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INFLUENCING SUSTAINABLE BEHAVIOR IN THE ONLINE EDUCATION INDUSTRY VIA KNOWLEDGE SHARING

Songyu Jiang [1], Rita YiMan Li [2]*, Xiaojun Ke [3] and Hao Li [4]

[1] Rattanakosin International College of Creative Entrepreneurship, Rajamangala University of Technology Rattanakosin, Nakhon Pathom, 73170, Thailand. Email: jiang.song@rmutr.ac.th
[2] Sustainable Real Estate Research Center, Hong Kong Shue Yan University, Hong Kong, 999077, China. *Corresponding Author Email: ymli@hksyu.edu
[3] School of Business Administration, Guangzhou Institute of Science and Technology, Guangzhou, 510540, China. Email: drxjke@gzist.edu.cn
[4] Faculty of Humanities, Kasetsarts University, Bangkok, 10900, Thailand. Email: li.hao@ku.th

Abstract

In the digital economy era, sustainable education online flourishes. This research included 527 valid questionnaires from higher education students in China, to study the relationship between knowledge sharing, digital technology acceptance, and sustainable behavior in the online education industry (SBOEI). Using bootstrapping, structural equation models (SEM), independent samples t-test and one-way ANOVA test, the results indicated that knowledge sharing positively impacts SBOEI, perceived ease of use of digital technology (PEUD), and perceived usefulness of digital technology (PUD). A meticulous analysis delineated that PEUD and PUD served as significant mediators of relationship between the knowledge sharing and SBOEI. In essence, higher income levels, urban locations, specific regions (with East China being the most favorable), and certain academic grade levels (particularly sophomores) are associated with higher perceived ease of use of digital technology and greater engagement in sustainable behavior within the online education industry. This study highlights the importance in cultivating knowledge-sharing communities and promote digital acceptance psychology.

Keywords: Knowledge Economy, Digital Economy, Online Education İndustry, Sustainable Behavior, Sharing Economy, Education Marketing.

1. INTRODUCTION

Sustainable behavior in the online education industry refers to the adoption of educational practices and choices that prioritize long-term ecological, economic, and social viability (Azeiteiro et al., 2015), ensuring that the utilization of online educational resources does not deplete or harm future possibilities when consuming the online education products, such as online course, platform and service (Li & Zhou, 2018). The quest for sustainability has become more urgent than ever, necessitating innovative approaches and methodologies to solve the eco, social, and economic problems.

Online education has inadvertently presented challenges that could undermine sustainable development (Kamalov et al., 2023). These include the digital divide which deepens educational inequities between urban, affluent communities and their rural, disadvantaged counterparts (Shao & Kostka, 2023). The environmental impact of online learning platforms include energy consumption, carbon emissions and sustainability (Casado-Aranda et al., 2021). Oversupply online course market also threatens institutional viability (Zhang et al., 2020). Hence, while online education offers transformative possibilities, critical evaluation and strategic interventions are necessary to align with sustainable development goals.

Given the prominence online education and the associated challenges that could potentially impede sustainable development, understanding sustainable behavior within this industry becomes imperative. The digital divide, environmental concerns, economic uncertainties, cultural fragmentation, and an overarching technocentric

approach all underscore the need to reevaluate how educational resources are consumed online (Alam, 2022). By studying sustainable behavior, we can gain insights into how to make online education more accessible, environmentally responsible, economically viable, and pedagogically holistic. Such an understanding would not only ensure that online education truly democratizes learning but also ensures that is in harmony with broader sustainability objectives, thereby reconciling its transformative potential of sustainable development (Burbules et al., 2020).

In the digital economy, traditional manufacturing, food, hotel, medicine, agricultural products, and other industries conducted sustainable behavior research (Song et al., 2022). They threw light on digital trading platforms, P2P activities, blockchain and energy, digital products, and the environment (Jiang & Pu, 2022). However, as online education is a crucial product of the digital economy, study on sustainable behavior in this industry is rare.

The development of the online education industry is undoubtedly successful. From 2011 to 2019, the scale of China's online education market has grown annually (Zhou et al., 2020). Thanks to the policy support and the development of 5G, AI, and other technologies, the scale of China's online education market has expanded in the post-pandemic era (Jiang, 2020). In 2020, China's online education market was 67 billion dollars, and the online higher education market will be 18.5 billion dollars, accounting for 27.80% of the online education market. In 2021, China's online education market worthed 75.8 billion dollars, and the online higher education market was about 21.3 billion dollars, accounting for 28.21% of the online education market (Y. Jiang et al., 2022; Li & Wang, 2021). As one of the hottest industries in recent years, higher education has attracted much capital. In 2021, there were 30 investments and financings in China's higher education industry, with an investment and financing of 900 million dollars. In 2021, 8 platforms in China's online higher education industry r more than 16.52 million dollars (Y. Jiang et al., 2022; Li & Wang, 2021).

Under the trend of the online education, technology acceptance models (TAM) play a significant role (Jamšek & Culiberg, 2020). TAM explain the sustainable behavior of students from HEIs by using the technology (Sukendro et al., 2020), tourism (Sadiq & Adil, 2021), and sharing knowledge (Wang et al., 2018). Similarly, as an essential knowledge-sharing channel, online education provides knowledge management and dissemination convenience (Shahzad et al., 2020). Knowledge sharing, as a way of knowledge interaction between subject and object, has become indisputable in universities, whether it is for sustainable development or sustainable behavior (Blindheim & Karlsen, 2018). However, although Jiang et al. (2022) have demonstrated SBOEI from the perspective of psychology and contextual factors based on consumer value theory, social exchange theory, and planned behavior theory, this study is the first of its kind to explain SBOEI from the perspective of technology and knowledge.

The objective of this study is to examine the knowledge sharing affecting the sustainable behavior in online education industry (SBOEI) based on the technology acceptance model and knowledge-sharing theory. Furthermore, in the context of the digital economy, the research aims to explore.

RQ1: How does knowledge-sharing affect sustainable behavior in the online education industry?

RQ2: Does digital technology acceptance mediate between knowledge sharing and sustainable behavior in the online education industry?

RQ3: What variations exist among demographic groups in terms of their perceptions of the ease of use of digital education technology and their sustainable behavior within the online education sector?

Following the introduction, the subsequent section provides an in-depth review of the theory of knowledge sharing and the technology acceptance model, elaborating on associated variables and formulating hypotheses. The ensuing section is dedicated to detailing the research methodologies employed. Subsequently, the fourth section elucidates the research findings. The study culminates in a discussion of these results, offering managerial implications and suggesting potential avenues for future research.

