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Promoting Adoption Behavior Towards the Smart Education System: Case of Lectures from Chinese Private Higher Education Institutions

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Abstract:

This study delves into the burgeoning realm of smart education systems (SES) within Chinese private higher education institutions (PHEIs), aiming to identity the determinants affecting lectures' adoption of SES and the relationship among them. 617 available data were collected from Chinese private university lectures through purposive sampling. Descriptive statistical analysis, reliability and validity tests, confirmatory factor analysis, structural equation modeling, and path analysis are employed in this study. The findings reveal that factors such as subjective norms, attitudes towards technology, self-efficacy, perceived usefulness, and perceived ease of use significantly impact lecturers' acceptance of SES. This study also uncovers the mediating roles of perceived usefulness and ease of use in this acceptance process. Implications of this research are multifaceted, offering valuable insights for educational administrators, policy makers, technology developers, and educators. This study enriches the academic discourse on technology adoption in higher education. It extends the existing theoretical frameworks by integrating the technology acceptance model (TAM) and the theory of planned behavior (TPB), providing a more holistic understanding of technology acceptance in educational settings. Additionally, the study offers practical strategies for various stakeholders to enhance the adoption and effective utilization of SES in higher education, thereby contributing to the advancement of educational technology and pedagogy.

Key words*: smart education systems, technology acceptance, higher education pedagogy, user-friendly design, educational technology integration, Chinese private higher education institutions*

1. Introduction

In the contemporary educational landscape, the integration of Smart Education Systems (SES) stands as a pivotal development, particularly against the backdrop of rapid technological advancements in information technology (Barakabitze et al., 2019). This trend, gaining significant traction globally, is notably evident in the establishment of digital campuses in various countries, including the United States, China, Japan, and several European nations (Flavián et al., 2019). Within the Chinese context, Private Higher Education Institutions (PHEIs) have been at the forefront of this shift, increasingly acknowledging the vital role that

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SES plays in elevating the standards of teaching and academic services. This recognition positions these institutions as leaders in the technological transformation of the educational sector (Kourgiozou et al., 2021; Latif et al., 2020). Despite the promising potential of SES, its implementation in PHEIs has surfaced a range of challenges, particularly affecting young lecturers who are essential to the vibrancy and progression of academic institutions (Mullen, 2021). These educators face notable obstacles in their professional development, primarily due to the intricate and often complex nature of SES. Such complexity not only restricts their ability to engage effectively with these systems but also diminishes the practical applicability of SES, despite its capacity to revolutionize educational practices (Aduba & Mayowa-Adebara, 2022; Barakabitze et al., 2019).

This scenario highlights a critical need for the adaptation of SES within higher education to be more user-centric. The focus should be on enhancing the accessibility and usability of these systems, ensuring that their transformative potential is fully realized and effectively harnessed to improve the educational landscape. The goal is to create an environment where SES not only supports but also enriches the teaching and learning experience, thereby contributing significantly to the advancement of higher education (Fu et al., 2023). This approach necessitates a thoughtful consideration of the user experience, aiming to simplify the operational aspects of SES and make them more intuitive for educators, particularly those who are in the early stages of their academic careers. While the adoption of SES in higher education presents a promising avenue for enhancing educational quality and services, it also brings to light the need for careful consideration of the challenges faced by educators, especially in terms of system complexity and usability. Addressing these challenges is essential for ensuring that SES implementations are effective, beneficial, and conducive to the professional growth of educators, ultimately leading to a more dynamic and innovative educational environment.

In the domain of educational technology, current research predominantly focuses on areas such as teachers' experiences with digital tools, the application of artificial intelligence and machine learning, interoperability, data privacy, security, and the utilization of advanced educational technologies like virtual and augmented reality, and mobile learning (Bond et al., 2020). However, this body of research primarily concentrates on the technology usage by teachers and students, with a limited exploration into its impact on the professional development of lecturers, especially in the context of specialized platforms like the National Platform for Intelligent Education in Higher Education. This study identifies several critical research gaps in this area. Firstly, while the digital development of higher education has been extensively explored at the student and teacher levels (Amhag et al., 2019; Vielsmeier et al., 2020), there is a notable lack of research focusing on how lecturers interact with and benefit from platforms specifically designed for their professional growth. This gap underscores the need for studies that delve into lecturers' engagement with such platforms and the resultant impact on their professional development. Existing literature extensively covers the use of online offices and digital teaching tools by teachers (Tabery et al., 2007; Tikhonova et al., 2022), but it often neglects the unique needs and impacts of these technologies on lecturers' professional development within the digital higher education landscape. This oversight suggests a need for research that specifically addresses the distinct requirements and effects of digital tools on lecturers' professional growth and self-improvement. Furthermore, numerous studies have investigated the digital acceptance behavior of staff in higher education settings, including their engagement with MOOCs, online open resources, and online education and training platforms (Su et al., 2022; Valade et al., 2019; Wong & Moorhouse, 2021).

However, the unique aspects of the smart education system as a new vector for lecturer development remain largely unexplored. This gap indicates a research opportunity to investigate how smart education systems are perceived and utilized by lecturers for their professional advancement. Additionally, theoretical frameworks like the technology acceptance model and the theory of planned behavior have been widely used to predict the digital acceptance behavior of teachers and students in higher education (Barakabitze et al., 2019; Kaushik & Verma, 2020). Yet, the integration and application of these theories in understanding the acceptance and optimal use of platforms like the smart education system in Higher Education, particularly in Chinese private higher education institutions, have not been thoroughly examined.

To address the identified gaps in the existing academic discourse, the research objectives are outlined as follows. The primary goal is to comprehensively analyze the factors influencing lecturers' adoption of SES. Additionally, the study explores the intricate relationships among these influencing factors, illuminating the complex dynamics that drive lecturers' acceptance and use of SES. The research culminates in the creation of a detailed theoretical model that encapsulates the essential determinants of SES adoption within Chinese private higher education. Through these objectives, this study endeavors to contribute significantly to the advancement of educational technology, particularly in enhancing the engagement of lecturers with SES in higher education contexts.

This study begins with a comprehensive introduction, outlining the research background, significance, problems addressed, objectives. It then establishes a theoretical foundation through an extensive literature review and hypothesis formulation, setting the stage for the theoretical framework. Following this, a theoretical model is constructed, underpinned by specific hypothesis. The research methodology is detailed next. The results section presents the empirical findings, offering key insights. This study concludes with a discussion and conclusion section, which not only explores the theoretical and practical implications of the findings but also addresses the research's limitations and suggests directions for future research, thereby enriching the academic conversation on SES adoption in higher education.

2. Literature Review

2.1 Theoretical approach

Integrating the extended theory of planned behavior and the technology acceptance model, this dual-framework approach allows for a nuanced understanding of how behavioral attitudes, subjective norms, perceived behavioral control, and factors like perceived usefulness and ease of use collectively influence lecturers' decisions to adopt SES.

