notably, HM and PV did not significantly impact IUB, suggesting unique contextual differences in BLPE adoption in Southwest China. Other variables like HT, FC, PE, EE, and SI also showed significant impacts on IUB, reflecting the multifaceted nature of BLPE adoption. The study concludes that quality of content and system, along with user satisfaction, play pivotal roles in determining the success of BLPE. Contrasting with some global trends, cultural and contextual factors significantly influence BLPE adoption in Southwest China. These findings provide essential insights for educators and policymakers, emphasizing the need for contextually tailored BLPE strategies and highlighting the critical interplay of various factors in the successful implementation of blended learning in physical education.

Keywords: blending learning, physical education, structural equation model, higher education, digital education.

1. Introduction

Blended learning, characterized by the integration of traditional face-to-face instructional methods with digital and online learning techniques, is gaining traction in diverse educational domains (Fleischmann, 2021), including physical education (PE) (Zheng et al., 2021). This educational model is pivotal in offering a more adaptable and individualized learning experience. In the context of PE, it extends beyond the dissemination of theoretical knowledge to include virtual demonstrations and interactive activities, aiming to enhance both physical skills and academic understanding (Zheng et al., 2021). The significance of blended learning in PE lies in its potential to provide a dynamic and varied learning environment that is responsive to the evolving educational landscape and student diversity (Calderón et al., 2021).

The application of blended learning in PE (BLPE) is not without challenges. Key issues include maintaining effective online engagement, bridging theoretical knowledge with practical physical skills, and addressing technological access disparities (Rasheed et al., 2020). Educators in PE are often

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confronted with the task of adapting conventional physical activities for online platforms while keeping students motivated and participatory (Calderón et al., 2021). Additionally, remote assessment of physical skills presents a notable deviation from traditional in-person evaluations, posing a significant challenge (Rasheed et al., 2020).

The adoption of blended learning across China's higher education institutions varies significantly by region. While institutions in the eastern, southern, and northern regions have embraced digital education methodologies more readily, often due to superior technological infrastructure and resource availability, such adoption has been accelerated by global circumstances necessitating a shift towards more flexible learning models (Ashraf et al., 2021).

Higher education institutions in Southwest China encounter distinct challenges in adopting blended learning, particularly in sports-related disciplines (Xu et al., 2023). These challenges are attributed to a combination of factors including less advanced technological infrastructure, limited access to quality digital learning resources, and disparities in faculty training for digital pedagogy. This situation results in a noticeable disparity in the adoption and efficacy of blended learning strategies between Southwest China and its more technologically advanced counterparts (Liu et al., 2022).

The efficacy of blended learning in enhancing the educational outcomes of students in physical education has been increasingly recognized and implemented globally. Empirical evidence from various countries substantiates that the blended learning paradigm significantly augments learning performance (Jiang & Pu, 2021). Nevertheless, there appears to be a notable discrepancy in the perception and utilization of this educational model among higher education students in Southwest China (Pu et al., 2022). This lack of emphasis on the criticality of blended learning could be a contributing factor to the challenges faced by sports majors in the region, particularly in terms of competitiveness and advancement within the national and global sports arenas (Liu et al., 2022). This situation underscores the need for a more focused and strategic approach to integrating blended learning methodologies in the physical education curriculum, aligning with contemporary educational trends and requirements (Wang et al., 2020).

The hurdles faced in the digitalization and globalization of sports education in Southwest China are multi-dimensional (Wang et al., 2020). Key among these is the requirement for substantial investment in technological infrastructure to support effective online learning. Furthermore, educators in the region may need enhanced support and training to adeptly transition to blended learning methodologies (Hastie et al., 2020). There is also a pressing need for content that is culturally and contextually pertinent to the students in Southwest China, acknowledging the region's distinct educational requirements and characteristics (Laar et al., 2021).

Hence, this study aims to base on the User satisfaction and technology acceptance integration theory and UTAUT2 model to 1) explore the path of quality of BLPE affect intention to use BLPE; 2) identify the prediction role of hedonic motivation, price value, habit, facilitating conditions, social influence, effort expectance and performance expectance to the intention to use BLPE; 3) To uncovers the roles of the satisfaction of BLPE, perceived ease of use, perceived usefulness, and attitude in the relationship between the quality of BLPE and intention to use BLPE; 4)To construct the structural equation model for the intention to use BLPE; and finally, 5)To implications the stakeholders.

2. Literature review

2.1 Theoretical approach

Developed by Li and Zhu (2022), USATA synergizes the User Satisfaction and Technology Acceptance Models to enhance the prediction of user behavior in technology contexts. It posits that the characteristics of an information system and its information quality (object-based beliefs) directly impact user satisfaction with the system and its information (object-based attitudes). This satisfaction, in turn, influences behavioral beliefs about system use, such as perceived ease of use (system satisfaction) and perceived usefulness (information satisfaction), ultimately affecting the user's attitudes toward

using the system and their intention to use it (Vieira et al., 2022).

In USATA, system characteristics and information quality significantly affect user satisfaction, which then influences perceived ease of use and usefulness, leading to the behavioral intention to use the system. This integrated approach provides a holistic view of technology acceptance, combining initial behavioral intentions with feedback on system and information characteristics (Han & Sa, 2022).

The UTAUT2, an extension of the Unified Theory of Acceptance and Use of Technology (UTAUT), introduced by Venkatesh et al. (2012), incorporates additional constructs to account for consumer technology use. It includes performance expectancy, effort expectancy, social influence, facilitating conditions, hedonic motivation, price value, and habit.

UTAUT2's comprehensive nature, encompassing multiple contextual factors, makes it a powerful tool for understanding technology acceptance behaviors in diverse settings (Tamilmani et al., 2021). This model is particularly relevant for studying the acceptance and use of technologies like blended learning in educational settings.

Both USATA and UTAUT2 are instrumental in understanding the adoption of blended learning in physical education. USATA will help explore how system and information satisfaction influences the acceptance of blended learning technology among students and teachers. Meanwhile, UTAUT2 will provide insights into the broader range of factors affecting the adoption of blended learning, including performance expectancy, effort expectancy, and social influences, among others.

By leveraging these two theories, this research will unravel the key factors driving the intentions of students and teachers to use blended learning in physical education. This dual-theoretical approach not only deepens the understanding of technology acceptance in an educational context but also aids in formulating strategies to enhance the effective implementation and acceptance of blended learning in physical education within Southwest China's higher education institutions.

2.2 Hypothesis statement

Blended Learning in Physical Education (BLPE) offers a combination of online digital media and traditional classroom methods (Wang et al., 2022). The quality of information disseminated in this method is instrumental in determining the satisfaction of its participants (Li & Zhu, 2022). High-quality information directly correlates with user satisfaction in the context of e-learning systems (Jiang & Pu, 2021). Aspects of information quality such as reliability, relevance, and timeliness significantly influence the perception of users (Li & Zhu, 2022). This concept can be extended to blended learning systems like BLPE. In the context of blended learning, the quality of information in online resources positively influences the learner's satisfaction and learning outcomes. For physical education, the quality of both digital and in-person information becomes essential.