2. LITERATURE REVIEW

2.1 Theoretical approach

The research attempts to achieve the integration of knowledge sharing theory and the technology acceptance model because the technology acceptance model can explain sustainable behavior in most scenarios. Knowledge sharing is an essential bridge for media, education, and management to predict sustainable behavior in the era of the digital economy. Therefore, the research involves the premise of integrating the digital economy and knowledge economy, explores the factors affecting SBOEI, and tries to construct an SBOEI model.

2.1.2 Theory of knowledge sharing (TKS)

The knowledge-sharing theory holds that shared content, channels, shared results constitute a knowledge-sharing framework and cycle. Moreover, in the digital era, the speed of knowledge sharing has accelerated, and there are more channels than before (Wang et al., 2022). Hence, knowledge-sharing is not only an independent theory in the digital era but also a fashion to integrate knowledge-sharing theory into digital technology digital economy research (Blindheim & Karlsen, 2018). Knowledge sharing facilitates the promotion of technology acceptance models in education, shaping technology adoption behaviors in the education industry (Blindheim & Karlsen, 2018).

Knowledge sharing is often a prerequisite for technology adoption in healthcare, media technology, and organizational management (Blindheim & Karlsen, 2018). Online education is a topic close to knowledge sharing with technology acceptance models. However, we rarely discussed the impact of knowledge sharing or technology-level factors on sustainable behavior in online education. Knowledge sharing has a predictive effect on adopting digital teaching platforms, education models, and online teaching resources (Colnar et al., 2022). Knowledge-sharing and digital technologies are powerful explanatory forces for students' knowledge acquisition, technology adoption, and after-school practice and employee behaviors (Gregson et al., 2015).

On the other hand, knowledge sharing in today's digital society is developing quickly, and there are relevant predictions for shaping sustainable concepts and behaviors. However, knowledge sharing is often mentioned as an essential concept of a knowledge and sharing economy (Wang, 2022).

2.1.2 Technology adoption model (TAM)

In the digital age, technology models are widely used to explain behavior using 5G, IoT, and the web. They also illustrate how teachers and students adopt digital technologies in online education (Bennett et al., 2018). The TAM argues that external forces predict perceived usefulness and ease of use, including policy, economic development, and education (Ma et al., 2017). Perceived ease of use directly impacts perceived usefulness. At the same time, they can help interpret behavioral intent, which in turn can spur technology adoption (Granić & Marangunić, 2019).

The TAM posits that households' adoption of sustainable technologies, spanning energy, media, and intelligent robots, hinges on their Perceived Usefulness (PU) and Perceived Ease of Use (PEOU), suggesting that technologies perceived as beneficial and user-friendly are more likely to be integrated into daily practices (Ofosu-Ampong, 2022). Furthermore, TAM suggests the utilization of these sustainable technologies is directly influenced by the behavioral intention to use them, which is in turn shaped by their perceived utility and ease of operation, emphasizing the need for both intuitive design and clear communication of benefits for widespread adoption (Yarimoglu & Binboga, 2019). In this process, TAM explains how the ease and usefulness of digital or intelligent technologies can advance technology adoption and sustainable behaviors (Kim et al., 2020). Therefore, to promote and realize SBOEI, the study focuses on the impact of knowledge sharing on the usefulness and ease of use of digital technologies in online education. Moreover, to illustrate the ease of use and usefulness of digital education technology for SBOEI of students from Higher education institutions in China.

2.2 Hypothesis statement

Knowledge sharing is the act of knowledge dissemination and knowledge development through the interaction between the subject and the subject knowledge level (Al-Kurdi et al., 2018). Knowledge sharing is one of the main concepts in the digital and knowledge economy era because knowledge sharing is vital in marketing, especially consumer behavior research (Tietz & Werner, 2022). Knowledge sharing of scientific agricultural products can promote consumers' attention to the production mechanism of green agricultural products, pay attention to health information, and form sustainable behaviors (Khor et al., 2015). Social media and digital teaching platforms are becoming the main channels for knowledge sharing, so consumers in the travel industry, whether in hotels or on the go, may promote sustainable behavior (Strähle & Gräff, 2017). At the same time, industries closely related to sustainability, such as automotive and energy, are increasingly waking up to the role of knowledge sharing in shaping green consumption behaviors (Mansoor & Wijaksana, 2021). In education sector, knowledge sharing has become one of the main ways to promote education equality and achieve quality education Through online education platforms, which is also a topic encouraged by current government agencies and education departments (Farahian et al., 2022). Therefore, the study posits:

H1: Knowledge sharing has a positive impact on Sustainable Behavior in the Online Education Industry (SBOEI).

Perceived ease of use is one of the main factors in technology acceptance models and is often used to explain the behavior of technology acceptance (Yu et al., 2023). Refers to the degree to which users believe that using these digital technology systems and platforms can improve their learning and work performance during online

education (Esteban-Millat et al., 2018). It indicates whether someone thinks the technology is helpful for what they want to do in the knowledge economy, where perceived ease of use is often associated with knowledge sharing (de Kervenoael et al., 2020). Besides that, it is evident that the positive effect of knowledge sharing on perceived ease of use in the computer and education fields (Al-Emran et al., 2020). In early research on social media applications, this knowledge-sharing drove perceived ease of use, leading to the acceptance of digital social media (Baima et al., 2022). In similar studies, the healthcare (Talukder et al., 2020) and education industries (Rafique et al., 2020) acknowledge the significant positive effects of sharing expertise and digital information on technology acceptance. Therefore, the study proposes the following:

H2. Knowledge sharing positively influence on the Perceived Ease of Use of Digital Education Technology (PEUD).

Perceived Ease of Use of Digital Education Technology and Perceived usefulness of Digital Education Technology always come in pairs because they have a strong explanatory power for system and technology acceptance (Granić & Marangunić, 2019). The PUD refers to the degree to which people think using a particular system is effortless (Granić & Marangunić, 2019). If online education is easy to use, then obstacles will be overcome. If it is not easy to use and the interface is complicated, no one will take a positive attitude towards it (Almaiah et al., 2020). Similarly, the predictive effect of knowledge sharing on PUDs has been demonstrated in education (Rafique et al., 2020), healthcare (Talukder et al., 2020), and tourism (Roman et al., 2022), all of which are successful developments in technology acceptance models.

H3. Knowledge sharing has a positive influence on the Perceived Usefulness of Digital Education Technology (PUD).

The TAM ultimately explains human activity behavior at the scientific and technological levels (Granić & Marangunić, 2019). In the face of sustainable behavior, the TAM, like other classical theories, tries to give solutions (Gbongli et al., 2019). In the digital era, technology acceptance perception is one of the driving forces of sustainable practices (Jamšek & Culiberg, 2020). In this process, social development forces human beings to constantly perceive technology, thereby changing consumption patterns and serving sustainable development (Ma et al., 2017). Moreover, the evidence from industry of households (Vita et al., 2019), tourism (Roman et al., 2022), medicine (Dhagarra et al., 2020), and social media (Hansen et al., 2018) acknowledged that conclusion.