The technology acceptance model (TAM) is a foundational framework for understanding educators' adoption of new technologies (Davis, 1989; Szymkowiak et al., 2021). Perceived usefulness (PU) is the educators' subjective evaluation of a technology's benefits in enhancing teaching effectiveness and student learning outcomes (Rejón-Guardia et al., 2020). Perceived ease of use (PEOU) pertains to the perceived simplicity of using a technology system in teaching, with greater ease promoting higher acceptance and usage (Davis, 1989). ETAM, an evolution of TAM, posits that PU and PEOU jointly influence educators' intentions and behaviors regarding technology use. This model emphasizes that actual system usage is shaped by these perceptions (Chen & Aklikokou, 2020). Subsequent versions, ETAM 2 and ETAM 3, have introduced additional variables to further refine the model. Moreover, the unified theory

acceptance and usage technology model (UTAUT), amalgamates various technology acceptance models, including ETAM, and has seen widespread application across different fields, notably in educational technology (Venkatesh & Davis, 2000). Research employing ETAM, such as those by Khlaisang et al. (2021), Ray et al. (2022), and others, underscores its extensive applicability in diverse educational contexts, from e-learning to science education, demonstrating its effectiveness in assessing technology acceptance and its integration with models like ISSM for comprehensive insights into technology adoption in education (Prasetyo et al., 2021; Rahmi et al., 2018).

The Theory of Planned Behavior is a pivotal framework for predicting individual behaviors, incorporating behavioral, normative, and control beliefs (Ajzen, 1991; Habibi et al., 2023). It posits that an individual's behavior is shaped by their attitudes (behavioral beliefs), perceived social pressures (normative beliefs), and self-efficacy (control beliefs) (Husain et al., 2021). The extended TPB model, often used in designing behavioral interventions, suggests that behavioral intention and perceived behavioral control (PBC) directly influence actual behavior when individuals have adequate resources and opportunities (Odou & Schill, 2020). In this research, the extended TPB is employed to analyze Chinese private university lecturers' acceptance of smart education systems in higher education. A key aspect of this model is perceived behavioral control, focusing on lecturers' perceptions of the ease or difficulty of using the National Platform for Intelligent Education in Higher Education (Lim & Weissmann, 2023). This study aims to comprehensively understand lecturers' acceptance behavior by considering factors like perceived behavioral control, attitudes, and subjective norms. The goal is to develop strategies that enhance system usage and acceptance, thereby enriching the understanding of behavioral intentions in the educational technology context.

2.2 Hypothesis Development

Subjective norms, refer to the social pressure individuals perceive regarding the decision to engage in a particular behavior (Ming et al., 2023). In the context of using Smart Education Systems, these norms can stem from various sources such as teachers, classmates, and school administrators (Qin et al., 2023). Their opinions significantly influence lecturers' perceptions of the system's usefulness and ease of use, and consequently, their willingness to adopt the technology (Tahar et al., 2020).

When individuals perceive that influential people in their lives, such as friends, family, and colleagues, believe that SES is beneficial and should be used, this belief reinforces their own perception that SES is valuable, easy to master, and worth using. For instance, the popularity of a social media platform within a social group can create a trend that encourages its adoption, particularly among younger generations (Pop et al., 2021). In certain professional fields, like media, marketing, and public relations, the use of SES can be a critical requirement, thus establishing subjective norms that drive individuals towards its usage (Chen et al., 2022).

Therefore, subjective norms play a crucial role in shaping individuals' perceptions of the usefulness and ease of use of SES, as well as their intentions to use it. These norms act as a significant motivational factor, influencing user evaluations based on their social context and subjective beliefs, either encouraging or deterring their use of SES (Rejón-Guardia et al., 2020). Considering this, the following hypotheses are proposed:

H1 : *Subjective Norm positively affects the Intention to Use SES.*

H2 : *Subjective Norm positively affects the Perceived Usefulness.*

H3 : *Subjective Norm positively affects the Perceived Ease of Use.*

Attitude towards Smart Education Systems encompasses an individual's overall perspective, feelings, or assessment of the system, reflecting their cognitive and emotional attitudes (Zhai et al., 2023). This includes evaluations of the system's usability, functionality, reliability, effectiveness, and user experience (Cui, 2022). According to the theory of cognitive consistency, individuals strive for cognitive harmony in their attitudes (Metzger et al., 2020). Consequently, if users harbor a positive attitude towards SES, they are likely to align their perceptions of its usefulness and ease of use with this positive attitude, maintaining cognitive consistency (Dohle et al., 2021).

Thus, the relationship between attitudes towards using SES and perceived usefulness, ease of use, and intention to use SES can be articulated as follows: users' attitudes towards SES significantly influence their perceived usefulness, ease of use, and intention to use SES (Feng & Wu, 2022). A positive attitude towards SES typically results in a favorable perception and evaluation of the system's features and functionalities, leading to a stronger intention to use them (Fuchs et al., 2023). In light of these insights, the following hypotheses are available:

H4 : *Attitude positively affect the Intention to use SES.*

H5 : *Attitude positively affect the Perceived Usefulness.*

H6 : *Attitude positively affect the Perceived Ease of Use.*

Self-efficacy, conceptualized as an individual's belief in their capability to execute specific behaviors, is a critical factor in user engagement with Smart Education Systems (Duan & Jiang, 2024). Individuals with high self-efficacy are confident in their ability to successfully perform desired actions, such as effectively utilizing SES (Goodbody, 2023). This belief significantly influences their cognitive processes, leading them to concentrate on the benefits of SES and their own successful experiences, thereby fostering a positive evaluation of the system's usefulness and ease of use (Guerin et al., 2020).

In the context of private higher education institutions, lecturers' self-efficacy plays a pivotal role in shaping their perceptions of SES. Lecturers with high self-efficacy are more likely to perceive online student management platforms positively, believing in their ability to efficiently manage students using these platforms. This belief is underpinned by an acknowledgment of the resources and support offered by the platforms, enhancing their utility in educational settings (Kretschmer et al., 2022). Such lecturers are inclined to actively explore various functionalities of the platform, engage effectively with students, and integrate the platform into their pedagogical practices.

Conversely, lecturers with low self-efficacy may harbor reservations about the effectiveness of online student management platforms. Their lack of confidence in utilizing these platforms for student management can result in a diminished perception of the platform's effectiveness, leading to negative attitudes and a lower frequency of usage (Machluf et al., 2022). Therefore, there exists a notable relationship between self-efficacy and lecturers' perceptions of the usefulness and ease of use of online student management platforms, as well as their intention to use them (Punjani & Mahadevan, 2022). High self-efficacy among lecturers can encourage more active engagement with the platform, culminating in more positive experiences and evaluations. Consequently, the following hypothesis are proposed:

H7 : *Self-efficacy positively affects the Intention to use SES.*

H8 : *Self-efficacy positively affects the Perceived usefulness.*

H9 : *Self-efficacy positively affects the Perceived ease of Use.*

Individuals' perception that a system is easy to use significantly influences their assessment of its usefulness (Hastings, 2022). Usability factors, such as ease of operation, user-friendly interface, and smooth interaction processes, contribute to this perception (Ertugrul et al., 2020). When users find a system easy to use, they are more inclined to recognize its helpful functions and benefits, particularly in student management, thereby enhancing their perception of the system's usefulness. Improved usability facilitates understanding and use of the system's functions, streamlines learning and adaptation, and improves work efficiency by simplifying tasks like data analysis and information retrieval (Tseng et al., 2021). Consequently, a high level of perceived ease of use bolsters individuals' understanding of the system's usefulness and positively influences their evaluation of its effectiveness and value (Pal & Vanijja, 2020)s. Based on these insights, the following hypothesis is proposed:

