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A learner model for MOOCs: Evidence from Southwest China

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ABSTRACT

This study employs Structural Equation Modeling (SEM) and the Technology Acceptance Model (TAM) framework to explore the factors influencing Massive Open Online Courses (MOOCs) usage among college students in Southwest China. Using probability sampling, data were collected from 602 participants through an online survey distributed over a period of ten days, yielding a robust sample for analysis. The survey, divided into 7 sections, focused on various dimensions of user interaction with MOOCs, including perceived ease of use, usefulness, and value. The findings indicate that perceived usefulness significantly impacts user engagement, with attitude serving as a critical mediator. The study's theoretical contributions include extending TAM by emphasizing cultural and regional specifics in MOOC adoption. Practically, the results suggest targeted strategies to enhance user engagement and highlight the importance of designing MOOC platforms that cater to the educational expectations and preferences of students in diverse socio-economic settings.

Keywords: Massive Open Online Courses (MOOCs), Structural Equation Modeling (SEM), Technology Acceptance Model (TAM), perceived usefulness, perceived ease of use, user behavior.

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INTRODUCTION

Digital platforms have emerged as a pivotal medium for enhancing educational access and outreach, with university-based MOOCs in China being a prominent example of this trend (McCann et al., 2023). Massive Open Online Courses (MOOCs) represent a significant advancement in digital education, offering accessible and flexible learning opportunities to a broad audience (Çakiroğlu et al., 2024). These platforms are particularly pivotal in democratizing education, allowing universities to extend their reach beyond traditional campus boundaries. In China, MOOCs are integral to the national educational strategy, aimed at enhancing lifelong learning and workforce skills amidst rapid socio-economic changes (Cheng and Li, 2024). Despite their potential, there exists a notable gap in their effective utilization, especially in motivating Chinese college students to engage actively in their learning journeys (Geng and Jin, 2023).

Research indicates that many students in China perceive MOOCs as less effective compared to traditional classroom settings (Du, 2023). This perception can be attributed to factors such as the quality of online content, the strength of virtual interactions, and overall learning environments (Han and Geng, 2023). Moreover, there's a significant challenge in aligning the outcomes of MOOC education with job market demands, suggesting a disconnect between the skills provided through MOOCs and those valued by employers (Song et al., 2024).

Southwest China, located in the inland region, has relatively weaker educational resources compared to the eastern and southern parts of the country (Yun et al., 2024). Particularly in the context of digital transformation in education, the Chinese government actively encourages

higher education institutions in the Western regions to utilize digital open learning platforms and resources (Liu et al., 2024). This initiative aims to integrate knowledge from world-class and renowned Chinese higher education institutions into the learning lives of students and teachers (Xu, 2023). The relatively underdeveloped economy of Southwest China results in lagging educational resources and opportunities, making the promotion and development of MOOCs a new opportunity for students in the region (Li, 2023). However, due to the digital divide and limitations in digital literacy, the constraints faced by higher education students in Southwest China in terms of resource access, learning methods, and future career development are increasingly apparent (Zamir and Wang, 2023).

The use of MOOCs has garnered significant attention and support, not only from governmental policies but also from academic institutions and the private sector (Olatokun et al., 2024). However, despite these advancements and the growing recognition of MOOCs, there remain several notable deficiencies in how MOOCs are utilized, particularly in terms of student engagement and the actualization of learning outcomes (Gardner and Brooks, 2018). In Southwest China, these challenges are compounded by regional disparities in technology access and educational infrastructure, which may hinder the effective adoption of MOOCs (Zhou and Zhang, 2022).

The current study sheds light on educational inequalities in Southwest China and evaluates MOOCs' potential role in addressing these challenges (Yu and Yu, 2023). It identifies key factors like perceived ease of use and usefulness that influence MOOC adoption, highlighting their impact on student motivation and engagement (Wei et al., 2023). However, gaps remain, particularly in integrating digital education with Sustainable Development Goals (SDGs) and assessing the educational value through consumer value theory (Talwar et al., 2023). Additionally, there's a lack of research on how MOOCs enhance specific competencies crucial for modern workforce success, most existing literature is qualitative (Hamori, 2023). Thus, there's a pressing need for mixed-methods studies that provide a more comprehensive understanding of educational practices. Thus, this research aims (1) to explore the path of perceived ease of use and perceived usefulness affecting the intention to use MOOCs, (2) to investigate the path of perceived value affecting the intention to use MOOCs, (3) to examine the role of attitude and motivation in predicting the intention to use MOOCs.

Following the introduction, this study outlines relevant theories and concepts before formulating hypotheses that probe the dynamics between user perceptions and technological aspects of MOOCs. The methodology section details the research design and data collection methods, paving the way for a robust analysis. Subsequent sections present the research findings, critically evaluating the hypotheses and uncovering factors influencing MOOCs adoption in Southwest China. Finally, the study discusses and highlights the theoretical significance and practical implications of the findings, while also paying attention to the limitations of the study and future research directions.

LITERATURE REVIEW

Theoretical basis

The Technology Acceptance Model (TAM) serves as a foundational theoretical framework for this study, aimed at understanding how perceptions of technology influence user behavior, specifically within the context of MOOCs. Developed on the premises of the Theory of Reasoned Action, TAM suggests that perceived ease of use and perceived usefulness are critical determinants of user acceptance and intention to engage with technology (David and Roberts, 2024). In the realm of online learning, these factors are crucial as they directly influence learners' attitudes and their subsequent willingness to use educational platforms. Extensive validations of TAM in various digital environments support its applicability to MOOCs, highlighting the importance of ease of use and content value in fostering learner engagement (Pan and He, 2024). This study employs TAM to examine variables such as perceived ease of use, perceived usefulness, attitudes towards MOOCs, and behavioral intentions to use MOOCs, integrating findings from recent research that emphasize the need for user-friendly interfaces and enriching educational content. By doing so, it aims to enhance our understanding of the factors that drive learner satisfaction and retention, providing a robust theoretical basis for developing effective strategies to increase engagement and reduce dropout rates in MOOCs.