H1：Information Quality of BLPE positively affect the Satisfaction of BLPE.

H2：System Quality of BLPE positively affect the Satisfaction of BLPE.

User satisfaction in a blended learning environment, particularly in physical education (PE), can influence the perceived ease of use of the blended learning system (BLS) (Raza et al., 2022). As posited by the Technology Acceptance Model (TAM), user satisfaction and perceived ease of use are intricately linked.

Previous research suggests that when learners are satisfied with their learning experience, they tend to perceive the technological systems as more user-friendly and easier to use (Nguyen, 2021). In the context of PE, if learners are satisfied with the blended learning approach—marked by a combination of online and offline physical activities—they are more likely to find the technology involved (e.g., online instructional videos, fitness tracking apps, virtual reality tools) more accessible and easier to navigate. Thus, this study develops.

H3：Satisfaction of BLPE positively affect the Perceived ease of use of BLPE.

H4：Satisfaction of BLPE positively affect the Perceived

usefulness of BLPE.

Blending learning, which combines online and face-to-face teaching methods, has been identified as a significant innovation in physical education (PE) (Calderón & MacPhail, 2023). According to the Technology Acceptance Model (TAM), perceived ease of use is a key determinant of technology acceptance, influencing perceived usefulness and thereby intention to use the technology (Alfadda & Mahdi, 2021).

In the context of PE, several studies have found that when blending learning is easy to use, it enhances the learner's perception of its usefulness (Fidan & Tuncel, 2019). In an empirical study discovered that students' perceived ease of use of blending learning in PE positively impacted its perceived usefulness (Keržič et al., 2019). Furthermore, if students perceive blended learning in PE as user-friendly, they are more likely to view it as beneficial for their learning. Hence, this study develops.

H5：Perceived ease of use of BLPE positively affect the Perceived usefulness of BLPE.

H6：Perceived ease of use of BLPE positively affect the Attitude towards BLPE.

Blended Learning in Physical Education (BLPE) refers to the combination of face-to-face and online learning methods to augment student learning outcomes (Zheng et al., 2021). The Technology Acceptance Model (TAM) stipulates that the perceived usefulness of a system or technology significantly influences attitudes towards it (Yuan et al., 2023).

In line with this model, a wealth of studies has confirmed the positive correlation between perceived usefulness and attitude towards technology (Yuan et al., 2023). Perceived usefulness has a direct influence on attitudes toward technology use (Tamilmani et al., 2021). This observation extends to the context of physical education; several studies have demonstrated that when students perceive BLPE as useful, they exhibit more positive attitudes toward it. Therefore, this study develops.

H7：Perceived usefulness of BLPE positively affect the Attitude towards BLPE.

In a rapidly evolving educational landscape, the integration of blending learning in physical education (PE) has emerged as a significant focus (Calderón & MacPhail, 2023). The attitude towards blended learning has a critical impact on the intention to use this approach, as indicated by numerous studies (Al-Maroof et al., 2022). Positive attitudes towards technology-enabled learning methods, such as blended learning, correlated with stronger intent to use these methods (Watson & Rockinson-Szapkiw, 2021). More recently, an empirical study specifically explored the attitudes of PE teachers towards blended learning (Zheng et al., 2021). The study revealed that teachers who held a favorable attitude towards blended learning were more inclined to adopt it in their PE classrooms. Therefore, this study develops.

H8：Attitude towards BLPE positively affect the Intention to use BLPE.

Hedonic motivation, which represents the fun or pleasure derived from using a technology, can play a significant role in determining the intention to use Blended Learning (Al-Azawei & Alowayr, 2020). This association is supported by various studies within the literature. Hedonic motivation is identified as a critical predictor of technology acceptance and use (Nikolopoulou et al., 2021). This model postulates that if users derive enjoyment from a technology, their intention to use it is heightened. Therefore, this research puts forwards (Granić, 2023).

H9：Hedonic motivation positively affects the Intention to use BLPE.

According to Technology Acceptance Model (TAM), perceived usefulness and perceived ease of use significantly predict users' acceptance of new technology, implying a role of cost-effectiveness (Alfadda & Mahdi, 2021). Users' perception of price value (economic assessment of the benefits versus the costs) significantly influences their adoption of new technology (Habib et al., 2020). The affordability and perceived benefits of e-learning resources drive their acceptance in the educational context, suggesting that the same might hold true for blended learning in physical education (Sewandono et al., 2023). In the

specific context of physical education, a study emphasizes the need for cost-effective solutions to the pedagogical challenges in the field, implying that the economic value of blended learning platforms may encourage their use (Hennessy et al., 2022). Therefore, this research puts forwards.

H10：Price value positively affect the Intention to use BLPE.

Blending learning in physical education involves a mix of traditional face-to-face instruction and technology-mediated activities (Wang et al., 2022). Research indicates that habits significantly influence the adoption and usage of such technologies (Tamilmani et al., 2019). A positive correlation between habit and intention to use technology has been established, suggesting that repetitive and automated behaviors can encourage further use (Yan et al., 2021). Focusing on physical education, a domain where routines and habitual activities are common, it is hypothesized that this connection might be stronger. Thus, this research puts forwards.

H11：Habit positively affects the Intention to use BLPE.

Facilitating conditions, defined as "the degree to which an individual believes that an organizational and technical infrastructure exists to support the use of the system", can significantly influence the adoption of blended learning (Al-Nuaimi et al.). In the context of, facilitating conditions may include access to necessary technology, availability of technical support, and relevant training (Peñarroja et al., 2019). Research has shown that these conditions enhance students' and teachers' perceived ease of use, which positively influences their behavioral intention to use a new technology (Nikou & Economides, 2017). Moreover, perceived ease of use can reduce anxiety about technology use, thus promoting user acceptance and intention to use (Donmez-Turan, 2020). Given the unique challenges of blending traditional physical activity with technology, the presence of facilitating conditions could significantly impact the intention to use BLPE.

H12：Facilitating conditions positively affect the Intention to use BLPE.

Blended learning, combining traditional and digital teaching techniques, has gained widespread attention due to its effectiveness (Al-Maroof et al., 2022). As a unique field, physical education could greatly benefit from blended learning methods by enhancing learner engagement, physical skills, and theoretical understanding (Washburn et al., 2019). The theory of planned behavior (TPB) suggest that attitudes, subjective norms, and perceived behavioral control shape an individual's behavioral intentions (Jiang et al., 2022). Therefore, this research puts forwards.

H13：Social influence positively affects the Intention to use BLPE.