H10 : *Perceived Ease of Use positively affect the Perceived Usefulness.*

Perceiving the usefulness of a system involves individuals recognizing its functionality and benefits, such as effective student management solutions, data analysis, and monitoring student progress (Khoa et al., 2020). This understanding fosters a positive attitude towards the system and willingness to use it. Perceived usefulness heightens expectations and satisfaction with system usage, as individuals believe it will yield positive outcomes, meet management needs, and enhance work efficiency (Alzahrani & Seth, 2021). Consequently, this perception increases acceptance of the system, reinforcing the belief in its positive impact on student management tasks and intensifying the intention to use it (Horota et al., 2023). A good user experience, derived from experiencing the system's actual benefits, further amplifies satisfaction and willingness to continue its use (Ashfaq et al., 2020). Based on these insights, the following hypothesis is available:

H11: *Perceived usefulness positively affects the intention to use SES.*

Perceived ease of use in digital systems enhances individuals' understanding and operation, reducing learning and adaptation challenges (Iglesias et al., 2021). This perception leads to easier management of student-related tasks and data analysis. When users find the system user-friendly, it lowers psychological and technical barriers, increasing their confidence and willingness to use the system (Li et al., 2022). High perceived ease of use contributes to achieving student management goals and improving work efficiency (Stone et al., 2020). It also positively impacts user satisfaction, leading to a favorable attitude towards the system and aligning with their management needs (Eraslan Yalcin & Kutlu, 2019). Thus, the following hypothesis is proposed:

H12 : *Perceived ease of use positively affects the intention to use SES.*

The intention to use digital systems is a key determinant and motivator for their actual usage (Kammerlohr et al., 2021). Strong intentions often lead to active engagement in activities like registration, login, and data management (Klemmt & König, 2020). This intention significantly influences decision-making and planning regarding system use, affecting usage timing, frequency, and functional choices. The strength of this intention also impacts the enthusiasm and precision in decision-making processes. Furthermore, a firm intention typically results in sustained, long-term system use, rather than sporadic engagement (Naranjo-Zolotov et al., 2019). Based on these insights, the following assumptions are proposed:

H13 : *Intention to Use SES positively affect the adoption behavior towards SES.*

In the Educational Technology Acceptance Model (ETAM), Perceived Usefulness (PU) is educators' perception of a technology's value in teaching (Leonel, 2023). ETAM indicates that users are more inclined to adopt technology they find beneficial for enhancing efficiency and achieving goals (Al-Maroof et al., 2023). Additionally, subjective norms, reflecting societal pressures and expectations, influence users' evaluations of digital systems, impacting their intention to use these systems for student management. Therefore, the relationship between subjective norms and intention to use digital systems is moderated by users' evaluations of these systems. Based on these insights, this research proposes the following hypothesis:

H14: *Perceived Usefulness mediates the relationship between the Subjective Norm and Intention to Use SES.*

Users' attitudes towards digital systems, encompassing their cognitive beliefs, emotional responses, and behavioral inclinations, significantly influence their usage intentions (Magnusson, 2022). This attitude is shaped by the perceived usefulness of the system, where a positive perception, such as finding the system efficient and helpful for academic tasks, leads to a favorable intention to use it (Martín & Martín, 2021). Factors like prior experiences and ease of use contribute to this positive attitude (Siagian et al., 2022). Specifically, the perceived usefulness of the National Platform for Intelligent Education acts as a mediator between users' attitudes and their usage intentions. Therefore, this research puts forward:

H15: *Perceived NPIE Usefulness mediates the relationship between the Use the NPIE Attitude and Intention to Use NPIE.*

Self-efficacy, the belief in one's ability to execute specific tasks, significantly influences the intention to use technology like the National Platform for Intelligent Education (NPIE) (Mielke et al., 2023; Paradas et al., 2021). Users with high self-efficacy, shaped by factors such as prior technology experience and personal confidence, are more likely to intend to use the NPIE. However, this relationship is mediated by perceived usefulness; users who deem the NPIE beneficial for academic management are more likely to strengthen their usage intention. Thus, perceived usefulness acts as a pivotal intermediary, enhancing the link between self-efficacy and intention to use the system (Khan et al., 2021). Consequently, this research proposes the following hypothesis:

H16: *Perceived Usefulness mediates the relationship between the Self Efficacy and Intention to Use SES.*

In the educational technology acceptance model, perceived usefulness (PU) is defined as educators' subjective assessment of a technology's value and effectiveness in teaching, while perceived ease of use (PEOU) relates to the perceived simplicity of using the technology (Usman et al., 2020). Perceived usefulness mediates the relationship between perceived ease of use and the intention to use digital technology. Users who find the system user-friendly and easy to navigate are more inclined to intend its use. This perception is influenced by factors like intuitive design and clear instructions (Tekler et al., 2022). However, the direct connection between ease of use and usage intention may not encompass the entire effect, leading to the following research proposal:

H17: *Perceived usefulness mediates the relationship between the perceived ease of use and intention to use SES.*

The subjective norm impacts users' perceptions of a digital system's ease of use; if users believe that significant others expect them to use the system, this belief can enhance their perception of its ease of use (Pireddu, 2022). Consequently, when users find the system easy to navigate, they are more inclined to view it as beneficial for academic tasks, associating user-friendliness

with utility and efficiency (Paudel, 2021). Thus, perceived ease of use acts as a mediator between subjective norm and perceived usefulness, indirectly shaping users' views on the system's utility (Aji et al., 2020). This study, therefore, proposes the following:

H18: *Perceived ease of use mediates the relationship between the subjective norm and perceived usefulness.*

Users' positive attitudes towards digital systems enhance their perception of the system's ease of use, leading them to view it as user-friendly (Pandita & Kumar, 2023). This perceived ease of use subsequently influences their belief in the system's usefulness, particularly in managing academic tasks, associating user-friendliness with increased utility and efficiency (Tahar et al., 2020). This research proposes the following hypothesis:

H19: *Perceived ease of use mediates the relationship between the attitude and Perceived Usefulness.*

Users' self-efficacy beliefs regarding digital systems positively influence their perceptions of ease of use (Romero, 2022). High self-efficacy leads to a belief in effective system navigation, enhancing perceived ease of use (Thongsri et al., 2020). This perception, in turn, impacts the perceived usefulness of the system, particularly in academic task management (Siiman et al., 2020). Consequently, perceived ease of use mediates the relationship between self-efficacy and perceived usefulness, with this research proposing the following:

H20: *Perceived ease of use mediates the relationship between the self-efficacy and perceived usefulness.*

Subjective norms shape users' perceptions of digital systems' ease of use; if users sense an expectation from others to use these systems, it can enhance their belief in the system's user-friendliness (Katoch & Rana, 2023). This social influence may lead users to align their views with others, believing in the system's manageability (Stewart, 2020). Consequently, perceived ease of use influences users' intention to use the systems, with ease of use fostering positive attitudes and confidence, thereby strengthening their intention to utilize the systems for academic purposes (X. Zhang et al., 2019). Therefore, this research proposes the following:

H21: *Perceived ease of use mediates the relationship between the subjective norm and intention to use SES.*