Consumer Value Theory (CVT) provides a robust framework for analyzing the perceived value consumers derive from products or services, considering the balance between benefits and costs. This theory, increasingly applied in fields such as marketing and online learning, posits that perceived value is a critical determinant of consumer satisfaction and behavioral intentions, emerging from the net result of the benefits received and the costs incurred (Hafez, 2023). CVT delineates perceived benefits, which may include functional aspects like performance, emotional gains like enjoyment, and social factors such as status, alongside perceived costs encompassing monetary, time, effort, and psychological expenditures (Le, 2024). This evaluation leads to perceived value, which significantly influences consumer behaviors such as loyalty and purchase intentions. Notably, the dimensions of value assessed under CVT—functional, emotional, and social—provide a nuanced understanding of consumer decision-making processes. This theoretical approach is critical for exploring how

students evaluate online learning platforms like MOOCs, where the perceived quality (educational content) and perceived cost (time and effort) shape their overall educational value and learning commitment (Kedas and Sarkar, 2023). By applying CVT to educational settings, researchers can gain insights into the factors that drive learner engagement and retention, offering valuable implications for enhancing digital learning experiences (Kaiqi and Kutuk, 2024).

Hypothesis development

The interrelationships within the Technology Acceptance Model (TAM), specifically focus on how perceived ease of use influences perceived usefulness, attitude, and motivation towards MOOCs. Research supports that ease of use enhances the perceived usefulness of online learning platforms, as learners who encounter fewer difficulties in navigation tend to appreciate the utility of the platform due to reduced cognitive load (Tang et al., 2023). Furthermore, the ease of using a platform also positively affects learners' attitudes towards it. An intuitive and user-friendly interface leads to higher satisfaction, making the learning experience more enjoyable and increasing the likelihood of recommending the platform to peers (Al-Adwan et al., 2023). Additionally, perceived ease of use significantly boosts learners' intrinsic motivation by making the learning process more accessible and less frustrating, thereby encouraging continued engagement and exploration of the platform's features (Lai et al., 2023). These dynamics underscore the importance of platform usability in promoting effective and satisfying interactions with digital learning environments.

H1: Perceived ease of use of MOOCs positively affects the perceived usefulness of MOOCs.
H2: Perceived ease of use of MOOCs positively affects attitude towards MOOCs.
H3: Perceived ease of use of MOOCs positively affects motivation to use MOOCs.

Perceived usefulness of MOOCs significantly influences both learner attitudes and their motivation towards these platforms. Romero-Frías et al. (2023) find that learners who perceive MOOCs as beneficial for achieving their educational and personal development goals tend to exhibit higher satisfaction and develop positive attitudes towards the platform. Luo (2023) further affirms that perceived benefits in enhancing knowledge and skills positively impact learners' attitudes, highlighting the essential role of perceived usefulness in technology acceptance. Additionally, the effect of perceived usefulness on motivation is evident, as studies by Nguyen and Chen (2023) illustrate that when learners see the e-learning systems as useful for their academic and personal growth, their intrinsic and extrinsic motivation to engage with these systems increases significantly.

H4: Perceived usefulness of MOOCs positively affects attitude towards MOOCs.
H5: Perceived usefulness of MOOCs positively affects motivation to use MOOCs.

The concept of perceived value in MOOCs plays a crucial role in shaping learners' attitudes and motivations towards using these platforms, as well as their intentions to continue using them. Research by Sitar-Tăut et al. (2024) suggests that favorable attitudes arise when learners perceive the benefits of MOOCs to outweigh the costs. This sentiment is echoed by Ram et al. (2024), who found that high perceived value in terms of flexibility, accessibility, and quality content leads to more positive attitudes towards MOOCs. Seo and Um (2023) further supported these findings, highlighting that perceived value significantly enhances user satisfaction and positive attitudes. Building on this, Wei et al. (2023) demonstrated that high perceived value also increases both intrinsic and extrinsic motivation to engage with MOOCs, while Alsayat and Ahmadi (2023) noted that it improves learner satisfaction and motivation to use the platform. Similarly, Rekha et al. (2023) identified a strong link between perceived value and the intention to continue using e-learning systems, emphasizing that learners who recognize substantial benefits are more likely to persist in their use of these platforms.

H6: Perceived value of MOOCs positively affects attitude towards MOOCs.
H7: Perceived value of MOOCs positively affects motivation to use MOOCs.
H8: Perceived value of MOOCs positively affects intention to use MOOCs.

The critical impact of learners' attitudes and motivation on their usage of MOOC platforms. Positive attitudes towards MOOCs have been shown to significantly enhance learners' motivation to engage with the platform for both academic and personal growth, as highlighted by Wei et al. (2023). Additionally, Anthony Çakiroğlu et al. (2024) demonstrated that such positive attitudes towards blended learning environments also significantly boost learners' motivation to participate. This positive correlation extends to learners' intentions to use the platforms, with studies by Songkram et al. (2023) indicating that favorable attitudes enhance intentions to engage with and persist in using online learning platforms. Mariam et al. (2023) further support this relationship in the context of blended learning. Moreover, motivation—both intrinsic, driven by personal interest, and extrinsic, influenced by external rewards—is pivotal in sustaining engagement with MOOCs (Wang et al., 2023). Research by Ghali and Amari (2024) shows that

motivated learners are more likely to continue using e-learning platforms, driven by perceived benefits such as knowledge acquisition and career advancement. Cheng (2022)) also found that strong motivation leads to heightened intentions to use online learning systems.

H9: Attitude towards MOOCs positively affects motivation to use MOOCs.
H10: Attitude towards MOOCs positively affects intention to use MOOCs.
H11: Motivation to use MOOCs positively affects intention to use MOOCs.

The interplay between perceived ease of use and perceived usefulness significantly influences learners' attitudes and motivations within MOOC platforms. Rekha et al. (2023) posited that learners are more likely to appreciate a MOOC platform's ease of use when they perceive it as beneficial, enhancing their favorable attitudes towards the platform. Similarly, Tan et al. (2023) found that perceived usefulness mediates the relationship between ease of use and attitudes toward e-learning systems, indicating that ease of use can enhance perceived usefulness, which in turn positively affects attitudes. Gaffas (2023) further supported this, noting that ease of use positively impacts students' perceptions of usefulness and, consequently, their attitudes towards blended learning platforms. In another related finding, Liesa-Orús et al. (2023) demonstrated that perceived ease of use significantly influences motivation, with perceived usefulness serving as a mediating factor. This suggests that when learners find an e-learning system easy to use, they are more likely to recognize its usefulness, thereby increasing their motivation to engage with the platform. Gunness et al. (2023) also highlighted that perceived usefulness effectively mediates the relationship between perceived ease of use and learners' motivation in online learning environments, enhancing learners' engagement and educational outcomes. An et al. (2024) corroborated these findings, reinforcing the pivotal role of perceived usefulness in mediating the effects of ease of use on students' motivation to use learning platforms.