Effort expectancy is a component of the Unified Theory of Acceptance and Use of Technology (UTAUT) that refers to the degree of ease associated with the use of a system (Li & Zhu, 2022). Studies conducted in the field of e-learning endorse that effort expectancy plays a crucial role in accepting and using blended learning approaches (Twum et al., 2022). In the context of physical education, blending traditional methods with digital learning platforms could simplify the learning process, offer flexibility, and stimulate learner engagement (Lo et al., 2021). Thus, if educators perceive that the effort put into implementing BLPE can ease the teaching process and increase the efficiency of instruction, it is likely to influence their intention to use it. Hence, this research puts forwards.

H14：Effort expectance positively affect the Intention to use BLPE.

Performance expectation (PE), understood as the degree to which an individual believes that using a system will improve job performance, is a key determinant of technology acceptance and use (Isaac et al., 2019). UTAUT2 model later confirmed that performance expectation significantly influences behavioral intention to use technology (Chao, 2019). This principle has been extended to the educational technology context. A study found PE to directly influence students' intention to use blended learning in their studies. Similarly, a study in a higher education setting confirmed the importance of PE on the intention to use blended learning. Therefore, this research puts forwards.

H15：Performance expectance positively affect the Intention to

use BLPE.

The information quality of blended learning in physical education could potentially affect the perceived ease of use of the technology (Zhang et al., 2022). High-quality information provided by the technology might simplify the learning process and make the technology easier to use (Haleem et al., 2022). Satisfaction in blended learning could serve as a mediator in this relationship. Students' satisfaction with blended learning is positively associated with the perceived ease of use of the technology (Huang, 2021). If students are satisfied with the information quality of blended learning, they may perceive the technology as easier to use (Prifti, 2022). Therefore, this research puts forwards.

H16: Satisfaction of BLPE mediates the relationship between the Information Quality of BLPE and Perceived ease of use of BLPE.

H17: Satisfaction of BLPE mediates the relationship between the Information Quality of BLPE and Perceived usefulness of BLPE.

H18: Satisfaction of BLPE mediates the relationship between the System Quality of BLPE and Perceived ease of use of BLPE.

H19: Satisfaction of BLPE mediates the relationship between the System Quality of BLPE and Perceived usefulness of BLPE.

Blending learning, or blended learning, which incorporates both face-to-face instruction and online learning, has seen increased use in physical education (PE) due to its potential to facilitate differentiated and personalized learning experiences (Zheng et al., 2021). The perceived ease of use (PEU) and perceived usefulness (PU) of this mode of learning are crucial factors determining user satisfaction and acceptance (Hennessy et al., 2022). The Technology Acceptance Model (TAM) suggests that PEU and PU are positively correlated with user satisfaction and can serve as mediators in the relationship between user satisfaction and PU (Granić & Marangunić, 2019). Extending this model, in a blended learning context, PEU significantly influences PU, further driving user satisfaction (Han & Sa, 2022). In PE, blended learning, when perceived as easy to use, resulted in higher learner satisfaction, which, in turn, positively influenced perceived usefulness. The PEU not only reduced the complexity of using the blended learning system but also improved the users' learning experiences and satisfaction, which positively influenced the PU of the blended learning approach in PE. Hence, this study puts forwards.

H20: Perceived ease of use of BLPE mediates the relationship between the Satisfaction of BLPE and Perceived usefulness of BLPE.

H21: Perceived ease of use of BLPE mediates the relationship between the Satisfaction of BLPE and Attitude towards BLPE.

Blending learning, an approach integrating traditional face-to-face and online teaching, has been explored in the context of Physical Education (PE) (Li & Zhu, 2022). Perceived usefulness, a key determinant of technology acceptance, has been suggested to mediate the relationship between satisfaction and attitude towards blending learning (Habib et al., 2020). PE students' satisfaction with blending learning, tied to both its online and face-to-face aspects, could be a crucial predictor of their attitudes towards this method. Additionally, if students perceive blending learning as useful, it enhances their satisfaction and thus, their overall attitude towards it (Taghizadeh & Hajhosseini, 2021). Hence, this study establishes.

H22: Perceived usefulness of BLPE mediates the relationship between the Satisfaction of BLPE and Attitude towards BLPE.

H23: Perceived usefulness of BLPE mediates the relationship between the Perceived ease of use of BLPE and Attitude towards BLPE.

The TAM provides a relevant theoretical framework to explore the proposed hypothesis. Perceived ease of use significantly influences the intention to use a technology, suggesting a direct correlation between these factors in the context of blending learning in PE (Al-Adwan et al., 2023). However, the role of the user's attitude in this relationship necessitates deeper examination. (Alfadda & Mahdi, 2021)

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Evidence suggests that positive attitudes towards blended learning can enhance its perceived ease of use, thus influencing users' intention to adopt it (Gupta & Yadav, 2022). Positive attitudes towards the use of technology have been found to strongly correlate with the intention to use such technologies, suggesting a potential mediation effect (Han & Sa, 2022). Therefore, this research puts forwards.

H24: Attitude towards BLPE mediates the relationship between the Perceived ease of use of BLPE and Intention to use BLPE.

H25: Attitude towards BLPE mediates the relationship between the Perceived usefulness of BLPE and Intention to use BLPE.

Based on the hypothesis statement, this research developed an empirical framework, as shown in figure 1.

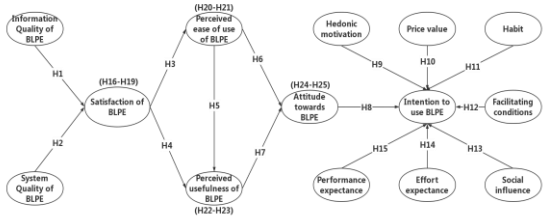

Figure 1. The empirical model of the blending learning in physic education.

3. Research method

The research study employs a comprehensive survey questionnaire as its principal tool to investigate the intention to use blended learning in the context of physical education among higher education students in Southwest China. The survey employs Likert scales, predominantly on a 7-point scale, to gauge responses, facilitating a nuanced understanding of participants' viewpoints.

The dimensions encompassed in the survey include Information Quality, System Quality, and Satisfaction with Blended Learning in Physical Education, all adapted from Li and Zhu (2022), which assess the content quality, system functionality, and user satisfaction levels, respectively. Additionally, the questionnaire delves into constructs like Perceived Ease of Use and Perceived Usefulness of Blended Learning in Physical Education, gauging user-friendliness, and efficacy, alongside Attitude Towards Blended Learning, sourced from the same authors. To capture the intrinsic motivations and economic considerations, Hedonic Motivation and Price Value constructs are included, based on Al-Azawei and Alowayr (2020). Habit and Facilitating Conditions, also adapted from these sources, evaluate the routine incorporation and infrastructural support of blended learning. Performance Expectance and Effort Expectance, essential to understanding anticipated academic benefits and required effort, are similarly sourced. Lastly, Social Influence, measuring the perceived societal and peer pressures to adopt blended learning, is included, enriching the comprehensiveness of the instrument.