Users' attitudes significantly impact their perceptions of a digital system's ease of use. A positive attitude towards the system typically leads to a belief in its user-friendliness and ease of operation (Van der Keylen et al., 2022). This perceived ease of use subsequently influences their intention to utilize the system. Users who find the system straightforward are more inclined to have a stronger intention to adopt and use it for academic purposes (Teo et al., 2019). Such a perception enhances their confidence in effectively using the system. Hence, this research proposes the following:

H22: *Perceived ease of use mediates the relationship between the Attitude and Intention to Use SES.*

The Educational Technology Acceptance Model indicates a complex interplay between AI platform usability, individual self-efficacy, and usage intention (Wang, 2022). High self-efficacy in users enhances their perception of a system's ease of use, subsequently influencing their intention to use it (Zhang, 2022). Users confident in navigating the system are more likely to intend its use for academic tasks, as ease of use boosts their usage confidence (Teo et al., 2019). This research, therefore, proposes the following:

H23: *Perceived Ease of Use mediates the relationship between the Self Efficacy and intention to use SES.*

Subjective norms significantly impact users' intentions to use digital platforms; perceived

expectations from others can positively shape their adoption intentions (Wang, 2022). Social pressures or expectations often strengthen users' compliance with these norms (Singh et al., 2021). Higher usage intentions typically lead to increased actual system use for academic tasks and activities. Consequently, this research proposes the following:

H24: *Intention to use SES mediates the relationship between the Subjective Norm and adoption behavior towards SES*.

Users' positive attitudes towards digital platforms enhance their intention to adopt and use these systems, influenced by beliefs in their usefulness, ease of use, and positive experiences (Tirocchi et al., 2022). This intention subsequently drives actual system usage (Katoch & Rana, 2023), with higher intentions leading to increased engagement in academic tasks and activities. Therefore, this research proposes the following:

H25: *Intention to use SES mediates the relationship between the attitude and adoption behavior towards SES*.

High self-efficacy in users enhances their belief in effective system navigation, fostering a stronger intention to adopt and use it (Rong, 2021). This positive self-efficacy instills confidence in successful system usage. Consequently, a higher intention to use smart tools leads to increased actual engagement with the system for academic tasks and activities (Katoch & Rana, 2023). Hence, this study proposes the following:

H26: *Intention to use SES mediates the relationship between the Self Efficacy and adoption behavior towards SES*.

The Educational Technology Acceptance Model posits that perceived usefulness and ease of use are key determinants of educators' intentions and behaviors towards using technological systems (Pereira & da Silva, 2021). These factors not only influence the planning but also the actual usage of a technological system, as they shape user behavioral plans (Chen & Aklikokou, 2020). Users who perceive a system as both useful and easy to use for academic management are more inclined to adopt and utilize it (Nikonova et al., 2023). The belief in the system's usefulness motivates users to consider its application in academic tasks (Morán et al., 2022). Furthermore, the intention to use smart tools directly impacts users' actual engagement with the system. A higher intention to use these tools correlates with increased actual usage for academic purposes. Therefore, this research proposes the following:

H27: *Intention to use SES mediates the relationship between the perceived usefulness and adoption behavior towards SES*.

H28: *Intention to use SES mediates the relationship between the Perceived Ease of Use and adoption behavior towards SES*.

3. Methodology

Utilizing a quantitative approach, the study gathered data through a structured questionnaire administered online with purposive sampling strategy. 617 valid responses are successfully retrieved. With the help of SPSS and AMOS, analytical methods include descriptive statistics for a preliminary data overview, exploratory factor analysis (EFA) and confirmatory factor analysis (CFA) for understanding and verifying the relationships between variables, and structural equation modeling (SEM) for testing the hypothesized model of consumer behavior.

The study implements a series of systematically organized online questionnaires, each meticulously formulated to accurately assess essential variables utilizing a 7-point Likert scale:

Self-Efficacy as conceptualized by Bandura (1977), is used to evaluate individuals' belief in their ability to effectively use the SES. It measures various dimensions including technical operation, system proficiency, problem-solving, and adaptability, providing insight into user confidence and potential for successful engagement with the platform. Theory of Planned Behavior, adopted from Katoch & Rana (2023), this theory assesses the subjective norms around using the SES. It explores the perceived social pressures and influences that may affect users' behaviors towards the system. Attitude towards SES this aspect evaluates the users' perceptions—encompassing students, teachers, and administrators—towards the SES. It considers their views on its usability, effectiveness, and overall benefit, capturing the emotional and rational responses to the system. Perceived ease of use assesses how users perceive the effort required to use the SES. It includes elements such as ease of learning, system control, and user-friendliness, emphasizing the importance of user experience in technology adoption (Venkatesh et al., 2003). Perceived usefulness measures the extent to which users believe that using the SES will enhance their performance. It encompasses aspects like productivity, efficiency, and job support, highlighting its significance in influencing technology acceptance (Venkatesh et al., 2003). Intention to Use, this construct reflects the users' readiness to employ the SES, influenced by their perceived ease of use and usefulness (Venkatesh et al., 2003). It covers aspects such as future usage plans and commitment to job-related use, providing an outlook on user engagement intentions with the platform. Adoption Behavior, finally, this measures the actual adoption of the SES among users, including frequency of use and integration into daily tasks. It aims to capture the practical application and effectiveness of the SES in the higher education context.

4. Results

4.1 Descriptive Analysis

Table 1 provides essential demographic information of the study's participants, encompassing gender, age, education level, and province of residence. The gender distribution among the 617 participants is nearly balanced, with males constituting 48.8% (301 individuals) and females 51.2% (316 individuals).

Regarding age, most participants fall within the 25-30 years range, representing 47.5% (293 individuals) of the sample, followed by the 30-35 years age group at 42.0% (259 individuals). Those under 25 years constitute a smaller segment at 4.1% (25 individuals), and participants over 35 years account for 6.5% (40 individuals) of the sample.

In terms of education level, a significant majority of the participants hold a master's degree, comprising 83.8% (517 individuals) of the sample. Those with a bachelor's degree represent 14.3% (88 individuals), and a small fraction, 1.9% (12 individuals), hold a Doctoral degree.

Geographically, the participants are distributed across various provinces in China. Guangdong has the highest representation with 22.9% (141 individuals), followed closely by Sichuan at 21.2% (131 individuals), Hubei at 19.0% (117 individuals), Henan at 18.2% (112 individuals), and Jiangsu at 18.8% (116 individuals). This geographical distribution indicates a diverse sample from different regions, providing a comprehensive overview of the demographic characteristics of the study's participants.

Table 1. Essential information.

		Frequency	Percent
Gender	Male	301	48.8
	Female	316	51.2
Age	<25	25	4.1
	25-30	293	47.5
	30-35	259	42.0
	>35	40	6.5
Education level	Bachelor	88	14.3
	Master	517	83.8
	Doctor	12	1.9
Province	Guangdong	141	22.9
	Sichuan	131	21.2
	Jiangsu	116	18.8
	Henan	112	18.2
	Hubei	117	19.0

4.2 Reliability and Validity Analysis

Table 2 presents the reliability statistics of the study's measurement instrument, quantified through Cronbach's Alpha, a widely recognized measure of internal consistency in research. The table 2 reports a Cronbach's Alpha value of .960, calculated over 46 items. This high alpha value, significantly above the commonly accepted threshold of .70, indicates an excellent level of reliability and internal consistency within the scale. It suggests that the items are highly correlated and collectively provide a consistent measure of the construct being studied.