Based on this, perceived ease of use, as an actual psychological state of educational digital technology perception, may be elaborated like other industries, and perceived ease of use is conducive to promoting sustainable behavior. Often, the ease of use of products positively promotes consumer purchase decisions (Sadiq & Adil, 2021). Therefore, the rapid development of technology, especially in education, perceived ease of use is one of the prerequisites to encourage students and teachers to adopt digital education technology (Dhagarra et al., 2020). In other words, perceived ease of use predicts the willingness to adopt digital technology (Sadiq & Adil, 2021). Therefore, the study hypothesis:

H4. The Perceived Ease of Use of Digital Education Technology (PEUD) exerts a positive impact on Sustainable Behavior in the Online Education Industry (SBOEI).

Perceived usefulness mainly discusses the significance of a technology or system to consumers from the level of consumers' understanding of the role of goods (Esteban-Millat et al., 2018). Therefore, in sustainable energy behavior, perceived usefulness has become essential in predicting the comprehensive saving of new energy and carbon (Irfan et al., 2020). In an era dominated by the sharing economy and the knowledge economy, users pay more attention to the impact of technology on their lives, and technology is often a commodity in itself (Curtis & Lehner, 2019). Technology in the online education industry, such as artificial intelligence, system management, and intelligent teaching platforms, has obtained huge benefits (Esteban-Millat et al., 2018). Whether from the perspective of commodities or public welfare, it subtly affects people's behavior (Quan et al., 2020). In addition, more and more industries are concerned about the impact of perceived usefulness on sustainable behavior (Jamšek & Culiberg, 2020), reflected in product design and promotion. Therefore, the study proposes:

H5. The Perceived Usefulness of Digital Education Technology (PUD) has a positive influence on Sustainable Behavior in the Online Education Industry (SBOEI).

The technical acceptance model suggests that perceived ease of use actively acts on perceived usefulness (Granić & Marangunić, 2019). In the research model of sustainable behavior based on medical and educational technology (Malik, 2018), the relationship line of Perceived Ease of Use of Digital Education Technology (PEUD) and Perceived usefulness of Digital Education Technologyis also valid (Ma et al., 2017). Specifically, users' perception of the convenience of digital technology may increase their awareness of these digital products, and thus form consumer behavior (Rafique et al., 2020). So, the study proposes:

H6. The Perceived Ease of Use of Digital Education Technology (PEUD) exerts a positive influence on the Perceived Usefulness of Digital Education Technology (PUD).

Perceived Ease of Use of Digital Education Technology refers to a person who feels the convenience of digital technology in his work or life and is willing to accept the penetration and use of a particular technology (Esteban-Millat et al., 2018). Perceived Ease of Use of Digital Education Technology is a unique mental perception in the technology field related to sustainable behavior at the level of technological development (Granić & Marangunić, 2019). It is an underlying psychological state in knowledge sharing process (Arfi et al., 2020). TAM emphasize the perception of digital technology is impressed by certain situational factors and acts on specific behaviors (Sukendro et al., 2020). Perceived Ease of Use of Digital Education Technology may be a promising mediating variable between knowledge sharing and sustainable behavior (Tang et al., 2020).

TAM states that Perceived Ease of Use influences behavioral expectations and Perceived Ease of Use plays a vital role in knowledge sharing (Granić & Marangunić, 2019). PEUD is closely related to people's consumption and shared consumption of digital goods (Sukendro et al., 2020). Perceived Ease of Use affects the promotion of sustainable behavior, which may have a new interpretation of behavior in the online education industry (Sukendro et al., 2020). Hence, this study posits:

H7. The Perceived Ease of Use of Digital Education Technology (PEUD) serves as a mediating variable between knowledge sharing and Sustainable Behavior in the Online Education Industry (SBOEI).

PUD is the consumer's perception of the value and role of digital products in their own lives (Sukendro et al., 2020). PUD represents users' feelings about the functions of digital products and indicates their psychological state of functional evaluation of digital products (Ma et al., 2017). PUD can be conceptualized as a holistic evaluation of the role of a digital product, referring to the users' overall sense of its value (Ma et al., 2017). Individuals with low PUD were associated with poorer sustainable behavior, such as refusal to use and buy the eco products (Esteban-Millat et al., 2018). Users with high PUD were associated with better sustianable behavior (Jamšek & Culiberg, 2020). Knowledge sharing theory emphasizes that knowledge sharing in digital technologies can also be used as an impact mechanism, i.e., to make more people aware of the usefulness of digital technologies through content-level considerations (Tietz & Werner, 2022). Therefore, promoting PUD will increase users' likelihood of being responsible for the sustainable development (Esteban-Millat et al., 2018).

On the other hand, PUD can predict sustainable behavior and is also associated with significant sustainable behavior in education (Esteban-Millat et al., 2018), healthcare (Dhagarra et al., 2020), and tourism (Mathew & Soliman, 2021). PUD plays a partial mediating role between knowledge sharing and sustainable practices (Tietz & Werner, 2022). In addition, research shows that PUD can positively predict educational technology use intent, attitudes, and sustainable behavior (Dabbous & Tarhini, 2019). Therefore, this research proposes:

H8. The Perceived Usefulness of Digital Education Technology (PUD) functions as a mediator between Knowledge Sharing and Sustainable Behavior in the Online Education Industry (SBOEI).

The ease of use of online education systems positively affects the usefulness of perceiving educational systems and can positively predict individuals' technology acceptance behaviors (Esteban-Millat et al., 2018). In addition, knowledge sharing plays a vital role in shaping consumer behavior, which is closely related to technology acceptance (Al-Kurdi et al., 2018). The more pronounced individual knowledge-sharing, the higher their technological acceptance, making it easier to produce specific behaviors (Gregson et al., 2015). Conversely, when individuals do not feel knowledge sharing in social activities, or the level of sharing is low, their perception of the usefulness and ease of use of digital technology will be lower, inducing negative emotions that produce behavior (Roth, 2022).

Furthermore, knowledge-sharing is a predictor of sustainable behaviors (Mansoor & Wijaksana, 2021). Individuals with high knowledge-sharing behaviors actively participate in sustainable practices and express their willingness to achieve sustainable development through digital technology (Ebrahimi et al., 2021). They tend to receive more positive responses in the consumption process, which further improves their perception of technology's usefulness and ease of use (Mathew & Soliman, 2021). Therefore:

H9. Knowledge sharing affects Sustainable Behavior in the Online Education Industry (SBOEI) via the sequential mediation of both the Perceived Ease of Use of Digital Education Technology (PEUD) and the Perceived Usefulness of Digital Education Technology (PUD).