In this study, an online questionnaire was administered to higher education students in Southwest China who have experienced blended learning in physical education majors. Utilizing purposive sampling, a total of 654 valid responses were collected. The data processing and analysis were conducted using SPSS 27.0 and AMOS 27.0, sophisticated statistical software packages renowned for their efficacy in handling complex data sets. The analytical approach encompassed a multifaceted methodology, beginning with descriptive statistical analysis to provide an overview of the data's fundamental characteristics. This initial phase laid the groundwork for more intricate analyses, including reliability and validity analysis. The latter was pivotal in establishing the consistency and accuracy of the questionnaire measures, thereby ensuring the integrity of the subsequent findings. Confirmatory factor analysis was then employed, a robust technique to test the validity of the constructs within the model, verifying their appropriateness and relevance to the study's theoretical framework. This analysis was crucial in ensuring that the measurement model adequately represented the underlying latent variables. The crux of the data analysis involved structural equation modeling (SEM), a comprehensive statistical approach that facilitates the examination of complex relationships among variables. SEM was instrumental in testing the study's hypotheses, particularly focusing on direct and mediated effects within the proposed model. This method's

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advanced capabilities allowed for a nuanced exploration of the relationships between variables, offering insights into the dynamics of blended learning adoption among physical education majors. Overall, the combination of these diverse analytical techniques provided a thorough and robust examination of the data, facilitating a comprehensive understanding of the adoption and impacts of blended learning in physical education within the context of higher education institutions in Southwest China. The study's methodological rigor and the use of advanced data analysis tools were central to assessing the validity of the proposed hypotheses, thus contributing valuable insights to the field.

4. Results

4.1 Reliability analysis

The Cronbach's Alpha value for the 50-item scale reported at 0.952 (Table 1), significantly exceeds the standard benchmark of 0.7 for acceptable internal consistency in social sciences and surpasses the 0.8 threshold for very good internal consistency (McCormick & Salcedo, 2017). This exceptionally high Alpha value indicates robust internal consistency, suggesting that the scale items are highly correlated and effectively measure a consistent underlying construct.

Table 1 Reliability Statistics

Cronbach's Alpha	N of Items
.952	50

4.2 Validity analysis

Adequacy and Bartlett's Test of Sphericity. The study reports a KMO value of 0.954, significantly exceeding the 0.9 benchmark, denoting excellent suitability for factor analysis, and suggesting a high proportion of variance attributable to underlying factors. Furthermore, Bartlett's Test of Sphericity reveals an approximate Chi-Square value of 14308.895 with 1035 degrees of freedom and a p-value of 0.000, robustly rejecting the null hypothesis of uncorrelated variables (McCormick & Salcedo, 2017). These results collectively affirm the dataset's aptness for factor analysis, underpinning the survey instrument's validity and reinforcing the methodological soundness of the research.

Table 2 KMO and Bartlett's Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.954
Bartlett's Test of Sphericity	Approx. Chi-Square	14308.895
	df	1035
	Sig.	.000

4.3 Descriptive analysis

The study's demographic profile is pivotal for comprehending the adoption of blended learning in physical education among college students in Southwest China. A judgment sampling approach targeted students with blended learning experience in physical education, aligning with the research's aims. Of the 800 distributed questionnaires, 707 were retrieved, but only 654 were valid, owing to exclusions based on non-conformity with the study's scope or incomplete data. Table 3 details the demographics of valid respondents. The sample featured a balanced gender distribution (51.4% male, 48.6% female) and a near-even split between rural (51.8%) and urban (48.2%) backgrounds, reflecting diverse experiences with blended learning. Participants hailed from various provinces including Sichuan, Chongqing, Yunnan, and Guizhou, ensuring regional representation. Economic backgrounds, as inferred from household income, varied, highlighting the potential impact of economic factors on blended learning engagement and perceptions. This demographic analysis is crucial, ensuring representative sampling and shedding light on how demographic variables might affect blended learning's adoption and efficacy in physical education in Southwest China.

Table 3 Essential Information

		Frequency	Percent
Gender	Male	336	51.4
	Female	318	48.6
Area	Rural	339	51.8
	City	315	48.2

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Province in Southwest China	Sichuan	152	23.2
	Chongqing	167	25.5
	Yunnan	164	25.1
	Guizhou	171	26.1
Annual household income	<100000 yuan	159	24.3
	100000-150000 yuan	152	23.2
	150000-200000 yuan	161	24.6
	>200000 yuan	182	27.8

Table 4 explores college students' perceptions of Blended Learning in Physical Education (BLPE) in Southwest China. The findings reveal mean scores ranging from 4.520 to 4.710, indicating a generally positive attitude towards BLPE, as these scores surpass the midpoint scale value of 4.0. Standard deviation values between 1.296 and 1.437 suggest a moderate variation in responses, reflecting diverse student experiences yet maintaining overall consistency. Particularly, high mean scores in areas like Information Quality and System Quality underscore positive perceptions of these BLPE aspects. Satisfaction scores align with this trend, suggesting general contentment with blended learning experiences. Skewness and kurtosis values fall within normal distribution parameters (skewness < 3, kurtosis < 10), validating the data's suitability for further analysis. In summary, the descriptive statistics indicate a favorable outlook towards BLPE among college students in Southwest China, with data quality suitable for advanced analysis. These insights are essential for gauging BLPE's current adoption status and identifying areas for improvement in the educational approach.

Table 4 Descriptive Statistics Results

Study variables	Measurement items	Mean	Std. Deviation	Skewness	Kurtosis
Information Quality of BLPE	IQB1	4.620	1.332	-1.030	0.137
	IQB2	4.590	1.338	-1.115	0.512
	IQB3	4.590	1.410	-1.003	-0.031
System Quality of BLPE	SQB1	4.580	1.356	-1.060	0.230
	SQB2	4.600	1.300	-0.990	0.170
	SQB3	4.660	1.298	-1.061	0.326
Satisfaction with BLPE	SAB1	4.640	1.309	-1.058	0.248
	SAB2	4.640	1.382	-1.080	0.271
	SAB3	4.520	1.371	-0.957	-0.166
	SAB4	4.640	1.361	-1.062	0.207
Perceived Ease of Use of BLPE	PEB1	4.650	1.331	-1.103	0.409
	PEB2	4.630	1.346	-0.950	-0.167
	PEB3	4.710	1.298	-1.191	0.743
Perceived Usefulness of BLPE	PUB1	4.610	1.372	-0.947	-0.113
	PUB2	4.620	1.406	-1.032	0.042
	PUB3	4.650	1.332	-1.031	0.216
Attitude Towards BLPE	ATB1	4.590	1.437	-1.038	0.028
	ATB2	4.560	1.342	-0.943	-0.070
	ATB3	4.600	1.317	-1.015	0.226
Hedonic Motivation	HM1	4.530	1.414	-0.952	-0.052