Table 3 details the results of the Kaiser-Meyer-Olkin (KMO) measure and Bartlett's Test of Sphericity, both of which are used to assess the suitability of data for factor analysis. The KMO measure of sampling adequacy is reported as .967, which is well above the acceptable threshold of .60. This high value indicates that the sample size is adequate, and the data patterns are suitable for factor analysis.

Bartlett's Test of Sphericity, which tests the hypothesis that the correlation matrix is an identity matrix (implying that variables are unrelated), shows an approximate Chi-Square value of 15367.189 with 1035 degrees of freedom and a significance level (Sig.) of .000. This result is highly significant, rejecting the null hypothesis and confirming that the variables are intercorrelated and suitable for factor analysis. Together, these tests validate the appropriateness of the data for conducting factor analysis, ensuring the reliability and validity of the constructs measured in the study.

Table 2: Reliability Statistics.

Cronbach's Alpha	N of Items
.960	46

Table 3: KMO and Bartlett's Test.

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.967
Bartlett's Test of Sphericity	Approx. Chi-Square	15367.189
	df	1035
	Sig.	.000

4.3 Confirmatory Factors Analysis

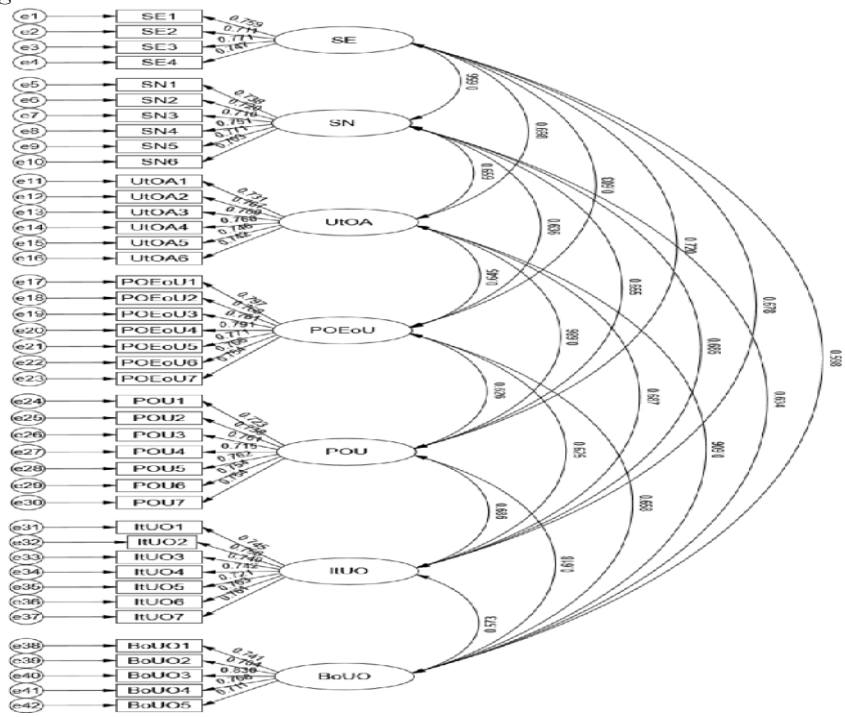

Figure 1: CFA for the Structural Model**.**

Table 4 presents the confirmatory factor model fit metrics, essential for evaluating the adequacy of the model in a structural equation modeling context. The fit indices include the Chi-square/degrees of freedom ratio ($\chi 2/df$), Root Mean Square Error of Approximation (RMSEA), Goodness of Fit Index (GFI), Adjusted Goodness of Fit Index (AGFI), Normed Fit Index (NFI), Tucker-Lewis Index (TLI), and Comparative Fit Index (CFI). The reference standards for a satisfactory model fit are $\chi 2/df < 3$, RMSEA < 0.08, and values greater than 0.9 for GFI, AGFI, NFI, TLI, and CFI. The results demonstrate a $\chi 2/df$ of 1.381 (<3), RMSEA of 0.025(<0.08), GFI of 0.924, AGFI of 0.914, NFI of 0.929, TLI of 0.978, and CFI of 0.979. These values surpass the reference standards, indicating a robust fit of the confirmatory factor model to the data, thus affirming the model's validity and the reliability of the constructs measured.

Table 4: Confirmatory Factor Model Fit Metrics.

Fit index	$\chi 2/df$	RMSEA	GFI	AGFI	NFI	TLI	CFI
Reference standards	<3	<0.08	>0.9	>0.85	>0.9	>0.9	>0.9
Result	1.381	0.025	0.924	0.914	0.929	0.978	0.979

Table 5 presents a detailed convergence validity analysis of the latent variables in the study, using observation indicators, factor loadings, Composite Reliability (CR), and Average Variance Extracted (AVE).

For the latent variable 'Self-Efficacy', observation indicators SE1 to SE4 show factor loadings ranging from 0.711 to 0.771, with a CR of 0.835 and an AVE of 0.559. This indicates a satisfactory level of internal consistency and a moderate amount of variance captured by the construct. 'Subjective Norm' is represented by indicators SN1 to SN6, with factor loadings

between 0.703 and 0.771. The CR for this construct is 0.874, and the AVE is 0.537, suggesting strong reliability and a good level of variance explained by the latent variable. The 'Attitude' variable, measured through indicators UtOA1 to UtOA6, exhibits factor loadings from 0.731 to 0.768. It has a CR of 0.887 and an AVE of 0.566, indicating high reliability and a substantial amount of variance accounted for by the construct. 'Perceived Ease of Use', with indicators POEoU1 to POEoU7, shows factor loadings ranging from 0.754 to 0.797. The CR is 0.912 and the AVE is 0.597, reflecting excellent internal consistency and a significant proportion of variance captured. Lastly, 'Perceived Usefulness' is assessed through indicators POU1 to POU3, with factor loadings between 0.723 and 0.761, a CR of 0.897, and an AVE of 0.554, denoting strong reliability and a moderate level of explained variance.

Overall, the factor loadings are well above the acceptable threshold of 0.7, CR values exceed the recommended 0.7, and AVE values are above the minimum requirement of 0.5, collectively indicating robust convergence validity of the constructs in the study.