3. RESEARCH METHOD

3.1 Data collection and sample

The research employed an online survey instrument to gather 527 valid responses from higher education students in China, all of whom were bachelor students with online education consumption experience by allocated the questionnaire in the social media, like *WeChat, QQ and XiaoHongShu* from June to August 2022. Projects for measuring the structure of the study are from the literature. Measuring of knowledge sharing by using Han et al. (2020). The measurement of PUD and PEUD are origin from Al-Rahmi et al. (2021). The project adopts S. Jiang et al. (2022) to measuring SBOEI. Moreover, the study adapts the items to the educational technology adoption. Table 2 describes the specific content and definitions of variables in the model. Based on this, the study concludes that knowledge sharing happens when people actively share their online education experience and knowledge, encouraging others to adopt online education. PEUD can be understood as an easy-to-use psychology that online education platforms bring to users. The PDU expresses the content that users perceive when using online education technology and is actively related to their learning and work. Sustainable behavior in the online education industry refers to a paradigm where students not only choose online educational products but also actively consider how their choices can further societal development (Calafell et al., 2019). Specifically, within this model, users prioritize platforms and resources that contribute to broader goals such as enhancing the quality of education and promoting educational equality (Ouahib et al., 2022).

Table 2: The measurement and definition of variables

Construct	Operational definition
Knowledge sharing	KS1: I will share my experiences and content of online learning with people around me more frequently.
	KS2: I will always provide the people around me with the manuals, methods, and models of my online learning.
	KS3: I will always provide my knowledge and methods to other students.
	KS4: I will strive to share the expertise I have gained in the online education industry with other learners more effectively.
Perceived Ease of Use of Digital education technology	PEUD1: The interface design of the online education platform is simple and intuitive.
	PEUD2: The operation method of the online education platform is relatively simple and easy to understand.
	PEUD3: I can be more skilled in using some online interactive learning methods, including bullet screens, comments, and discussions
	PEUD4: I can more easily search for the online education content or information that I am interested in.
Perceived usefulness of Digital education technology	PUD1: By learning online education content, I can feel self-improvement.
	PUD2: I can relieve my stress or anxiety through the way and content of online educational learning
	PUD3: Through the way and content of online education learning, I can gain a sense of existence and value
Sustainable behavior in the online education industry	SBOEI1: When selecting online courses or platforms over the past year, I have considered how they incorporate and promote sustainable practices or content.
	SBOEI2: I prioritize choosing online educational products that can be reused, shared, or have a long-term value, reducing the need for frequent repurchases or updates.

	SBOEI3: I actively choose online education platforms or courses that demonstrate a commitment to promoting educational equality and the continuous development of quality education, ensuring that my consumption contributes to broader societal goals.

The study employed a descriptive statistical analysis of participant data using SPSS 26.0, subsequently evaluating the reliability and validity of the survey instrument. Confirmatory factor analysis and structural equation modeling were undertaken through AMOS 26.0 to validate the direct effects, introductory effects, and the posited chained mediation effects. In the final stages, the research utilized ANOVA and the T-test to ascertain the differential impacts of various demographic variables on the perceived ease of use of digital education technology and the sustainable behavior within online education.

4. ANALYSIS AND RESULTS

4.1 Descriptive analysis of the participants' information

Table 1 describes participant information by gender, grade, area, location, and annual household income. 168 men participated in the survey, and 359 women. Participants are mainly sophomores and juniors, who are also the main users of online education. More samples were from rural areas (352) than urban areas (175). Participants came mainly from the west (181) and south (245), with only 49 participants in the east and 52 in the north. Fewer participants had annual household incomes above $30,000 (176), 137 participants with annual household incomes between $10,000-$20,000 and the 171 participants with annual household income between 20,000$-30,000 $. The studies were done using random sampling, so the distribution of demographics was not uniform, but demographic differences could also help further investigate the role of demographic variables on SBOEI.

Table 1: The respondents' information

		Frequency	Valid Percent
Gender	Male	168	31.9
	Female	359	68.1
Grade	Freshman	87	16.5
	Sophomore	201	38.1
	Junior	138	26.2
	Senior	101	19.2
Area	Rural areas	352	66.8
	City areas	175	33.2
Location	East China	49	9.3
	West China	181	34.3
	South China	245	46.5
	North China	52	9.9
Family income per year	<10000$	176	33.4
	10000-20000	137	26.0
	20000-30000	171	32.4
	30000-40000	43	8.2

4.2 Validity and reliability

The surface and content validity of the research tool was evaluated through a pilot study involving five professional professors working in universities in China, Philippines, and Thailand related to online education and sustainable behavior. The tool items were revised accordingly to assess the clarity and relevance of the

questionnaire items. The content validity of the developed questionnaire was ensured by thoroughly examining empirical and theoretical studies related to the primary research structures, including Knowledge Commons, PUD, PEUE, and SBOEI.

In the structural validity test, the KMO >0.9 indicates that the overall validity of the scale is close to perfect, and sig=0.000 (<0.05) in Bartlett's Test of Sphericity indicates that there is a strong correlation between variables. The variables are not independent, and factor analysis can be continued (Yetter et al., 2014).

Table 3: Validity test results

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.946
Bartlett's Test of Sphericity	Approx. Chi-Square	5171.894
	Df	91
	Sig.	.000

The purpose of reliability analysis is to show that the data is credible, reliable, and authentic. Cronbach reliability analysis is the most common and widely used measurement method, directly using an indicator, the Cronbach reliability coefficient value, to describe the reliability level. If the Cronbach reliability coefficient value is more significant than 0.6, it generally means that the reliability is acceptable, and the larger the reliability coefficient value, the better (Hair et al., 2010). From the measurement results of reliability statistics, Cronbach's alpha=0. 913, and the normalized term based on Cronbach's alpha value is also 0 913. Both coefficients are 90%, so the analyzed data have high internal consistency and reliability.

Table 4: Reliability Statistics

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.913	.913	14

4.3 Confirmatory Factor Analysis (CFA)

Confirmatory factor analysis (CFA) was used to assess face validity. Therefore, CFA derived from the Structural Equation Model (SEM) is also used to confirm or refine the one-dimensionality of the questionnaire measurement, as it is a more rigorous one-dimensional test (Mueller & Hancock, 2018). To assess CFA, we measure the goodness-of-fit of the SEM model. Table 5 describes the model adaptation results and indicators: X^2/df=2.987 (<3), GFI=0.946 (≥0.90), AGFI=0.920(≥0.80), NFI=0.953(≥0.90), CFI=0.968(≥0.90), RMSEA=0.061(< 0.08). Therefore, the research model fit fully meet the statistical requirements, which means that the research model can be continued to be studied.