	HM2	4.640	1.356	-1.029	0.095
	HM3	4.610	1.370	-1.004	0.098
	PV1	4.660	1.319	-1.059	0.180
Price Value	PV2	4.570	1.350	-1.016	0.095
	PV3	4.650	1.351	-1.077	0.336
	HT1	4.580	1.373	-1.003	-0.026
Habit	HT2	4.600	1.296	-0.969	0.083
	HT3	4.680	1.332	-1.027	0.146
	IUB1	4.660	1.356	-1.068	0.292
Intention to Use BLPE	IUB2	4.620	1.318	-1.073	0.435
	IUB3	4.630	1.369	-0.916	-0.189
	FC1	4.600	1.381	-0.915	-0.223
Facilitating Conditions	FC2	4.600	1.348	-0.988	0.012
	FC3	4.590	1.354	-1.055	0.238
	FC4	4.600	1.375	-1.050	0.200
	PE1	4.610	1.360	-1.003	0.057
Performance Expectance	PE2	4.640	1.371	-1.030	0.160
	PE3	4.630	1.387	-1.068	0.137
	PE4	4.580	1.385	-0.978	-0.032
	EE1	4.670	1.364	-1.030	0.053
Effort Expectance	EE2	4.590	1.347	-1.077	0.227
	EE3	4.680	1.324	-1.126	0.490
	EE4	4.620	1.363	-1.071	0.266
	SI1	4.590	1.350	-1.002	0.053
Social Influence	SI2	4.600	1.276	-1.013	0.264
	SI3	4.600	1.308	-0.928	-0.052

BLPE: Blended Learning in Physical Education.

4.4 Confirmatory factor analysis

Convergent validity, essential in the confirmatory factor analysis of Blended Learning in Physical Education (BLPE) in Southwest China's higher education institutions, is affirmed through the measurement model. Table 5 indicates that all factor loadings exceed the 0.5 threshold, suggesting a strong correlation between observed indicators and their corresponding latent variables, thereby validating each survey item's alignment with its intended construct. Moreover, Composite Reliability (CR) values surpass the 0.7 standard, indicating consistent measurement within latent variables and confirming the scale's internal consistency. The Average Variance Extracted (AVE) values, exceeding 0.5, indicate that a significant variance in observation indicators is attributable to their respective latent variables, rather than measurement error. These results, encompassing factor loadings, CR, and AVE, robustly support the convergent validity of the measurement model, underpinning the validity and reliability of the research findings on BLPE in this context.

Table 5 Convergence Validity

Latent variables	Observation indicators	Factor loading	CR	AVE
Information Quality of BLPE	IQB1	0.767	0.801	0.573
	IQB2	0.726		
	IQB3	0.777		
System Quality of BLPE	SQB1	0.742	0.836	0.561
	SQB2	0.780		
	SQB3	0.771		
Satisfaction with BLPE	SAB1	0.740	0.840	0.568
	SAB2	0.760		
	SAB3	0.734		
	SAB4	0.780		
Perceived Ease of Use of BLPE	PEB1	0.725	0.781	0.543
	PEB2	0.768		
	PEB3	0.717		
Perceived Usefulness of BLPE	PUB1	0.708	0.778	0.538
	PUB2	0.752		
	PUB3	0.740		
Attitude Towards BLPE	ATB1	0.780	0.778	0.540
	ATB2	0.700		
	ATB3	0.722		
Hedonic Motivation	HM1	0.705	0.766	0.521
	HM2	0.741		
	HM3	0.720		
Price Value	PV1	0.713	0.757	0.509
	PV2	0.714		
	PV3	0.713		
Habit	HT1	0.754	0.786	0.550
	HT2	0.707		
	HT3	0.763		
Intention to Use BLPE	IUB1	0.748	0.796	0.566
	IUB2	0.798		
	IUB3	0.707		
Facilitating Conditions	FC1	0.774	0.828	0.546
	FC2	0.721		
	FC3	0.712		
	FC4	0.747		
Performance Expectance	PE1	0.712	0.828	0.546

	PE2	0.739		
	PE3	0.762		
	PE4	0.741		
	EE1	0.806		
	EE2	0.775		
Effort Expectance	EE3	0.739	0.851	0.589
	EE4	0.746		
	SI1	0.755		
Social Influence	SI2	0.734	0.779	0.540
	SI3	0.715		

BLPE: Blended Learning in Physical Education.

Table 6 is instrumental in evaluating discriminant validity within the Confirmatory Factor Analysis for Blended Learning in Physical Education (BLPE) in Southwest China's higher education institutions. Utilizing the Fornell and Larcker criterion, it displays the correlation coefficients between latent variables and, on its diagonal, the square roots of Average Variance Extracted (AVE) for each construct. The discriminant validity is confirmed when the square root of AVE (diagonal elements) for each construct exceeds its correlation coefficients with other constructs (off-diagonal elements), affirming the uniqueness of each construct. In BLPE-related constructs, higher diagonal elements compared to off-diagonal coefficients indicate successful discriminant validity. This confirms distinct contributions of each construct to BLPE understanding. Marked correlations with '***' for $p<0.001$ align with hypothesized theoretical relationships.

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Table 6 Discriminant validity test

Latent variables	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Information Quality of BLPE	0.757													
System Quality of BLPE	0.551***	0.764												
Satisfaction with BLPE	0.532***	0.610***	0.754											
Perceived Ease of Use of BLPE	0.571***	0.535***	0.508***	0.737										
Perceived Usefulness of BLPE	0.519***	0.502***	0.565***	0.643***	0.733									
Attitude Towards BLPE	0.516***	0.431***	0.431***	0.395***	0.361***	0.735								
Hedonic Motivation	0.497***	0.503***	0.634***	0.545***	0.480***	0.490***	0.722							
Price Value	0.595***	0.607***	0.581***	0.585***	0.532***	0.573***	0.591***	0.713						
Habit	0.489***	0.506***	0.453***	0.441***	0.412***	0.588***	0.429***	0.668***	0.742					
Intention to Use BLPE	0.589***	0.539***	0.539***	0.562***	0.505***	0.629***	0.635***	0.695***	0.625***	0.752				
Facilitating Conditions	0.574***	0.489***	0.560***	0.533***	0.556***	0.449***	0.592***	0.597***	0.465***	0.664***	0.739			
Performance Expectance	0.541***	0.543***	0.556***	0.643***	0.542***	0.536***	0.674***	0.629***	0.549***	0.705***	0.589***	0.739		
Effort Expectance	0.570***	0.560***	0.618***	0.508***	0.554***	0.507***	0.574***	0.667***	0.445***	0.672***	0.622***	0.596***	0.767	
Social Influence	0.601***	0.540***	0.582***	0.585***	0.566***	0.567***	0.591***	0.683***	0.551***	0.710***	0.628***	0.618***	0.618***	0.735

Note: The diagonal is the square root of the corresponding dimension AVE

BLPE: Blended Learning in Physical Education.