Table 5: Convergence Validity Analysis

Latent variables	Observation indicators	Factor loading	CR	AVE
Self-Efficacy	SE1	0.759	0.835	0.559
	SE2	0.711		
	SE3	0.771		
	SE4	0.747		
Subjective Norm	SN1	0.738	0.874	0.537
	SN2	0.720		
	SN3	0.710		
	SN4	0.751		
	SN5	0.771		
	SN6	0.703		
Attitude	UtOA1	0.731	0.887	0.566
	UtOA2	0.767		
	UtOA3	0.760		
	UtOA4	0.768		
	UtOA5	0.746		
	UtOA6	0.742		
Perceived Ease of Use	POEoU1	0.797	0.912	0.597
	POEoU2	0.768		
	POEoU3	0.761		
	POEoU4	0.791		
	POEoU5	0.771		
	POEoU6	0.766		
	POEoU7	0.754		
Perceived Usefulness	POU1	0.723	0.897	0.554
	POU2	0.738		
	POU3	0.761		
	POU4	0.715		
	POU5	0.762		
	POU6	0.754		
	POU7	0.754		

Intention to Use SES	ItUO1	0.745	0.898	0.559
	ItUO2	0.758		
	ItUO3	0.740		
	ItUO4	0.742		
	ItUO5	0.721		
	ItUO6	0.763		
	ItUO7	0.761		
Adoption Behavior towards SES	BoUO1	0.741	0.867	0.566
	BoUO2	0.704		
	BoUO3	0.830		
	BoUO4	0.768		
	BoUO5	0.711		

Table 6 presents a discriminant validity test for the latent variables in the study. The diagonal elements represent the square roots of the Average Variance Extracted (AVE) for each corresponding dimension, while the off-diagonal elements are the correlations between the latent variables. The latent variables include Self-Efficacy (SE), Subjective Norm (SN), Attitude towards the smart education system (UtOA), Perceived Ease of Use (POEoU), Perceived Usefulness (POU), Intention to Use SES (ItUO), and Adoption Behavior towards the smart education system (BoUO). The square roots of AVE (diagonal values) for each latent variable are higher than the correlations with other variables (off-diagonal values), which is a key criterion for establishing discriminant validity. This indicates that each construct is distinct and captures a unique aspect of the model that is not overly overlapped with other constructs. For instance, the AVE square root for SE (0.748) is greater than its correlations with SN, UtOA, POEoU, POU, ItUO, and BoUO, affirming its distinctiveness. This pattern is consistent across all latent variables, demonstrating that each construct in the model is well-differentiated and valid.

Table 6: Distinguish between Validity Tests

Latent variables	**1**	**2**	**3**	**4**	**5**	**6**	**7**
SE	0.748						
SN	0.656	0.733					
UtOA	0.698	0.659	0.752				
POEoU	0.603	0.636	0.645	0.773			
POU	0.720	0.655	0.686	0.626	0.744		
ItUO	0.678	0.685	0.687	0.625	0.686	0.748	
BoUO	0.598	0.634	0.606	0.658	0.618	0.573	0.752

Note: The Diagonal is the Square Root of the Corresponding Dimension AVE.
SE: Self Efficacy; SN: Subjective Norm; UtOA: Attitude towards smart education system; POEoU: Perceived ease of use; POU: Perceived usefulness; ItUO: Intention to Use SES; BoUO: Adoption behavior of towards smart education system

4.4 Structural Equation Model

Table 7 provides a comprehensive evaluation of the model fit for the Structural Equation Model (SEM) using various fit indices. The Chi-square/degrees of freedom ratio ($\chi 2/df$) is a primary measure, with a result of 1.557, well below the reference standard of <3, indicating a good fit. The Root Mean Square Error of Approximation (RMSEA) stands at 0.030,

significantly lower than the <0.08 threshold, suggesting a close fit of the model to the data. The Goodness of Fit Index (GFI) and Adjusted Goodness of Fit Index (AGFI) are 0.915 and 0.905, respectively, both exceeding the >0.9 and >0.85 standards, indicating an adequate fit. The Normed Fit Index (NFI), Tucker-Lewis Index (TLI), and Comparative Fit Index (CFI) are 0.920, 0.967, and 0.970, respectively, all surpassing the >0.9 benchmark. These results collectively suggest that the SEM demonstrates an excellent fit across multiple criteria, affirming the model's structural validity and the hypothesized relationships within it.

Table 7. Model Fit Metrics for the Structural Equation Model.

Fit index	χ2/df	RMSEA	GFI	AGFI	NFI	TLI	CFI
Reference standards	<3	<0.08	>0.9	>0.85	>0.9	>0.9	>0.9
Result	1.557	0.030	0.915	0.905	0.920	0.967	0.970

Table 8 articulates a sophisticated path analysis and hypothesis validation within the Structural Equation Modeling (SEM) framework, scrutinizing the interrelations among various constructs. The analysis probes into the dynamics between Subjective Norm (SN), Attitude towards the Smart Education System (UtOA), Self Efficacy (SE), Perceived Ease of Use (POEoU), Perceived Usefulness (POU), Intention to Use SES (ItUO), and Adoption Behavior towards the Smart Education System (BoUO).

The salient findings reveal that Subjective Norm (SN) exerts a substantial impact on Intention to Use (ItUO), Perceived Usefulness (POU), and Perceived Ease of Use (POEoU), corroborating hypotheses H1, H2, and H3. This underscores the pivotal role of societal influences and expectations in molding users' intentions and perceptions related to the system. Furthermore, Attitude (UtOA) significantly influences ItUO, POU, and POEoU (H4, H5, H6), indicating that favorable attitudes towards the system markedly enhance users' intentions to use and their perceptions of its utility and ease of use. The influence of Self Efficacy (SE) on ItUO, POU, and POEoU is notably significant (H7, H8, H9), emphasizing the criticality of users' confidence in their capabilities to efficiently utilize the system. The interplay between POEoU and POU (H10) is also significant, suggesting that ease of use positively contributes to the perceived usefulness of the system. The effects of Perceived Usefulness (POU) on ItUO (H11) and Perceived Ease of Use (POEoU) on ItUO (H12) are consequential, highlighting the integral role of these perceptions in shaping usage intentions. Conclusively, Intention to Use (ItUO) robustly predicts Adoption Behavior (BoUO) (H13), affirming that heightened intentions to utilize the system culminate in augmented actual usage behavior.

Table 8. Path Test and Hypothesis Verify.

Hypothesis	Path	Estimate	β	S.E.	C.R.	P	Results
H1	SN→ItUO	0.239	0.244	0.050	4.785	***	Supported
H2	SN→POU	0.158	0.175	0.048	3.330	***	Supported
H3	SN→POEoU	0.322	0.311	0.057	5.606	***	Supported
H4	UtOA→ItUO	0.204	0.199	0.055	3.701	***	Supported
H5	UtOA→POU	0.208	0.221	0.053	3.920	***	Supported
H6	UtOA→POEoU	0.341	0.315	0.064	5.345	***	Supported
H7	SE→ItUO	0.167	0.168	0.057	2.925	0.003	Supported
H8	SE→POU	0.326	0.357	0.054	6.091	***	Supported
H9	SE→POEoU	0.188	0.179	0.063	3.001	0.003	Supported
H10	POEoU→POU	0.136	0.157	0.041	3.287	0.001	Supported

H11	POU→ItUO	0.218	0.200	0.059	3.698	***	Supported
H12	POEoU→ItUO	0.135	0.143	0.043	3.154	0.002	Supported
H13	ItUO→BoUO	0.594	0.631	0.047	12.778	***	Supported

SE: Self Efficacy; SN: Subjective Norm; Utoa: Attitude towards Smart Education System; Poeou: Perceived Ease of Use; POU: Perceived Usefulness; Ituo: Intention to Use SES; Bouo: Adoption Behavior of towards Smart Education System.

Table 9 presents the outcomes of a mediation effect bootstrap test within a Structural Equation Modeling (SEM) framework, focusing on the National Platform for Intelligent Education in Higher Education (SES). This table scrutinizes the mediating roles of constructs like Self Efficacy (SE), Subjective Norm (SN), Attitude towards the Smart Education System (UtOA), Perceived Ease of Use (POEoU), and Perceived Usefulness (POU) in the relationships between other constructs and outcomes like Intention to Use SES (ItUO) and Adoption Behavior towards the Smart Education System (BoUO).