H12: Perceived usefulness of MOOCs mediates the relationship between perceived ease of use of MOOCs and attitude towards MOOCs.
H13: Perceived usefulness of MOOCs mediates the relationship between perceived ease of use of MOOCs and motivation to use MOOCs.

The intricate relationships between learner perceptions of MOOC platforms and their behavioral intentions are explored, emphasizing the mediating role of attitudes. The studies by Rueda-Gómez et al. (2024) reveal that a platform's ease of use significantly bolsters positive attitudes among learners, which then enhances their motivation to engage with the platform. Correspondingly, the perceived usefulness of MOOCs, as discussed by Sallam et al. (2023) fosters favorable attitudes that lead to increased learner motivation. Moreover, the perceived value of MOOCs is linked with positive attitudes, which in turn influence motivation to engage with the platform, as shown by Zhao et al. (2024).

These positive attitudes also mediate the relationship between perceived ease of use and learners' intentions to continually engage with the platform, supported by findings from Green (2024). Furthermore, the perceived usefulness of MOOCs enhances learners' intentions to use the platform through positive attitudes, as demonstrated by the studies of Tennakoon et al. (2023). Additionally, perceived value strongly impacts learners' intentions to persist with MOOCs through the mediation of positive attitudes, as indicated by Seo and Um (2023).

H14: Attitude towards MOOCs mediates the relationship between perceived ease of use of MOOCs and motivation to use MOOCs.
H15: Attitude towards MOOCs mediates the relationship between perceived usefulness of MOOCs and motivation to use MOOCs.
H16: Attitude towards MOOCs mediates the relationship between perceived value of MOOCs and motivation to use MOOCs.
H17: Attitude towards MOOCs mediates the relationship between perceived ease of use of MOOCs and intention to use MOOCs.
H18: Attitude towards MOOCs mediates the relationship between perceived usefulness of MOOCs and intention to use MOOCs.
H19: Attitude towards MOOCs mediates the relationship between perceived value of MOOCs and intention to use MOOCs.

The intricate mechanisms through which learner perceptions and attitudes towards MOOC platforms influence their behavioral intentions, specifically examining the mediating role of motivation. It has been established that when learners recognize a high value in MOOCs, their positive attitudes towards the platforms intensify, thereby boosting their intentions to engage further with them. This is supported by findings from Alnoor et al. (2024) which collectively illustrate how perceived value strengthens positive attitudes and, in turn, increases the intent to use the platform. Building on this, the role of motivation as a mediator is critical in this dynamic. For instance, when learners perceive MOOC platforms as easy to use, their motivation to engage with these platforms increases, which subsequently enhances their intention to continue using them, as noted by Alharbi (2023). Similar observations apply to the perceived usefulness and overall value of the platforms, where increased motivation resulting from these perceptions leads to greater

engagement intentions, as indicated by Dastane and Haba (2023).

H20: Motivation to use MOOCs mediates the relationship between perceived ease of use of MOOCs and intention to use MOOCs.
H21: Motivation to use MOOCs mediates the relationship between perceived usefulness of MOOCs and intention to use MOOCs.
H22: Motivation to use MOOCs mediates the relationship between perceived value of MOOCs and intention to use MOOCs.
H23: Motivation to use MOOCs mediates the relationship between attitude towards MOOCs and intention to use MOOCs.

METHOD

This study employed an online questionnaire distributed via the Questionnaire Star platform to survey 602 college students from five southwestern provinces of China: Chongqing, Sichuan, Yunnan, Guizhou, and Tibet. The survey was conducted over a period of approximately 30 days. To ensure the representativeness of the sample and minimize selection bias, a simple random sampling technique was utilized, guaranteeing that each participant had an equal chance of being selected.

This questionnaire is structured into seven distinct parts, each designed to gather specific data on the participants' experiences and perceptions of Massive Open Online Courses (MOOCs).

The first part collects demographic and background information about the respondents, including gender, age (18-22, 23-27, 28-32, 33 and above, the research subjects are college students, their age will not be too old), education level (Junior College Students, Undergraduate, Graduate), province (Chongqing, Sichuan, Yunnan, Guizhou, Tibet), and prior experience with MOOCs.

The second part addresses the Perceived Ease of Use of MOOCs with four items adapted from Chen and Aklikokou (2020). It evaluates the user-friendliness of MOOC platforms by examining ease of learning, clarity, flexibility, and overall ease of use, aiming to identify potential usability barriers and enhance user experiences to boost satisfaction and adoption rates. The third section evaluates the Perceived Usefulness of MOOCs, incorporating five items from the same authors, to measure the functional benefits that MOOCs offer in accessing information, learning transparency, and overall educational effectiveness. The goal here is to ascertain how MOOCs align with learners' educational needs and enhance learning outcomes. The fourth part, exploring the Perceived Value of MOOCs, is the most comprehensive, with fifteen items based on Deng et al. (2021). This section assesses the multifaceted value learners derive from MOOCs, including functional, emotional, social, and conditional values, aiming to provide a holistic understanding of the benefits MOOCs deliver to inform strategic platform enhancements. The fifth part, derived from Satriadi et al. (2022), examines attitudes toward MOOCs through three items that probe into learners' enthusiasm, satisfaction, and preference for MOOCs over traditional educational tools, which are critical for predicting user engagement and retention. The sixth part investigates the Motivation to Use MOOCs, with five items from Satriadi et al. (2022), focusing on both intrinsic and extrinsic motivations that drive learner engagement with MOOCs. This section aims to pinpoint motivational factors to foster sustained learner participation. Lastly, the seventh part measures the Intention to Use MOOCs, through six items also from Satriadi et al. (2022), evaluating learners' long-term commitment and willingness to invest in MOOCs, which is vital for gauging the likelihood of sustained engagement.

All items were structured using a 5-point Likert scale to ensure nuanced data capture. The validity and reliability of the questionnaire were confirmed through an item-objective congruence (IOC) process to ensure the professionalism and relevance of the content.