***: $p<0.001$

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Table 7 indicates the Chi-Square/df ratio indicates a good model fit relative to complexity, with a lower ratio suggesting minimal discrepancy. The study's low Root Mean Square Error of Approximation (RMSEA) confirms a close fit to the population's covariance matrix. The Goodness of Fit Index (GFI) and Adjusted Goodness of Fit Index (AGFI) both exceed reference standards, indicating significant variance explanation in the observed data, with AGFI adjusting for model complexity. Collectively, these fit indices demonstrate a strong model fit, essential for validating the measurement instrument's factor structure. The convergence of these indices above thresholds assures the research findings' credibility, underpinning conclusions about blended learning in physical education in Southwest China's higher education institutions. The model's excellent fit, as evidenced by these metrics, highlights the study's methodological strength and the validity of its conclusions.

Table 7 Measure model fit metrics

Fit index	χ2/df	RMSEA	GFI	AGFI	TLI	CFI
Reference standards	<3	<0.08	>0.9	>0.85	>0.9	>0.9
Result	1.273	0.020	0.931	0.917	0.979	0.982

4.5 Structural equation model

Table 8 presents a succinct evaluation of the structural equation model (SEM) fit in the study, detailing fit indices like χ2/df, RMSEA, GFI, AGFI, TLI, and CFI. The χ2/df=1.721 （<3）, indicating an acceptable fit. The RMSEA =0.033(< 0.08), suggests good fit accuracy. GFI and AGFI values (0.911 and 0.897, respectively) meet the recommended standards, indicating satisfactory model fit. TLI and CFI values, exceeding 0.9, demonstrate a strong comparative fit. Collectively, these indices confirm a robust fit of the SEM, validating the model's structural adequacy in exploring blended learning in physical education, supporting the validity of the study's analyses and conclusions.

Table 8 Model fit metrics

Fit index	χ2/df	RMSEA	GFI	AGFI	TLI	CFI
Reference standards	<3	<0.08	>0.9	>0.85	>0.9	>0.9
Result	1.721	0.033	0.911	0.897	0.945	0.950

Table 9 offers a meticulous evaluation of direct relationships within the structural equation model (SEM) for Blended Learning in Physical Education (BLPE) in Southwest China's higher education institutions. This table is instrumental in testing the study's predefined hypotheses, with a focus on the path coefficients between various constructs. Each path relationship, such as IQB → SAB, is analyzed in terms of path estimates, standardized coefficients (β), standard errors (S.E.), critical ratios (C.R.), and P-values.

For instance, H1, represented by IQB → SAB, shows a path estimate of 0.345, a β =0.358, and a significant C.R.=7.040, strongly supporting this specific relationship. The statistical significance of these path coefficients is determined using thresholds like a C.R. >1.96 and a P< 0.05, indicative of a 95% confidence interval. Most hypotheses in the model (H1-H8, H11-H15) meet these criteria, demonstrating robust support within the data. However, certain hypotheses, notably H9 (HM → IUB) and H10 (PV → IUB), do not find support, as their P> 0.05 threshold. This indicates that variables such as Hedonic Motivation and Price Value do not significantly directly affect the Intention to Use BLPE.

The R^2 values in the model represent the variance proportion in dependent variables that can be predicted from independent variables. For example, the R^2 value of 0.580 for SAB indicates that 58% of its variance is explainable by the constructs of Information Quality and System Quality.

In summary, Table 9's path analysis demonstrates that most direct relationships hypothesized in the SEM hold statistical significance, aligning with the theoretical framework proposed. This indicates a well-structured and robust model, capturing the intricate dynamics influencing the adoption of BLPE. The findings, especially the supported paths, provide

substantial evidence for the interrelations among key constructs such as Information Quality, System Quality, and Satisfaction in the context of BLPE. The study's use of SEM, as visually represented in Figure 2's Path Diagram, effectively communicates these complex relationships, offering a clear and comprehensive understanding of the factors influencing BLPE in the higher education sector of Southwest China.

Table 9 Structural equation model path test

Hypothesis	Path	Estimate	β	S.E.	C.R.	P	Results
H1	**IQB → SAB**	0.345	0.358	7.040	***	7.040	Supported
H2	**SQB → SAB**	0.470	0.505	9.327	***	9.327	Supported
H3	**SAB → PEB**	0.597	0.597	11.256	***	11.256	Supported
H4	**SAB → PUB**	0.393	0.384	6.658	***	6.658	Supported
H5	**PEB → PUB**	0.422	0.413	6.803	***	6.803	Supported
H6	**PEB → ATB**	0.331	0.286	4.001	***	4.001	Supported
H7	**PUB → ATB**	0.242	0.213	3.020	0.003	3.020	Supported
H8	**ATB → IUB**	0.149	0.169	4.598	***	4.598	Supported
H9	**HM → IUB**	0.072	0.074	1.198	0.231	1.198	Rejected
H10	**PV → IUB**	0.053	0.051	0.647	0.518	0.647	Rejected
H11	**HT → IUB**	0.149	0.158	2.730	0.006	2.730	Supported
H12	**FC → IUB**	0.139	0.153	2.711	0.007	2.711	Supported
H13	**SI → IUB**	0.173	0.182	2.784	0.005	2.784	Supported
H14	**EE → IUB**	0.140	0.159	2.714	0.007	2.714	Supported
H15	**PE → IUB**	0.189	0.191	3.037	0.002	3.037	Supported

Note: IQB: Information Quality of BLPE; SQB: System Quality of BLPE; SAB: Satisfaction with BLPE; PEB: Perceived Ease of Use of BLPE; PUB: Perceived Usefulness of BLPE; ATB: Attitude Towards BLPE; HM: Hedonic Motivation; PV: Price Value; HT: Habit; IUB: Intention to Use BLPE; FC: Facilitating Conditions; PE: Performance Expectance; EE: Effort Expectance; SI: Social Influence.

BLPE:Blended Learning in Physical Education.

***: $p<0.001$

Table 10 offers an in-depth analysis of mediation effects within the structural equation model (SEM) for Blended Learning in Physical Education (BLPE). It employs a bootstrap test to assess the significance of indirect effects, a robust method for evaluating mediated relationships among constructs. This assessment is crucial for understanding the interconnectedness and indirect pathways that exist within the model.

The table 10 lists hypothesized indirect paths (H16 to H25), each denoting a sequence of relationships where one construct influences another through one or more intervening variables. The effect size column quantifies the strength of these indirect effects. For example, H16 (IQB→SAB→PEB) shows a moderate effect size of 0.206, indicating Information Quality of BLPE's indirect influence on Perceived Ease of Use, mediated by Satisfaction with BLPE.