H14 to H28 explore specific mediation paths, detailing the effect size, standard error (SE), and 95% Confidence Interval (Bias-Corrected) for each path. The results indicate the support status of each mediation hypothesis.

H14 to H23 assess the mediation effects of SN, UtOA, SE, POEoU on the relationships between various constructs and ItUO or POU. These hypotheses are predominantly supported, demonstrating significant indirect effects with confidence intervals excluding zero.

H24 to H28 evaluate the mediation effects of SN, UtOA, SE, POU, and POEoU on the relationship between ItUO and BoUO. Most of these hypotheses find support, indicating significant mediation effects.

Overall, the table 9 reveals substantial mediation effects across the proposed pathways, underscoring the critical intermediary roles played by factors like self-efficacy, subjective norms, attitudes, perceived ease of use, and perceived usefulness. These findings illuminate the intricate interconnections among various constructs and how they collectively influence user intentions and adoption behaviors towards the smart education system. The supported hypotheses underscore the multifaceted nature of user engagement with the system, shaped by a blend of psychological, social, and usability factors.

Table 9: Mediation Effect Bootstrap Test.

Hypothesis	**Mediation path**	**Effect size**	**SE**	**Bias-Corrected 95%CI**		**Results**
H14	SN→POU→ItUO	0.034	0.023	0.003	0.099	Supported
H15	UtOA→POU→ItUO	0.045	0.030	0.004	0.123	Supported
H16	SE→POU→ItUO	0.071	0.037	0.014	0.161	Supported
H17	POEoU→POU→ItUO	0.030	0.018	0.003	0.081	Supported
H18	SN→POEoU→POU	0.044	0.024	0.005	0.105	Supported
H19	UtOA→POEoU→POU	0.047	0.025	0.006	0.116	Supported
H20	SE→POEoU→POU	0.026	0.019	0.001	0.082	Supported
H21	SN→POEoU→ItUO	0.043	0.026	0.001	0.107	Supported
H22	UtOA→POEoU→ItUO	0.046	0.029	0.002	0.122	Supported
H23	SE→POEoU→ItUO	0.025	0.019	0.001	0.082	Supported
H24	SN→ItUO→BoUO	0.142	0.049	0.058	0.253	Supported

H25	UtOA→ItUO→BoUO	0.121	0.055	0.015	0.237	Supported
H26	SE→ItUO→BoUO	0.099	0.057	-0.019	0.210	Rejected
H27	POU→ItUO→BoUO	0.129	0.058	0.016	0.248	Supported
H28	POEoU→ItUO→BoUO	0.080	0.043	-0.008	0.166	Rejected

SE: Self Efficacy; SN: Subjective Norm; Utoa: Attitude towards Smart Education System; Poeou: Perceived Ease of Use; POU: Perceived Usefulness; Ituo: Intention to Use SES; Bouo: Adoption Behavior of Towards Smart Education System.

Figure 2 uncovers the structural equation model diagram and explains the relationship among subjective norms, attitude, and self-efficacy, the intention to use SES, and adoption behavior towards SES. By this way, this model identifys the mediation roles of perceived usefulness and perceived ease of use.

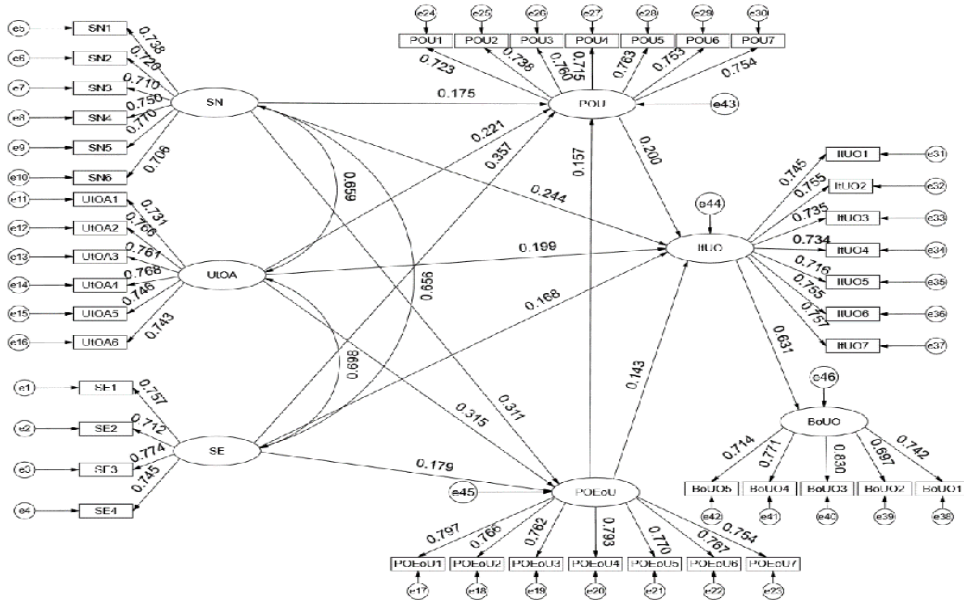

Figure 2: Structural Equation Model Diagram.

5. Discussion and Conclusion

The analysis of the SEM framework offers a comprehensive understanding of the factors influencing user interaction with the smart education system. The findings from the path analysis and the mediation effect bootstrap test collectively provide a nuanced view of the interrelationships among various constructs.

In the path analysis, the significant influence of subjective norm on intention to use, perceived usefulness, and perceived ease of use (H1, H2, H3) highlights the pivotal role of societal norms and expectations in shaping users' intentions and perceptions regarding the smart education system. Similarly, attitude towards smart education system significantly impacts intention to use, perceived usefulness, and perceived ease of use (H4, H5, H6), suggesting that users' positive attitudes towards the system enhance their intentions to use and their perceptions of its utility and ease. Furthermore, self-efficacy shows a notable effect on intention, perceived usefulness, and perceived ease of use (H7, H8, H9), emphasizing the importance of users' confidence in their ability to effectively use the system. The mediation effect bootstrap test

reveals the intricate roles of these constructs in influencing user behavior. For instance, the indirect effect of subjective norm on intention through perceived usefulness (H14) and attitude's mediation effect on intention through perceived usefulness (H15) indicate that perceptions of usefulness significantly mediate the relationship between subjective norms, attitudes, and intention to use the smart education system. Additionally, the mediation paths involving perceived ease of use (H17, H18, H19) underscore the importance of ease of use in enhancing perceived usefulness and shaping user intentions.

Overall, these findings elucidate the complex dynamics of technology adoption and usage within the educational context. They highlight that subjective norms, attitudes, self-efficacy, perceived ease of use, and perceived usefulness are key determinants of users' intentions and actual adoption behaviors towards the smart education system. This comprehensive analysis underscores the multifaceted nature of user engagement with digital education platforms, influenced by a blend of psychological, social, and usability factors.

5.1 Theoretical Implications

The theoretical implications of this study, which integrates insights from the Technology Acceptance Model and the Theory of Planned Behavior, provide a nuanced understanding of technology adoption, particularly in the context of the smart education system. This integration offers a comprehensive perspective that enhances the existing literature on technology acceptance and usage.