Upon completion of data collection, statistical software will be employed to conduct preliminary tests such as reliability and descriptive statistical analysis, thereby preparing the data for more in-depth examination. Subsequently, Structural Equation Modeling (SEM) along with Confirmatory Factor Analysis (CFA) will be utilized to perform path analysis. (Table 1)

RESULTS

Table 2 shows the demographic details of the study's sample. The sample features a nearly equal gender distribution, with males making up 47.8% (288 participants) and females 52.2% (314 participants), providing a balanced gender perspective. The majority of respondents are young adults, with 47.0% aged between 18 and 22 years, and 27.2% between 23 and 27 years. Those aged 28 to 32 years account for 21.3% of the sample, while the smallest group, aged 33 and above, makes up 4.5%, highlighting a sample predominantly in the early stages of their careers or academic pursuits. This is crucial for exploring MOOC engagement among young learners. The sample is well-educated, with undergraduates constituting 47.0% and graduates 53.0%, indicating a higher education-focused cohort. Geographical representation spans several provinces, with 21.1% from Chongqing, 20.4% from Sichuan, 21.4% from Yunnan, 19.6% from Guizhou, and 17.4% from Tibet. This ensures that the study captures a wide range of experiences and viewpoints from across Southwest China, providing insights into regional differences in MOOC engagement.

Table 1. Provide legend.

Variables	Items	Source
Perceived ease of use of MOOCs	PE1. It is easy to learn how to use MOOCs. PE2. The use of MOOCs is clear and understandable. PE3. The use of MOOCs is flexible. PE4. It is easy to use MOOCs.	Chen and Aklikokou (2020)
Perceived usefulness of MOOCs	PU1. I can quickly access information online through MOOCs. PU2. I find it practical to obtain and verify information online through MOOCs. PU3. MOOCs facilitate transparency and accountability in learning. PU4. MOOCs are more effective for learning. PU5. MOOCs are useful for acquiring new knowledge and skills.	Chen and Aklikokou (2020)
Perceived value of MOOCs	FV1. The MOOCs are part of my learning collection. FV2. I regard the MOOCs as a valuable learning experience. FV3. The MOOCs are intended to be useful both during the course and after completion. MV1. MOOCs allow me to share my learning experiences with family and friends. MV2. MOOCs are representative of current educational trends and evoke my interest in learning. MV3. MOOCs are a unique record of my educational journey. EV1. The MOOCs is my favorite way to study. EV2. I like the MOOCs when I choose the way to study. EV3. The MOOCs make me feel good about my learning progress. SV1. The MOOCs make me feel recognized for my learning achievements. SV2. The MOOCs leave a good impression on others regarding my commitment to learning. SV3. The MOOCs give participants social recognition in the field of education. CV1. The MOOCs are reasonably priced. CV2. The MOOCs are worth every penny. CV3. The MOOCs are fairly priced.	Deng et al. (2021)
Attitude towards MOOCs	AT1. I am interested in pursuing further education through MOOCs. AT2. Participating in MOOCs will bring me considerable satisfaction. AT3. Among various options, I prefer using MOOCs for further education.	Satriadi et al. (2022)
Motivation to use MOOCs	MT1. Like being affluent and proud of my family, hence I want to expand my knowledge through MOOCs. MT2. I am interested in using MOOCs to further my knowledge because I excel at recognizing new learning opportunities. MT3. I aspire to use MOOCs to acquire valuable knowledge, believing that I can gain significant insights.	Satriadi et al. (2022)

Table 1. Continue.

	MT4. Our key reason for participating in MOOCs is the prospect of satisfying educational demands. MT5. My main motive for engaging in MOOCs is the chance to improve my knowledge and skills.	
Intention to use MOOCs	IT1. In the near future, I plan to fully commit to expanding my knowledge through MOOCs. IT2. I will make every effort to utilize MOOCs for my learning. IT3. I intend to participate in MOOCs in the near future. IT4. My ultimate goal is to become proficient through MOOCs. IT5. I will do everything in my power to realize my ambition of continuous learning through MOOCs. IT6. I have a strong desire to continually expand my knowledge through MOOCs.	Satriadi et al. (2022)

Table 2. Essential information.

		Frequency	Percent
Gender	Male	288	47.8
	Female	314	52.2
Age	18-22	283	47.0
	23-27	164	27.2
	28-32	128	21.3
	33 and above	27	4.5
Education level	Undergraduate	283	47.0
	Graduate	319	53.0
Province	Chongqing	127	21.1
	Sichuan	123	20.4
	Yunnan	129	21.4
	Guizhou	118	19.6
	Tibet	105	17.4

Table 3 details the descriptive statistics for the study variables, including mean, standard deviation, skewness, and kurtosis for each measurement item. The mean scores for perceived ease of use of MOOCs range from 3.58 to 3.65, showing a generally positive perception. Standard deviations hover around 1.0, indicating moderate response variability (Rogers et al., 2020). All skewness values are negative, from -0.637 to -0.747, suggesting a leftward skew in distributions, while kurtosis values are slightly negative, pointing to flatter distributions than normal. Similar trends are observed in the perceived usefulness and value of MOOCs, with mean scores from 3.54 to 3.62 and comparable skewness and kurtosis values. The sections on attitude towards MOOCs, motivation to use them, and intention to use them also display mean scores between 3.53 and 3.63, with distributions characterized by negative skewness and slight kurtosis, reinforcing the generally favorable views towards MOOCs. These patterns indicate positive perceptions with mild deviations in distribution shapes.

Table 4 displays the reliability statistics for the study variables, as measured by Cronbach's (1951) α, confirming internal consistency among the items. Perceived ease of use of MOOCs, evaluated with four items, shows a Cronbach's (1951) α of 0.830, which is well above the acceptable threshold = 0.7, indicating very good reliability. Perceived usefulness of MOOCs, covered by five items, has an α of 0.865, suggesting strong internal coherence. For perceived value of MOOCs, assessed with fifteen items, the α reaches 0.951, denoting excellent

reliability and confirming the robustness of this construct's measurement. Attitude towards MOOCs, with three questions, has an α of 0.787, exceeding the acceptable limit and indicating good consistency. Motivation to use MOOCs, through five items, achieves an α of 0.840, while intention to use MOOCs, measured with six items, records an α of 0.880, both reflecting very good reliability. These results underscore that all constructs exhibit strong internal consistency, ensuring the reliability of the measurements within this study.

Table 3. Descriptive statistics results.