CFA requires that the factor loading of the observed variable higher than 0.6. Otherwise, it should be removed, and a factor load higher than 0.7 indicates good explanatory power, and a factor load higher than 0.8 indicates excellent explanatory ability (Chau, 1997). From the results of CFA, the factor loading between the four observed variables and the latent variable of knowledge sharing is higher than 0.8, indicating four items with excellent explanations. In the same way, the factor loads of the four observed variables of PEUD are all higher than 0.7, indicating that the four factors are the potential to explain PEUD. In addition, the three observation variables of PUD have the same power. The three observation variables (>0.8) in the construction of SBOEI that can help interpret SBOEI.

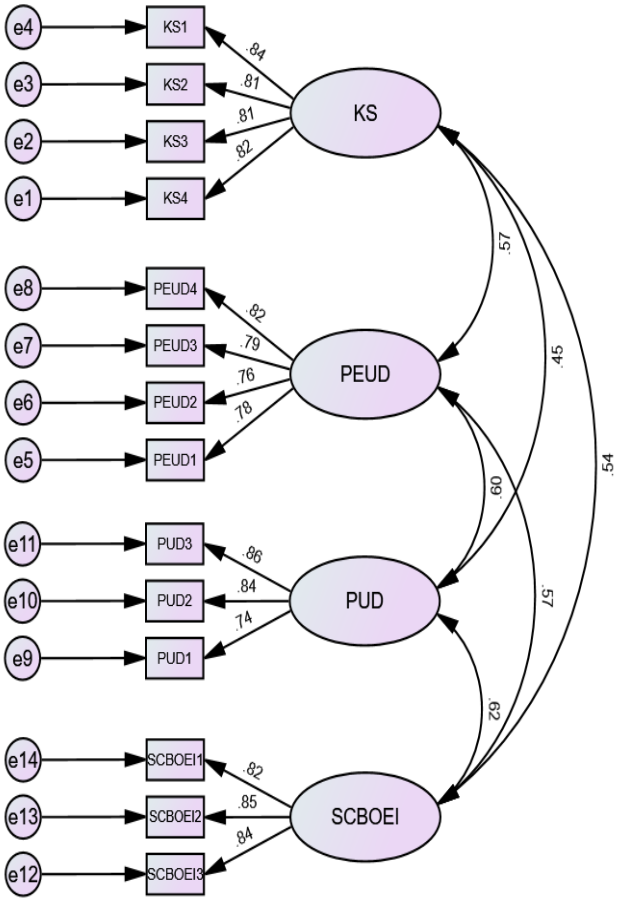

Figure 1: Confirmatory factor analysis diagram.

Table 5: Model fitting

Index	χ2/df	RMSEA	GFI	AGFI	NFI	IFI	TLI	CFI
Standard	<3	<0.08	>0.9	>0.9	>0.9	>0.9	>0.9	>0.9
Results	2.987	0.061	0.946	0.920	0.953	0.968	0.959	0.968

Convergent validity means a question or test that measures the same latent trait that falls on the same factor and a high correlation between the measured values between the questions or tests (Mueller & Hancock, 2018). AMOS calculates Average variation extraction (AVE) and Combination reliability (CR) according to the standardized factor loads of each item of the latent variable. When the standardized factor loads in the study are greater than 0.5, AVE is more significant than 0.6. If the CR is greater than 0.7, it has good convergence validity (Mueller & Hancock, 2018). Table 5 indicates that the NFI value of all CFA models is equal to or greater than 0.90. In addition, all factor loads are significant, and the scale exhibits a high internal consistency level, indicating that the measurement is convergent. In addition, as shown in Table 6, the composite reliability and mean-variance (AVE) values for each construct are> 0.60 (KS=0.672, PEUD=0.622, PUD=0.666, SBOEI=. 0.874). CR is also higher than 0.7 (KS=0.891, PEUD=0.868, PUD=0.856, SBOEI=0.874). Therefore, the convergence validity of the study meets the requirements.

Table 6: Convergence validity test

Latent Variable	Items	Factor load	CR	AVE
KS	KS1	0.835	0.891	0.672
	KS2	0.810		
	KS3	0.809		
	KS4	0.825		
PEUD	PEUD1	0.776	0.868	0.622
	PEUD2	0.764		
	PEUD3	0.793		
	PEUD4	0.820		
PUD	PUD1	0.743	0.856	0.666
	PUD2	0.837		
	PUD3	0.863		
SBOEI	SBOEI1	0.821	0.874	0.698
	SBOEI2	0.846		
	SBOEI3	0.840		

Discriminant validity refers to a low correlation or significant difference between the underlying qualities represented by the facet and the underlying qualities represented by other facets (Mueller & Hancock, 2018). Table 7 suggests that the absolute value of the correlation coefficient between any two factors is less than the square root of the corresponding factor AVE, indicating a certain degree of distinction between the four factors studied. Hence, the distinguishing validity of the scale is reliable.

Table 7: Discriminant validity test

Latent variable	KS	PEUD	PUD	SBOEI
KS	**0.820**			
PEUD	0.573	**0.789**		
PUD	0.455	0.600	**0.816**	
SBOEI	0.539	0.568	0.624	**0.835**
Note: The diagonal is the square root of the corresponding dimension AVE				

Thus, the study uses CR and AVE as the evaluation criteria for convergence validity. When the CR value of each factor is greater than 0.7 and the AVE value is more significant than 0.50, the convergence validity is better. The criterion for distinguishing validity is that the square root value of each factor AVE is greater than the correlation coefficient of the factor with other factors (Mueller & Hancock, 2018). Table 6 introduces the standardized factor load of the latent variable to which each item belongs is above 0.7. In addition, the average variance of each variable extracted AVE values was between 0.622-0.698, greater than the standard of 0.5 (Mueller & Hancock, 2018). The combined reliability CR exceeded 0.856-0.891(>0.7), indicating that the convergence validity is reliable.

4.4 Structural equation models (SEM) and path analysis

After establishing the SEM, the estimated value, standardized path coefficient, and standard error, C.R., p-value are obtained by the Amos 26.0 version. If the C.R. is more significant than 1.96, the p-value is less than 0.05. The path coefficient can be considered to pass the significance test within the 95% confidence interval. It indicates that the corresponding path of the preset model is hypothetical. Otherwise, the assumption is not valid (Chau, 1997). Table 8 shows the test results.