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Standard Error (SE) values provide variability estimates, aiding precision assessment. The Bias-Corrected 95% Confidence Interval (95%CI) is pivotal for statistical significance; intervals excluding zero confirm the significance of indirect effects. The findings support the statistical significance of all listed hypotheses, with bias-corrected confidence intervals confirming the meaningfulness of indirect paths.

Key results include significant mediating roles of Satisfaction with BLPE between Information Quality and System Quality on Perceived Ease of Use and Perceived Usefulness, and Perceived Ease of Use's mediating role between Satisfaction with BLPE and Attitude Towards BLPE. These relationships underscore the intricate dynamics within the model. In essence, Table 10's mediation effect analysis validates significant indirect relationships, shedding light on the complex mechanisms influencing student engagement with BLPE. These insights are vital for educators and policymakers in higher education in Southwest China, providing a nuanced understanding of the factors driving BLPE adoption and effectiveness.

Table 10. Mediation effect bootstrap test

Hypothesis	Mediation path	Effect size	SE	Bias-Corrected 95%CI		Results
H16	**IQB→SAB→PEB**	0.206	0.06	0.103	0.335	Supported
H17	**IQB→SAB→PUB**	0.136	0.04	0.056	0.246	Supported
H18	**SQB→SAB→PEB**	0.281	0.06	0.160	0.401	Supported
H19	**SQB→SAB→PUB**	0.185	0.05	0.092	0.301	Supported
H20	**SAB→PEB→PUB**	0.252	0.05	0.147	0.369	Supported
H21	**SAB→PEB→ATB**	0.197	0.07	0.065	0.381	Supported
H22	**SAB→PUB→ATB**	0.095	0.05	0.012	0.218	Supported
H23	**PEB→PUB→ATB**	0.102	0.05	0.027	0.224	Supported
H24	**PEB→ATB→IUB**	0.049	0.02	0.013	0.122	Supported
H25	**PUB→ATB→IUB**	0.036	0.02	0.001	0.091	Supported

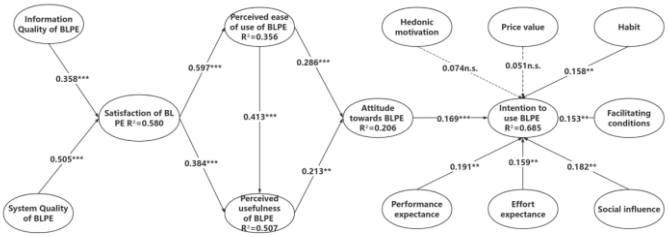

Figure 2. Path Diagram for the structural model

Note: *p<0.05, **p<0.01, ***p<0.001; n.s.=non-significant.

5. Discussion and conclusion

5.1 Theoretical implication

The comprehensive analysis of the study, utilizing the structural equation model (SEM) for Blended Learning in Physical Education (BLPE) in Southwest China's higher education institutions, extends beyond direct relationships (H1-H15) to explore mediating effects (H16-H25). This exploration is integral to understanding the complex interplay of constructs within the User Satisfaction and Technology Acceptance Integration Theory (USATA) and the Unified Theory of Acceptance and Use of Technology 2 (UTAUT2) frameworks.

H1-H8 focused on relationships between constructs like Information Quality (IQB), System Quality (SQB), Satisfaction (SAB), Perceived Ease of Use (PEB), Perceived Usefulness (PUB), and Attitude Towards BLPE (ATB). These hypotheses were supported, demonstrating significant direct effects. For instance, IQB positively influenced SAB (β = 0.358), and SAB significantly affected PEB (β = 0.597) and PUB (β = 0.384). Similarly, ATB's positive influence on Intention to Use BLPE

(IUB) was substantiated (β = 0.169). H9 and H10, examining the impact of Hedonic Motivation (HM) and Price Value (PV) on IUB, were not supported, suggesting these factors do not directly influence BLPE adoption in this context. H11-H15 showed significant influences of Habit (HT), Facilitating Conditions (FC), Social Influence (SI), Effort Expectance (EE), and Performance Expectance (PE) on IUB. These findings align with UTAUT2, underscoring the importance of these factors in technology acceptance in education.

H16-H25 delve into the indirect influence of constructs through mediating variables. The bootstrap test for mediation effects substantiates the presence of significant mediated relationships. For instance: H16 (IQB→SAB→PEB) showed a notable mediation effect (effect size: 0.206), indicating that Satisfaction with BLPE (SAB) significantly mediates the relationship between Information Quality of BLPE (IQB) and Perceived Ease of Use of BLPE (PEB). H17 (IQB→SAB→PUB), Similarly, SAB was a significant mediator in the link between IQB and Perceived Usefulness of BLPE (PUB), with an effect size of 0.136, H18-H19 further demonstrated the mediating role of SAB between System Quality of BLPE (SQB) and PEB/PUB. 20-H25 revealed additional mediated paths, such as the mediation role of Perceived Ease of Use and Perceived Usefulness between satisfaction and attitude Toward BLPE, and between these constructs and the Intention to use BLPE. The significant mediation effects uncovered in H16-H25 provide a deeper insight into how various factors like system and information quality indirectly influence user attitudes and intentions, mediated through satisfaction and perceived ease/usefulness.

The findings offer an enriched perspective on these theories, emphasizing not just direct, but also indirect pathways of influence within technology acceptance models. This highlights the intricacies of user satisfaction and technology acceptance dynamics in an educational setting. The results also reveal how specific constructs interact within the context of Southwest China's higher education, offering tailored insights for this region. This adds to the global understanding of BLPE adoption and showcases the need for context-specific strategies in educational technology.

The study's results, particularly regarding the mediation effects in hypotheses H16-H25 and the direct relationships in H1-H15, demonstrate distinct differences from previous research and showcase several innovative and developmental aspects in the context of Blended Learning in Physical Education (BLPE) within higher education institutions in Southwest China.

Previous studies on blending learning often focused on direct effects of variables like information quality, system quality, and user satisfaction (Li & Zhu, 2022). However, this study extends beyond direct impacts to explore how these variables interact indirectly, revealing a deeper, more nuanced understanding of the adoption process. The mediation effects identified demonstrate the complex, multi-layered interplay of factors influencing BLPE, an aspect less explored in existing literature. Prior research on technology acceptance and blended learning has predominantly centered on Western educational contexts (Prifti, 2022; Rasheed et al., 2020; Taghizadeh & Hajhosseini, 2021). This study, however, provides insights specific to Southwest China, highlighting cultural and educational dynamics that may differ significantly from Western models. For example, the finding that Hedonic Motivation (HM) and Price Value (PV) do not significantly influence the Intention to Use BLPE contrasts with studies from other contexts where these factors are more impactful.

The study innovatively combines elements from USATA and UTAUT2, offering a more comprehensive framework for understanding technology acceptance in education. This integration allows for a more holistic view of user satisfaction and technology adoption, specifically tailored to the educational sector. Utilizing structural equation modeling (SEM) to assess both direct and mediated effects represents a methodological advancement. This approach provides a more sophisticated analysis than traditional methods, allowing for a more detailed understanding of the relationships among variables.