Study variables	Measurement items	Mean	Std. Deviation	Skewness	Kurtosis
Perceived ease of use of MOOC	PE1	3.580	1.016	-0.637	-0.497
	PE2	3.650	1.005	-0.666	-0.318
	PE3	3.600	1.000	-0.747	-0.268
	PE4	3.630	1.034	-0.730	-0.315
Perceived usefulness of MOOC	PU1	3.590	1.001	-0.758	-0.252
	PU2	3.580	1.046	-0.741	-0.294
	PU3	3.620	0.975	-0.759	-0.172
	PU4	3.610	1.000	-0.809	-0.060
	PU5	3.590	0.982	-0.637	-0.535
Perceived value of MOOC	FV1	3.610	0.971	-0.763	-0.117
	FV2	3.620	1.025	-0.781	-0.250
	FV3	3.560	0.998	-0.735	-0.318
	MV1	3.540	1.080	-0.794	-0.210
	MV2	3.600	1.043	-0.761	-0.258
	MV3	3.630	1.029	-0.729	-0.315
	EV1	3.580	1.006	-0.829	-0.082
	EV2	3.630	0.998	-0.764	-0.067
	EV3	3.590	1.004	-0.772	-0.155
	SV1	3.590	0.992	-0.803	-0.102
	SV2	3.630	1.012	-0.790	-0.046
	SV3	3.570	1.038	-0.864	-0.060
	CV1	3.600	0.986	-0.828	-0.085
	CV2	3.600	0.964	-0.725	-0.261
	CV3	3.630	1.038	-0.792	-0.082
Attitude towards MOOC	AT1	3.600	1.069	-0.777	-0.276
	AT2	3.610	0.998	-0.812	-0.115
	AT3	3.600	1.006	-0.722	-0.316
Motivation to use MOOC	MT1	3.580	1.053	-0.828	-0.151
	MT2	3.530	1.027	-0.649	-0.584
	MT3	3.570	0.944	-0.724	-0.182
	MT4	3.580	1.005	-0.822	-0.209
	MT5	3.570	0.997	-0.765	-0.210
Intention to use MOOC	IT1	3.580	1.063	-0.693	-0.445
	IT2	3.630	1.017	-0.749	-0.171
	IT3	3.600	0.985	-0.820	0.013
	IT4	3.600	1.001	-0.655	-0.470
	IT5	3.570	1.022	-0.593	-0.566
	IT6	3.570	1.049	-0.766	-0.275

Table 4. Reliability statistics.

Study variables	Number of questions	Cronbach's α
Perceived ease of use of MOOC	4	0.830
Perceived usefulness of MOOC	5	0.865
Perceived value of MOOC	15	0.951
Attitude towards MOOC	3	0.787
Motivation to use MOOC	5	0.84
Intention to use MOOC	6	0.880

Table 5 illustrates the outcomes of the Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy and Bartlett's (1950) test of sphericity, which are pivotal for evaluating the dataset's suitability for factor analysis. The KMO value is reported at 0.968, significantly surpassing the recommended threshold of 0.9, as noted by Ledesma et al. (2021). This exceptional KMO value indicates that the sample is highly appropriate for factor analysis, showing dense patterns of correlations that facilitate reliable factor extraction. Additionally, Bartlett's test of sphericity reports an approximate Chi-Square of 13,056.360 with 703 degrees of freedom, achieving a significance level of less than 0.001. This result robustly confirms that the correlation matrix differs significantly from an identity matrix, suggesting substantial interrelationships among the variables and affirming their suitability for structural analysis.

Table 5. KMO and Bartlett's test.

Kaiser-Meyer-Olkin measure of sampling adequacy.		.968
Bartlett's test of sphericity	Approx. Chi-Square	13056.360
	df	703
	Sig.	.000

Table 6 summarizes the fit metrics of the measurement model, demonstrating its alignment with the observed data. The chi-square to degrees of freedom ratio (χ2/df) stands at 1.330, well under the upper limit of 3, indicating an excellent fit (Jafari et al., 2024). The Root Mean Square Error of Approximation (RMSEA) at 0.023, significantly lower than the cutoff of 0.08, suggests minimal discrepancies between the hypothesized model and the observed data. Additional indices like the Goodness of Fit Index (GFI) and Adjusted Goodness of Fit Index (AGFI) register at 0.931 and 0.921, respectively, both surpassing the benchmark of 0.9, confirming that the model adequately captures the data structure. The Normed Fit Index (NFI), Tucker-Lewis Index (TLI), and Comparative Fit Index (CFI) are recorded at 0.935, 0.982, and 0.983, respectively, each exceeding the preferred standard of 0.9. The results reflect exceptional fit across all measured indices, substantiating the validity of the model and confirming its effectiveness in capturing the underlying data structure (Figure 1).

Table 6. Measure model fit metrics.

Fit index	χ2/df	RMSEA	GFI	AGFI	NFI	TLI	CFI
Reference standards	<3	<0.08	>0.9	>0.9	>0.9	>0.9	>0.9
Result	1.330	0.023	0.931	0.921	0.935	0.982	0.983

Table 7 presents the convergent validity analysis for the latent variables in the study, utilizing factor loadings, composite reliability (CR), and average variance extracted (AVE) as metrics. The findings reveal that each latent variable demonstrates good convergent validity, adhering to the standard that CR should exceed 0.7 and AVE should be above 0.50. Specifically, 'Perceived Ease of Use of MOOC' displays factor loadings between 0.719 and 0.780, with a CR of 0.830 and an AVE of 0.550. 'Perceived Usefulness of MOOC' shows factor loadings from 0.720 to

0.773, a CR of 0.865, and an AVE of 0.563, indicating robust internal consistency and adequacy in capturing the construct. 'Perceived Value of MOOC' exhibits particularly strong validity with factor loadings ranging from 0.714 to 0.778, alongside a CR of 0.951 and an AVE of 0.564. The constructs 'Attitude towards MOOC,' 'Motivation to use MOOC,' and 'Intention to use MOOC' also meet the validity criteria, with CR values of 0.788, 0.845, and 0.880, respectively, and all AVE values surpassing 0.50. For example, 'Attitude towards MOOC' has factor loadings from 0.720 to 0.770, a CR of 0.788, and an AVE of 0.553. These metrics collectively confirm that the measurement model is effective in capturing the intended constructs, with each indicator accurately reflecting its respective latent variable, ensuring the reliability and validity of the constructs within the study framework.

Table 7. Convergence validity.