Table 8: Structural equation model path test

Hypothesis	Path	Estimate	B	S.E.	C.R.	P
H2	KS→PEUD	0.538	0.573	0.047	11.437	***
H3	KS→PUD	0.139	0.165	0.046	3.022	0.003
H6	PEUD→PUD	0.455	0.506	0.055	8.310	***
H5	PUD→SBOEI	0.449	0.399	0.063	7.102	***
H4	PEUD→SBOEI	0.187	0.184	0.060	3.115	0.002
H1	KS→SBOEI	0.240	0.252	0.049	4.928	***

Therefore, all direct effects in the study model are significant, as follows:

The positive effect of knowledge sharing on perceived ease of use of digital technology was significant (β=0.573, p<0.001), and H2 was supported. The positive effect of knowledge sharing on perceived usefulness of digital technology was significant (β=0.165, p<0.05), and H3 was supported. The positive effect of perceived ease of use of digital technology on perceived usefulness of digital technology was significant (β=0.506, p<0.001), H6 was supported. The positive effect of perceived usefulness of digital technology on sustainable behavior in online education industry was significant (β=0.399, p<0.001), H5 was supported. The positive effect of perceived ease of use of digital technology on sustainable behavior in online education industry was significant (β=0.184, p<0.05), and H4 was supported. The positive effect of knowledge sharing on sustainable behavior in online education industry was significant (β=0.252, p<0.001), and H1 was supported.

Based on the SEM, Figure 2 shows the diagram of the path analysis model constructed by the study, KS, as the independent variable, it will affect SBOEI, and the technology accepts PUD and PEUD in the model. The role of chain intermediaries is also reflected. Table 9 describes the conclusions of the analysis of the indirect effect.

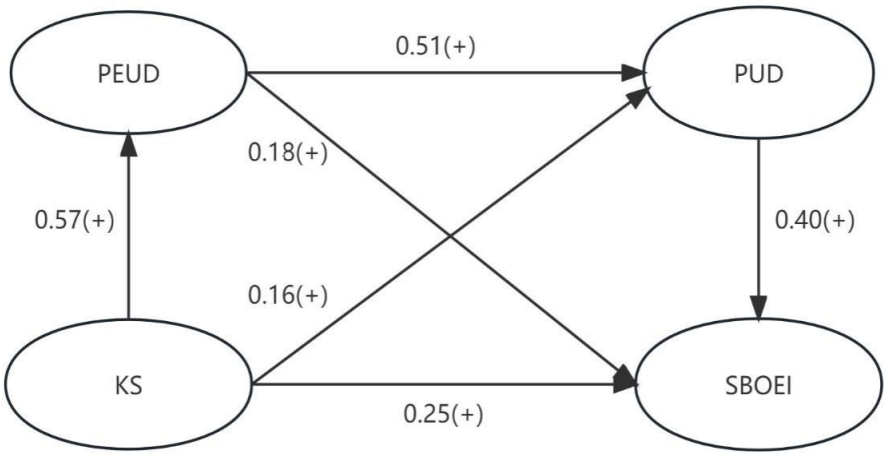

figure 2: Model of sustainable behavior in online education industry.

(PEUD: perceived ease of use of digital technology; PUD: perceived usefulness of digital technology; KS: Knowledge sharing; SBOEI: Sustainable behavior in online education)

The Bootstrapping method was employed to test the mediating effect due to its advantages in addressing issues of non-normality in the sampling distribution of the

indirect effect. Bootstrapping, a non-parametric resampling procedure, provides a more accurate inference about the indirect effects by generating an empirical representation of the sampling distribution of the mediator. This method is particularly robust against potential violations of normal distribution assumptions, making it a preferred choice over traditional methods like the Sobel test. Furthermore, Bootstrapping enhances the power of the test and provides confidence intervals for the indirect effect, allowing for a more nuanced understanding of the mediation process (Mueller & Hancock, 2018).

This research set a random sample size of 5000 with a 95% confidence interval. Amos calculates the effect size, standard error, and upper-lower bound confidence interval using the Bias-Corrected estimation method. If the confidence interval does not contain it, 0 indicates that the mediating effect is significant and 0 indicates that the effect is not significant.

Table 9: The results of testing the total effect, direct effect and mediation effect

Effect	Path	Effect	Std. E	Bootstrapping (N=5000) 95%CI		Results	Hypothesis
Total effect	KS→SBOEI	0.539	0.043	0.448	0.618	***	
Direct effects		0.252	0.057	0.137	0.361	***	
Mediation effect	KS→PEUD→SBOEI	0.106	0.044	0.026	0.199	Partial	H7
	KS→PUD→SBOEI	0.066	0.027	0.020	0.128	Partial	H8
	KS→PEUD→PUD→ SBOEI	0.115	0.024	0.077	0.172	Partial	H9

In the online education industry, the 95% confidence interval for the mediating role of perceived ease of use of digital education technology in the relationship between knowledge sharing and sustainable behavior is [0.026, 0.199]. Given that this interval does not include 0, it suggests that the perceived ease of use of digital education technology significantly mediates the relationship between knowledge sharing and sustainable behavior, with an effect size of 0.106. Consequently, H7 is supported.

In the context of the online education industry, the 95% confidence interval for the mediation path from knowledge sharing to sustainable behavior through perceived usefulness of digital education technology is [0.02, 0.128]. Given that this range does not encompass 0, it underscores that the perceived usefulness of digital education technology significantly mediates the relationship between knowledge sharing and sustainable behavior, with an effect magnitude of 0.066. Accordingly, H8 is substantiated.

Within the online education industry, the 95% confidence interval for the sequential mediation path from knowledge sharing through perceived ease of use and perceived usefulness of digital education technology to sustainable behavior is [0.077, 0.172]. As this interval does not encompass 0 (Mueller & Hancock, 2018), it indicates that perceived ease of use and perceived usefulness together play a significant chained mediating role between KS and SBOEI, with an effect magnitude of 0.115. Hence, H9 is corroborated.

Hence, all mediating effects in the model are significant, but the mediating effects are partial.

4.5 Impact of Demographic Variables on Perceived Ease of Use of Digital tools and Sustainable Behavior in Online education Industry

Table 10 presents a detailed comparative analysis elucidating the impacts of diverse demographic variables on perceived ease of use and sustainable behavior in the online education industry across different cohorts. The Independent Sample T-test was employed to analyze the distinctions between perceived ease of use of digital technology (PEUD) and sustainable behavior in the online education industry in varied gender groups. The observed significance from the t-test exceeded 0.05, elucidating that the disparities between perceived ease of use and sustainable behavior in the online education industry across distinct gender categories are not statistically significant.