In summary, this research differs from previous studies by providing a more comprehensive analysis of the factors influencing BLPE adoption, incorporating cultural context, and innovatively applying combined theoretical frameworks. These aspects represent significant advancements in the field of educational technology research, particularly in the context of BLPE in Southwest China. In conclusion, the incorporation of mediation effect analysis provides a comprehensive picture of the factors influencing BLPE adoption. It highlights the nuanced relationships among constructs within USATA and UTAUT2, enriching the theoretical landscape and offering practical insights for educators and policymakers in the realm of educational technology.

5.2 Practical implication

Based on the relationships identified between the variables in the study of Blended Learning in Physical Education (BLPE) in Southwest China's higher education institutions, several practical suggestions emerge for stakeholders, including educators, administrators, policymakers, and technology developers.

The positive influence of Information Quality (IQB) and System Quality (SQB) on Satisfaction (SAB) underscores the need for high-quality content and robust system infrastructure. Educational institutions should invest in developing and maintaining high-quality digital content that is relevant, accurate, and timely. Additionally, ensuring that the technological infrastructure is reliable and user-friendly will enhance student satisfaction and engagement with BLPE.

Given the significant role of satisfaction in mediating the relationship between quality aspects and perceived ease of use (PEB) and perceived usefulness (PUB), institutions should prioritize strategies to enhance student satisfaction. This could involve regular feedback mechanisms, user-centric design, and responsive support systems to address student concerns and preferences.

The positive impact of Habit (HT) on Intention to Use BLPE (IUB) suggests that fostering habitual use of BLPE can enhance student engagement. Stakeholders should consider strategies that encourage regular and consistent use of BLPE platforms, such as integrating them into daily routines and incentivizing regular participation.

The study highlights the importance of Social Influence (SI) and Performance Expectance (PE) in BLPE adoption. Educators and administrators should leverage social learning communities and peer influence to encourage BLPE usage. Additionally, clearly communicating the performance benefits of BLPE can motivate students to engage more actively with these platforms. The finding that Hedonic Motivation (HM) and Price Value (PV) do not significantly influence BLPE adoption in Southwest China suggests a need for context-specific approaches. Stakeholders should consider cultural factors and local educational norms when designing and implementing BLPE strategies.

Given the complexity of BLPE, providing adequate training and support for educators is crucial. This includes familiarizing them with the technology, pedagogical approaches for blended learning, and strategies to engage students effectively. Policymakers should consider these findings when allocating resources and developing policies related to educational technology. Ensuring that institutions have the necessary resources and guidance to implement effective BLPE programs is essential.

By considering these practical implications, stakeholders can better harness the potential of BLPE to enhance educational experiences and outcomes in Southwest China's higher education context. The study's findings provide a valuable guide for effectively implementing and optimizing BLPE strategies in this unique educational landscape.

5.3 Limitations and Future Research

The present study, while providing valuable insights into Blended Learning in Physical Education (BLPE) within Southwest China's higher education institutions, is not without its limitations. Firstly, the research predominantly relied on self-reported data from students, which may introduce biases such as social desirability or response bias. The use of a single method for data collection, primarily the survey, could also

limit the depth of understanding, as qualitative nuances might be missed. Additionally, the study's focus on higher education institutions in Southwest China means that the findings may not be generalizable to other regions or educational levels. This geographical limitation raises questions about the applicability of the results to different cultural or educational contexts. Another limitation is the cross-sectional nature of the study, which restricts the ability to infer causality from the observed relationships. Longitudinal studies could provide a more dynamic understanding of how students' perceptions and usage of BLPE evolve over time.

Future research in this field should aim to address these limitations and explore new avenues. Expanding the scope of the study to include other regions, both within and outside China, could offer comparative insights and enhance the generalizability of the findings. Incorporating qualitative methods such as interviews or focus groups could provide a richer, more nuanced understanding of students' experiences and perceptions of BLPE. Longitudinal studies could track changes in attitudes and behaviors over time, offering insights into the long-term impact of BLPE and the sustainability of its adoption. Further, exploring the perspectives of educators and administrators could provide a more holistic view of BLPE implementation challenges and opportunities. Investigating additional variables, such as technological advancements, changes in educational policies, or shifts in student demographics, could also enrich the understanding of BLPE dynamics. Additionally, future research could explore intervention-based studies to test the effectiveness of specific strategies or programs designed to enhance the adoption and effectiveness of BLPE. These studies could provide actionable insights for educators and policymakers to optimize BLPE strategies in various educational settings.

5.4 Conclusion

The research conducted on Blended Learning in Physical Education (BLPE) in higher education institutions in Southwest China provides critical insights into the factors influencing its adoption and effectiveness. Through a structured application of the User Satisfaction and Technology Acceptance Integration Theory (USATA) and the Unified Theory of Acceptance and Use of Technology 2 (UTAUT2), the study has made significant theoretical contributions. It elucidates the complex interplay of factors such as Information Quality, System Quality, Satisfaction, Perceived Ease of Use, and Perceived Usefulness, and their impact on students' attitudes and intentions toward BLPE. Notably, the study highlights the importance of satisfaction in mediating the relationship between system and information quality and the perceived ease and usefulness of BLPE.

The practical implications of these findings are substantial for educators, administrators, and policymakers in the realm of educational technology. The study underscores the necessity of high-quality content and robust systems, the importance of user satisfaction, and the influence of social and behavioral factors on the acceptance of BLPE. These insights are crucial for the design and implementation of effective BLPE strategies, tailored to the unique educational and cultural context of Southwest China.

However, the study is not without limitations. The reliance on self-reported data and the geographical focus on Southwest China, among other factors, suggest caution in generalizing the findings. Future research should aim to broaden the geographical scope, incorporate longitudinal and qualitative methods, and explore the perspectives of different stakeholders, such as educators and administrators, to build a more comprehensive understanding of BLPE.

In conclusion, this study contributes to the growing body of knowledge on blended learning in physical education, particularly in the context of higher education in Southwest China. It sheds light on the nuanced factors influencing the adoption of BLPE and provides a foundation for future research and practical applications in the field. As educational institutions continue to navigate the challenges and opportunities presented by technological advancements in learning, studies like this one will be instrumental in guiding effective and contextually relevant educational strategies.

Data Availability Statement

The datasets presented in this article are not readily available because they involve the interests of collaborators, as well as some privacy issues, and some data are confidential. However, further individual scholars or experts are welcome to request these datasets for academic references or other needs; requests to access these datasets should be directed to SJ: jiang.song@rmutr.ac.th.

Author Contributions

J.F, J.D and S.J: conceptualization and writing—original draft preparation.

J.F, J.D and S.J: methodology, formal analysis, and writing—review and editing.

All authors have read and agreed to the published version of the manuscript.

Conflict of Interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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