Latent variables	Observation indicators	Factor loading	CR	AVE
Perceived ease of use of MOOC	PE1	0.719	0.830	0.550
	PE2	0.720		
	PE3	0.746		
	PE4	0.780		
Perceived usefulness of MOOC	PU1	0.720	0.865	0.563
	PU2	0.757		
	PU3	0.752		
	PU4	0.773		
	PU5	0.747		
Perceived value of MOOC	FV1	0.747	0.951	0.564
	FV2	0.760		
	FV3	0.751		
	MV1	0.719		
	MV2	0.750		
	MV3	0.778		
	EV1	0.774		
	EV2	0.754		
	EV3	0.720		
	SV1	0.770		
	SV2	0.714		
	SV3	0.756		
	CV1	0.754		
	CV2	0.755		
	CV3	0.763		
Attitude towards MOOC	AT1	0.741	0.788	0.553
	AT2	0.770		
	AT3	0.720		
Motivation to use MOOC	MT1	0.755	0.845	0.521
	MT2	0.674		
	MT3	0.720		
	MT4	0.746		
	MT5	0.713		
Intention to use MOOC	IT1	0.729	0.880	0.551
	IT2	0.747		
	IT3	0.765		
	IT4	0.748		
	IT5	0.705		
	IT6	0.759		

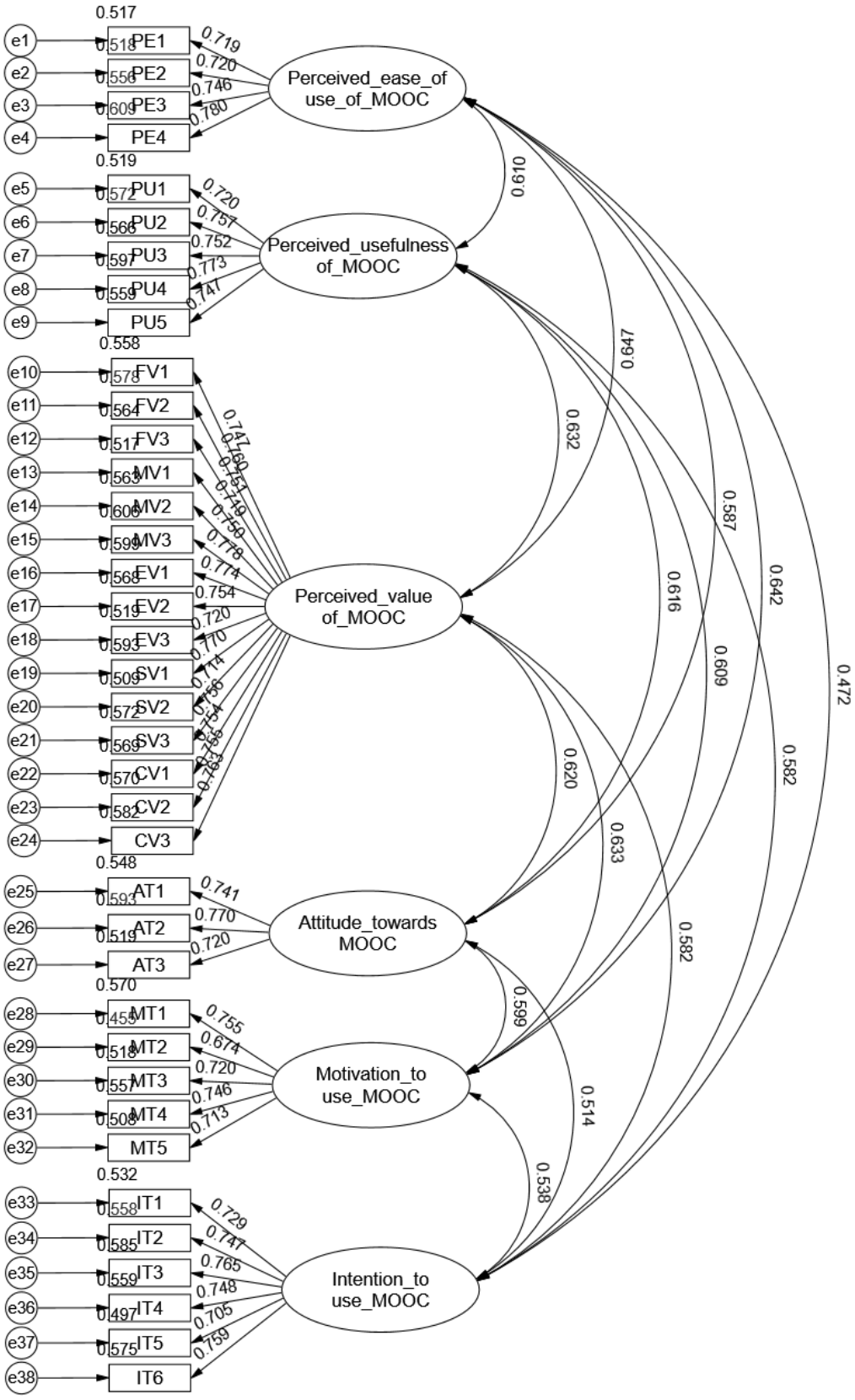

Figure 1. Measurement model.

Table 8 presents the discriminant validity results for the constructs measured in the study, ensuring that each construct is distinctly separate from others. Discriminant validity is confirmed when the square root of the Average Variance Extracted (AVE) for each construct—listed along the diagonal—exceeds the inter-construct correlations. The constructs and their square roots of AVE are as follows: Perceived Ease of Use of MOOC (0.742), Perceived Usefulness of MOOC (0.750), Perceived Value of MOOC (0.751), Attitude towards MOOC (0.744), Motivation to Use MOOC (0.722), and Intention to Use MOOC (0.742). These diagonal values surpass the correlations between constructs, which are significant but lower, ranging from 0.472 to 0.647, indicating that each construct interacts more strongly with its own measures than with those of other constructs. For example, the correlation between Perceived Ease of Use and Perceived Usefulness of MOOC is 0.610, and between Perceived Value of MOOC and Motivation to Use MOOC, it is 0.633. Despite their significance ($p < 0.001$), these correlations are below the AVE square roots, affirming that the constructs are unique and measure distinct aspects of user engagement with MOOCs. The table successfully demonstrates the discriminant validity, underscoring that each latent variable distinctly captures a specific dimension relevant to the model.

Table 8. Discriminant validity test.