In contrast, when comparing the differences in perceived ease of use and sustainable behavior among individuals from rural areas and city areas through the Independent Sample T-test, the test results demonstrated significance below 0.05. This is indicative of substantial disparities in perceived ease of use and sustainable behavior among varying regions. Urban settings exhibited a stronger inclination towards these constructs compared to their rural counterparts, emphasizing the potential influence of infrastructural and educational differences that these locales may experience. Urban areas typically have better access to technology and educational resources compared to rural regions. This access leads to a greater familiarity with and adoption of online education platforms, as reflected in higher PEUD and SBOEI. The disparity suggests that infrastructure and educational opportunities, which are generally more abundant in urban settings, significantly influence the ease with which individuals use digital tools and engage in sustainable behaviors. An examination of the means revealed that both perceived ease of use and sustainable behavior are predominantly higher in urban locales compared to rural ones.

Single-Factor ANOVA was utilized to investigate the variances in perceived ease of use and sustainable behavior across different grade levels, revealing a significance level below 0.05. This establishes that noteworthy differences exist in perceived ease of use and sustainable behavior among the grade categories. A comparative analysis of the means highlighted sophomores as having the highest values in perceived ease of use and sustainable behavior, followed by juniors and freshmen, while seniors exhibited the lowest values.

Similarly, a Single-Factor ANOVA was conducted to explore the divergences in perceived ease of use and sustainable behavior among different geographical locations, and the results indicated a significance level below 0.05, representing significant disparities in perceived ease of use and sustainable behavior across the varied locations. A further evaluation of the means showed a descending order of perceived ease of use from East, South, North, to West, and for SBOEI from East, North, South, to West. The observed regional disparities in PEUD and SBOEI, with the East leading, could stem from its advanced technological infrastructure, higher economic development, and concentration of educational resources. This facilitates greater access to and comfort with digital technology, boosting online education's perceived ease of use. Additionally, urbanized areas often have more exposure to sustainability initiatives, enhancing sustainable behaviors. Cultural and policy differences across regions may also influence these perceptions and behaviors.

Lastly, Single-Factor ANOVA demonstrated significant differences in perceived ease of use and sustainable behavior among individuals with varying family incomes, with a significance below 0.05. A meticulous examination of the mean values suggested a direct proportionality between family income and the values of perceived ease of use and sustainable behavior, indicating higher values of both constructs with increased family income.

These methodical analyses offer profound insights into the interrelation between demographic variables and the perceived ease of use and sustainable behavior, paving the way for further intricate studies in this domain.

Table 10: Comparative Analysis of the impact of demographic variables on perceived ease of use and sustainable behavior in ANOVA

		PEUD	SBOEI
Gender	Male	5.018	4.691
	Female	4.969	4.488
	T	0.407	1.664
Grade	Freshman	4.710	4.460
	Sophomore	5.244	4.841
	Junior	5.047	4.577
	Senior	4.621	4.026
	F	7.220***	9.383***
Area	Rural areas	4.902	4.424
	City areas	5.151	4.811
	T	2.124*	3.396**
Location	East China	5.454	5.054
	West China	4.801	4.309
	South China	4.968	4.633
	North China	5.260	4.551
	F	4.374**	4.955**
Family Income	<10000$	4.716	4.070
	10000-20000	5.000	4.591
	20000-30000	5.161	4.910
	30000-40000	5.337	4.985
	F	4.913**	15.120***

Table 10 illuminates the disparities in both perceived ease of use and sustainable behavior across different demographic and socio-economic strata. Urban settings exhibited a stronger inclination towards these constructs compared to their rural counterparts, emphasizing the potential influence of infrastructural and educational differences that these locales may experience. Additionally, our analysis underscores a noteworthy trend among academic years, with sophomores demonstrating the most pronounced values in both domains, while seniors registered the least. This descending pattern might reflect an initial enthusiasm during intermediate years of study that wanes as students approach graduation, warranting further investigation.

Geographical disparities were also manifest, with regions in the East consistently outperforming their western counterparts. This suggests regional variations in technological adoption, educational priorities, or even cultural differences in the perception and practice of sustainability. The relationship between family income and the two constructs is particularly salient, revealing a direct proportionality.

Families with higher incomes potentially have more exposure to and can afford better technological resources, leading to greater ease in adopting digital platforms. Moreover, their financial security might allow them to prioritize sustainable practices, viewing it not as a luxury but as a responsibility.

In synthesizing these insights, it becomes apparent that while there are overarching trends in the adoption of digital education platforms and sustainable behaviors, these are still deeply influenced by socio-economic, geographical, and academic factors. Future studies could delve deeper into the underlying reasons for these variations, potentially guiding policy, and institutional strategies to bridge these disparities.

5. DISCUSSION AND CONCLUSION

5.1 Theoretical implication

The digital economy has changed the channels of knowledge sharing, an essential prerequisite for forming sustainable behavior and one of the critical contents of the discussion in the online education industry. The study demonstrates the positive effect of knowledge sharing on SBOEI and elevates the research of knowledge sharing to a new height. Moreover, as a classic model for explaining sustainable behavior in the digital economy era, TAM has developed with many achievements, demonstrated the intention of TAM to use online education platforms or technologies, and emphasized the construction of sustainable behavior at the technical level. However, this study introduces TAM into the theory of knowledge sharing. It demonstrates the mediating role of perceived usefulness and ease of use in the SBOEI model of knowledge-sharing construction. Therefore, the research not only develops the theory of knowledge sharing and introduces it to the online education industry but also elevates the research level of TAM.

On the other hand, the study elucidates intriguing correlations and variations in PEUD and SBOEI across a spectrum of demographic variables, delivering pivotal insights into the intricate interplay between user perceptions and demographic constituents. The manifested disparities across regions, grade levels, geographical locations, and family income levels, underscore the imperative of tailoring technological interfaces and interventions to cater to the diverse needs and preferences of different demographic cohorts, thereby optimizing user engagement and experience. The absence of significant gender-based differences offers a crucial understanding of the universal applicability of the studied constructs, necessitating future studies to delve deeper into uncovering the nuanced influences and potential moderating variables within the framework of user perceptions and ease of use.

As one of the critical topics of sustainable development in the digital economy era, online education can reduce the phenomenon of education inequality, increase knowledge sharing, improve human quality, and pay attention to the community with a shared future for humankind. Although research on online education as a commercial market is excellent, rare studies focus on online education sustainable behavior. Jiang et al. (2022) constructed the positive effects of consumer value and identity on SBOEI using SEM. Moreover, they highlighted the positive effects of contextual factors (government behavior, market conditions, consumer engagement, education) on SBOEI in planned behavior theory and social exchange theory. However, this paper is almost the first attempt to understand the knowledge-sharing theory and TAM to explain SBOEI, breaking the previous reality of using interview

materials to construct the conceptual framework of SBOEI. The research pulls TAM and knowledge sharing into SBOEI, developed from integrating psychology, management, and consumer behavior.