This study aligns with the foundational principles of the Technology Acceptance Model, as proposed by Davis (1989), which posits perceived usefulness and perceived ease of use as critical determinants of technology acceptance. The significant influence of perceived ease of use on perceived usefulness (H10) and the subsequent impact of perceived usefulness on intention (H11) in our findings corroborate Davis's model. This alignment is consistent with Venkatesh & Davis (2000), who emphasized the centrality of these factors in technology adoption. However, our study extends the Technology Acceptance Model by incorporating the role of self efficacy, which significantly affects both perceived usefulness and perceived ease of use (H8, H9). This extension provides a more comprehensive understanding of technology acceptance, resonating with the findings of Compeau & Higgins (1995), who underscored the importance of self-efficacy in technology usage.

Theory of Planned Behavior, as articulated by Ajzen (1991), suggests that attitude, subjective norms, and perceived behavioral control (akin to self efficacy in our study) are instrumental in shaping an individual's behavioral intentions. Our findings, particularly the significant roles of subjective norm and attitude in influencing intention, are in harmony with the Theory of Planned Behavior. This is in line with Daxini et al. (2019), who found similar influences in technology usage contexts. However, our study diverges from traditional Theory of Planned Behavior by demonstrating the mediating role of perceived usefulness and perceived ease of use in these relationships, suggesting a more intricate interplay of factors than originally posited by Ajzen.

The integration of the technology acceptance model and theory of planned behavior in our study offers a more holistic view of technology acceptance. The significant mediating roles of perceived usefulness and perceived ease of use in the relationship between subjective norm, subjective efficacy, attitude, and intention underscore the complex mechanisms through which these factors interact. This perspective is relatively unexplored in existing literature and aligns

with the unified model approach advocated by Venkatesh et al. (2003), which combines elements of both theories.

In summary, this study not only corroborates key aspects of the Technology Acceptance Model and Theory of Planned Behavior but also extends these models by incorporating additional variables and exploring their interrelationships. This approach contributes to a richer and more nuanced understanding of the factors influencing technology adoption in educational settings. It offers new insights that could guide future research and practical applications in this domain, particularly in understanding the multifaceted nature of user engagement with digital education platforms. The findings suggest that subjective norms, attitudes, self-efficacy, perceived ease of use, and perceived usefulness collectively influence user intentions and behaviors, a perspective that enriches the theoretical discourse on technology adoption in educational contexts.

5.2 Practical Implications

The integration of the Technology Acceptance Model and the Theory of Planned Behavior in this study offers comprehensive managerial implications for stakeholders in the educational technology sector, especially concerning Smart Education Systems. These implications span across various aspects, addressing the strategic needs of different stakeholders in the field.

The study's insights into the influence of subjective norms on technology adoption are particularly relevant for educational administrators and policy makers. The significant role of societal norms and expectations in technology adoption highlights the need for cultivating a supportive educational culture. This culture should actively promote the integration of technological advancements in educational settings. For technology developers, understanding the impact of social norms is crucial for developing effective marketing strategies. Leveraging social proof and testimonials can significantly enhance the perceived value and acceptance of their educational technology systems.

Regarding the role of attitude in technology acceptance, the findings offer critical insights for educators, trainers, and smart education system providers. Educators and trainers are encouraged to focus on fostering positive attitudes towards technology, alongside skill development. Training programs should emphasize the benefits and user-friendliness of smart education system to improve attitudes and adoption rates. For smart education system providers, the results underline the importance of user experience and interface design. A well-designed, intuitive system can positively influence user attitudes, leading to higher adoption rates.

The impact of self-efficacy on technology use has important implications for educational institutions and smart education system designers. Institutions should invest in comprehensive training programs to enhance educators' and administrators' self-efficacy in using smart education system. Concurrently, smart education system designers should focus on creating user-friendly features and providing ample support resources to enhance users' self-efficacy, making technology more accessible and easier to adopt.

The mediating roles of perceived usefulness and ease of use underscore the need for smart education system developers and marketing teams to prioritize the development of user-friendly, functionally rich systems. Marketing strategies should highlight both the ease of use and practical benefits of SES, using demonstrations and case studies to showcase the system's functionality and user-friendliness. Furthermore, the finding that Intention to Use is a strong predictor of Actual Use has significant implications for strategic planners in educational

technology. This insight stresses the importance of enhancing factors that improve the intention to use, such as user satisfaction and perceived value, to drive actual usage and ensure the successful implementation and adoption of educational technologies.

In conclusion, this study's integration of the Technology Acceptance Modell and Theory of Planned Behavior enriches the understanding of factors influencing the adoption and effective use of smart education systems. It advocates for a holistic approach that considers a range of influencing factors, providing valuable insights for various stakeholders in the educational technology sector.

5.3 Conclusion

This study has provided a comprehensive analysis of factors influencing the adoption and effective utilization of smart education systems (SES), integrating the technology acceptance model (TAM) and the theory of planned behavior (TPB). The results underscore the significant roles of subjective norms, attitudes, self-efficacy, perceived usefulness, and perceived ease of use in shaping users' intentions and behaviors towards SES. Notably, subjective norms were found to significantly influence users' intentions and perceptions of usefulness and ease of use. Attitudes towards SES also played a crucial role, positively impacting users' adoption intentions. Furthermore, self-efficacy emerged as a key determinant, influencing both perceived usefulness and ease of use. The study also highlighted the mediating roles of perceived usefulness and ease of use, suggesting a more complex interplay of factors than traditionally posited in TAM and TPB models.

The contributions of this study are manifold. Firstly, it extends existing theoretical frameworks by integrating TAM and TPB, offering a more holistic understanding of technology acceptance in educational settings. Secondly, the study provides practical insights for various stakeholders, including educational administrators, policy makers, technology developers, and educators, guiding them in fostering a conducive environment for technology adoption and effective utilization. Thirdly, the study's findings contribute to the broader discourse on technology adoption in education, highlighting the importance of psychological, social, and usability factors.

Despite its contributions, this study is not without limitations. One of the primary limitations is the focus on a specific context - smart education systems - which may limit the generalizability of the findings to other types of educational technologies or settings. Additionally, the study predominantly relies on self-reported data, which may be subject to biases such as social desirability or respondent interpretation. Future research should aim to address these limitations. Expanding the study to include diverse educational technologies and settings would enhance the generalizability of the findings. Longitudinal studies could provide deeper insights into how attitudes and perceptions towards technology evolve over time and influence long-term adoption and usage. Furthermore, incorporating objective measures of technology usage, alongside self-reported data, could provide a more comprehensive understanding of user behavior. Future studies could also explore the impact of additional variables, such as cultural factors or individual differences, on technology acceptance and usage in educational contexts.

In conclusion, this study makes significant contributions to the understanding of technology acceptance in education, providing valuable insights for enhancing the adoption and effective

use of smart education systems. However, the exploration of this complex field is far from complete, and future research is essential to build upon these findings and further our understanding of technology adoption in educational environments.

Data Availability Statement

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

Author Contributions

Z.Z took care of data collection, data analysis, and writing the manuscript. C.S provided substantial inputs for improving the statistical analysis of the manuscript. C.S took care of editing and proofreading. All authors contributed to the article and approved the submitted version.

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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