Latent variables	1	2	3	4	5	6
Perceived ease of use of MOOC	0.742					
Perceived usefulness of MOOC	0.610***	0.750				
Perceived value of MOOC	0.647***	0.632***	0.751			
Attitude towards MOOC	0.587***	0.616***	0.620***	0.744		
Motivation to use MOOC	0.642***	0.609***	0.633***	0.599***	0.722	
Intention to use MOOC	0.472***	0.582***	0.582***	0.514***	0.538***	0.742

Note: The diagonal is the square root of the corresponding dimension AVE
***: $p < 0.001$

Table 9 assesses the fit of the Structural Equation Model (SEM), confirming a robust alignment between the proposed theoretical model and the collected data. The model demonstrates an excellent fit as evidenced by a chi-square to degrees of freedom ratio ($\chi 2/df$) of 1.448, comfortably below the advised maximum of 3. The Root Mean Square Error of Approximation (RMSEA) stands at 0.027, well beneath the acceptable upper limit of 0.08, indicating a tight fit. These indices collectively suggest that the model is well-structured and reflective of the data. Complementing these results, the Goodness of Fit Index (GFI) and Adjusted Goodness of Fit Index (AGFI) post values of 0.925 and 0.915, respectively, both surpassing the 0.9 benchmark, indicating a substantial proportion of variance explained by the model. Additionally, the Normed Fit Index (NFI), Tucker-Lewis Index (TLI), and Comparative Fit Index (CFI) present high measures of 0.929, 0.975, and 0.977, respectively, all exceeding the critical threshold of 0.9. These metrics reinforce the model's reliability and validity, showcasing its capability to accurately encapsulate the relationships among the studied constructs.

Table 9. Model fit metrics.

Fit index	$\chi 2/df$	RMSEA	GFI	AGFI	NFI	TLI	CFI
Reference standards	<3	<0.08	>0.9	>0.9	>0.9	>0.9	>0.9
Result	1.448	0.027	0.925	0.915	0.929	0.975	0.977

Table 10 outlines the path analysis results within the structural equation model, affirming the significant relationships among the latent variables based on the hypothesis tests. The analysis reveals that all paths exhibit significant coefficients with critical ratios exceeding the threshold of 1.96 and p-values below 0.05, ensuring their statistical significance within a 95% confidence interval. Notably, the path from Perceived Ease of Use of MOOC (PE) to Perceived Usefulness (PU) showcases a robust relationship with a β of 0.663, highlighting strong support for Hypothesis H1. Similarly, the paths from PE to both Attitude towards MOOC (AT) and Motivation to Use MOOC (MT) are significant, supporting Hypotheses H2 and H3 with respective β values of 0.214 and 0.293. The

relationships involving Perceived Usefulness to AT and MT, and Perceived Value of MOOC (PV) to AT, MT, and Intention to Use MOOC (IT) are similarly validated, confirming Hypotheses H4 through H8. Additionally, the pathways linking AT to MT and IT, and MT to IT, are significant, supporting Hypotheses H9 through H11, showcasing a structured interconnection that corroborates the theoretical framework positing that ease of use, usefulness, and value of MOOC significantly influence attitudes, motivation, and intentions regarding MOOC usage. These results collectively underscore the robustness of the model and the distinct impact of each construct within the educational context of MOOCs (Figure 2).

Table 10. Structural equation model path test.

Hypothesis	Path	Estimate	β	S.E.	C.R.	P	Results
H1	**PE→PU**	0.665	0.663	0.055	12.151	***	Supported
H2	**PE→AT**	0.231	0.214	0.086	2.693	0.007	Supported
H3	**PE→MT**	0.320	0.293	0.082	3.909	***	Supported
H4	**PU→AT**	0.333	0.309	0.066	5.035	***	Supported
H5	**PU→MT**	0.197	0.181	0.063	3.117	0.002	Supported
H6	**PV→AT**	0.318	0.295	0.064	4.938	***	Supported
H7	**PV→MT**	0.237	0.219	0.061	3.872	***	Supported
H8	**PV→IT**	0.333	0.313	0.058	5.719	***	Supported
H9	**AT→MT**	0.176	0.175	0.061	2.913	0.004	Supported
H10	**AT→IT**	0.197	0.199	0.059	3.363	***	Supported
H11	**MT→IT**	0.225	0.230	0.057	3.945	***	Supported

Note: PE: Perceived ease of use of MOOC; PU: Perceived usefulness of MOOC; PV: Perceived value of MOOC; AT: Attitude towards MOOC; MT: Motivation to use MOOC; IT: Intention to use MOOC.
***: $p < 0.001$

Table 11 showcases the mediation effect bootstrap test results, providing a comprehensive evaluation of indirect effects among the variables within the structural equation model. This analysis meticulously tests the mediated relationships, as exemplified by H12 which assesses the impact of Perceived Ease of Use (PE) on Attitude towards MOOC (AT) through the intermediary of Perceived Usefulness (PU). The analysis reveals a mediation effect size of 0.154 with a standard error of 0.071, and a 95% bias-corrected confidence interval ranging from 0.027 to 0.296, indicating significant mediation as the interval does not include zero. Similarly, H13, examining the path PE→PU→MT (Motivation to Use MOOC), reports an effect size of 0.212, confirming significant mediation with a confidence interval stretching from 0.078 to 0.374.

Further significant mediation effects are observed in paths such as H14 (PE→AT→MT) and H16 (PV→AT→MT), with effect sizes of 0.041 and 0.056 respectively, both supporting their hypotheses as their confidence intervals exclude zero. The results affirm the robustness of the structural model by validating the proposed mediated paths including those leading to Intention to Use MOOC (IT), like H17, H18, and H19, all demonstrating confidence intervals that affirm significant mediation. However, H15 (PU→AT→MT) stands as an exception where the hypothesis was not supported due to a confidence interval that includes zero, suggesting no significant mediation effect. In contrast, hypotheses H20 through H23, exploring the effects of PE, PU, PV, and AT on IT through MT, are all substantiated by significant mediation effects, showcasing the comprehensive validity of the theoretical framework posited in the study.

Table 12 provides a comprehensive analysis of the total effects within the structural equation model, quantifying the direct and indirect influences among the variables. Notably, the path from Perceived Ease of Use (PE) to Perceived Usefulness (PU) showcases a significant total effect, with an effect size of 0.665, suggesting that ease of use greatly enhances perceived usefulness. This is further supported by the effect of PE on Attitude towards MOOC (AT), which registers an effect size of 0.453, demonstrating how ease of use positively influences user attitudes towards MOOCs. Additionally, Perceived Value (PV) strongly affects user attitudes (effect size of 0.318), motivation (effect size of 0.293), and intention to use MOOCs (effect size of 0.461), underscoring the critical impact of perceived value on various user-related outcomes. The influence of Perceived Usefulness (PU) on attitude (effect size of 0.333) and motivation (effect size of 0.256) highlights its role in shaping user engagement and behavioral intentions. Furthermore, the paths from Attitude (AT) and Motivation to Use (MT) to Intention to Use MOOC (IT) illustrate the significant mediating roles these constructs play, with effect sizes of 0.237 and 0.225

respectively. These results validate the interconnected relationships between ease of use, usefulness, value perceptions, and their cumulative effect on attitudes, motivation, and intention to engage with MOOCs, offering a nuanced understanding of user dynamics in a lifelong learning context.