5.2 Practical implications

The study explores the positive effects of knowledge sharing on sustainable behavior in the online education industry, aims to inspire the online education market to build user knowledge-sharing behaviors and platforms, pays attention to the sharing of sustainable knowledge on online education platforms and encourages consumers to absorb and share this knowledge actively.

Second, the PUD and PEUD are chain mediated in the path of knowledge sharing affects SBOEI, indicating that the online education may need to pay more attention to the convenience development of the platform so that more users can adapt to online education technology. It is necessary to increase users' return visits and services in technology acceptance. At the same time, the online education department must cultivate users' perception of ease of use because this paper proposes the positive effect of PEUD on PUD. Therefore, the formation of user PEUD may be the primary premise for users to move further toward sustainable practices in online education.

The positive role of PEUD on SBOEI requires the technology department of the online education market to develop and design content that is more attractive to students in higher education sector. The discussion of PUD recommends focusing on the actual value of technology, including evident knowledge and skill improvement, convenient platforms and interfaces, and easy-to-operate procedures. Therefore, the technology sector still has a long way to go to cultivate sustainable behavior in the industry.

As one of the major markets and industries in the digital age, research inspired the development of the online education industry to focus on knowledge sharing and technical support. To promote SBOEI, the government should have relevant policies for the online education industry, whether commercial or public welfare, to encourage knowledge sharing, including sustainable knowledge sharing and online education technology knowledge sharing. Furthermore, even encourage the online education market to build relevant knowledge-sharing communities and platforms. At the same time, the online education market and users need to cooperate and respond to understand the value of knowledge sharing in sustainable behavior in the online education industry (Jiang & Pu, 2022).

The revealed disparities across academic grades, geographical locations, and economic backgrounds emphasize the need for designing digital education tools that are universally accessible, user-friendly, and that foster sustainable behaviors, catering to the diverse preferences and requirements of various demographic groups. Interestingly, the lack of significant differences between genders suggests that gender-neutral approaches in designing digital educational tools are effective, and such universality in design can contribute to equitable access and sustainability in online education (de Miguel González & Sebastián-López, 2022).

Given the insights from this study, stakeholders like educators, policymakers, and digital platform designers should collaborate to develop strategies that leverage the nuanced understanding of Perceived Ease of Use of Digital Education Tools (PEUD) and Sustainable Behavior in the Online Education Industry (SBOEI). They should create digital education tools that are user-friendly, intuitive, and accessible to people

from different academic grades, geographical locations, and economic backgrounds, emphasizing inclusivity and universal design.

Policymakers need to formulate guidelines and regulations that encourage the development and adoption of sustainable and inclusive online educational tools, addressing the significant differences observed across various demographics. Educators must be proactive in adapting to these inclusive and user-friendly digital tools, ensuring effective learning experiences for diverse learner groups. Additionally, all stakeholders must engage in ongoing dialogue and collaboration to continually refine and enhance the inclusivity and sustainability of online education platforms, addressing the evolving needs and preferences of users to promote equitable access and sustainable behavior in the education sector.

Recognizing the pronounced disparities in both perceived ease of use and sustainable behavior based on locality, academic year, region, and family income can inform targeted interventions.

The marked preference for digital platforms in urban environments suggests the need for bolstered infrastructural and training initiatives in rural areas to bridge the technological divide. Such efforts could ensure equitable access and usability of online resources irrespective of geographical location.

The discernible trend among academic years, especially the high values among sophomores and the subsequent decline as students' progress, calls for educational institutions to sustain and reinforce digital literacy and sustainability ethos throughout the academic journey. Ensuring that this momentum is not lost, especially during the senior years, can lead to more consistent outcomes in digital education engagement and sustainable behavior.

Furthermore, the regional discrepancies, notably the East's dominance over the West, hint at the potential benefits of cross-regional collaborative endeavors. Sharing best practices, resources, and curriculum innovations can harmonize the perceived ease of use and sustainable practices across regions.

Lastly, the direct relationship between family income and the two constructs underscores the imperative for financial aid and subsidy programs. By facilitating access to quality digital education resources for lower-income families, we can democratize the benefits of online education and inculcate sustainable behaviors across socio-economic strata.

In essence, this study's findings serve as a clarion call for tailored strategies and interventions, ensuring that the promise of online education and sustainable behavior is realized universally, devoid of socio-economic or geographical barriers.

6. CONCLUSION

The research first integrates knowledge sharing theory and TAM, developing research on SBOEI. This paper identifies the positive effects of knowledge sharing on TAM, shows the impact of knowledge sharing on SBOEI, and discusses factors of TAM mediating the relationship between knowledge sharing and SBOEI. Finally, grade and annual household income became the demographic variables that influenced the SBOEI. Based on these conclusions, the study provides relevant suggestions for the online education market, government, and consumers. It encourages marketing and educational institutions to build a knowledge-sharing platform to share online

education and sustainable development knowledge content. Also, they should pay attention to the cognition of SBOEI among different groups. By the way, to put forward suggestions from the aspect of technological development. Online education businesses or departments should further improve technology, devote more energy to establishing ease of use and usefulness, and let consumers integrate and accept online education technology to cultivate the SBOEI.

The study was limited to university students with experience in online education consumption, so the study may not use participants from other educational stages and sectors. Secondly, the study used online questionnaires, which may be lacking in the accuracy of the samples. There are only two main factors in TAM that explain sustainable behavior, so it may not be exhaustive to explain the mediating role of TAM in the model but only partially explain PUD and PEUD. Although it also emphasizes the positive psychological factor of consumers' perception of technology. Finally, the study only superficially integrates knowledge-sharing theory and TAM to explain SBOEI and does not enter in-depth arguments. Specifically, we need to fully explain knowledge sharing and TAM in the online education industry content.

Based on the conclusions and shortcomings of the research, we can further focus on the impact of knowledge sharing on SBOEI. Even to discuss the dimensions of knowledge sharing and sustainable knowledge sharing in online education using qualitative and quantitative methods and further construct the SBOEI model of knowledge sharing service. At the same time, the development of TAM also needs to be further used to build SBOEI. Finally, the research can also expand the scope of the research, expand the research to the field of K12 education and vocational education, and expect more scientific and complete results.

Author Contributions

Conceptualisation, S.J. K.X and L.Rita.; methodology, S.J. K.X and L.Rita.; validation, H.L, L.Rita.; formal analysis, H.L, S.J., L.Rita; writing—original draft preparation, S.J., L.Rita; writing—original, review and editing, S.J., L.Rita; project administration, S.J., L.Rita. All authors have read and agreed to the published version of the manuscript.

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