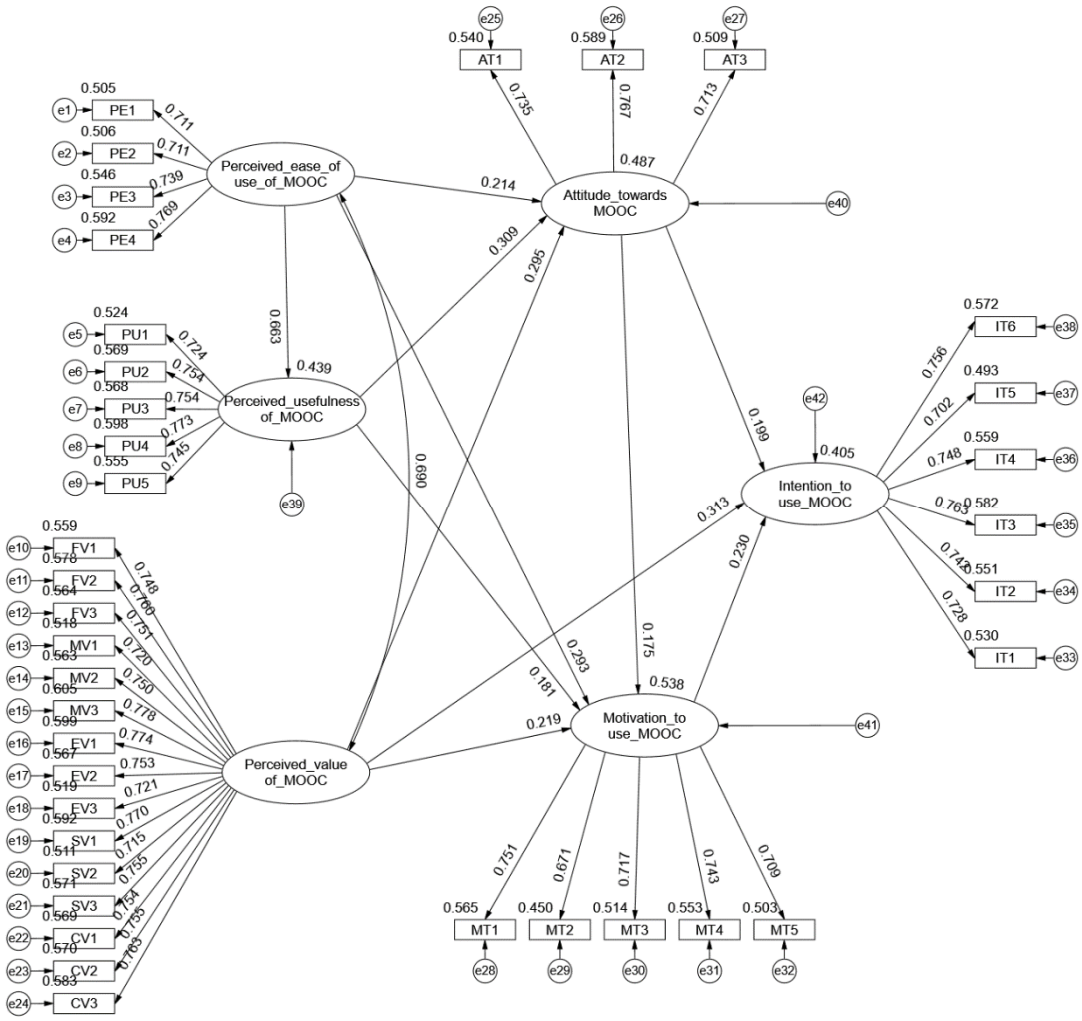

Figure 2. Path diagram for the structural model.

Table 11. Mediation effect bootstrap test.

Hypothesis	Mediation path	Effect size	SE	Bias-Corrected 95%CI		Results
H12	PE→PU→AT	0.154	0.071	0.027	0.296	Supported
H13	PE→PU→MT	0.212	0.076	0.078	0.374	Supported
H14	PE→AT→MT	0.041	0.029	0.002	0.119	Supported
H15	PU→AT→MT	0.059	0.037	-0.001	0.150	Rejected
H16	PV→AT→MT	0.056	0.036	0.001	0.149	Supported
H17	PE→AT→IT	0.045	0.030	0.008	0.138	Supported
H18	PU→AT→IT	0.066	0.041	0.006	0.166	Supported
H19	PV→AT→IT	0.063	0.032	0.015	0.142	Supported
H20	PE→MT→IT	0.072	0.038	0.014	0.168	Supported

Table 11. Continue.

H21	PU→MT→IT	0.044	0.031	0.002	0.134	Supported
H22	PV→MT→IT	0.053	0.027	0.009	0.121	Supported
H23	AT→MT→IT	0.040	0.026	0.000	0.110	Supported

Note: PE: Perceived ease of use of MOOC; PU: Perceived usefulness of MOOC; PV: Perceived value of MOOC; AT: Attitude towards MOOC; MT: Motivation to use MOOC; IT: Intention to use MOOC.

Table 12. Total effects.

Effect path	Effect size	SE	Bias-Corrected	
			95%CI	
PE→PU	0.665	0.064	0.539	0.800
PE→AT	0.453	0.092	0.286	0.647
PV→AT	0.318	0.095	0.140	0.507
PU→AT	0.333	0.095	0.142	0.519
PE→MT	0.531	0.093	0.359	0.733
PV→MT	0.293	0.089	0.113	0.462
PU→MT	0.256	0.087	0.092	0.435
AT→MT	0.176	0.093	-0.026	0.354
PE→IT	0.209	0.052	0.115	0.321
PV→IT	0.461	0.072	0.320	0.607
PU→IT	0.123	0.044	0.051	0.214
AT→IT	0.237	0.083	0.062	0.395
MT→IT	0.225	0.084	0.051	0.386

Note: PE: Perceived ease of use of MOOC; PU: Perceived usefulness of MOOC; PV: Perceived value of MOOC; AT: Attitude towards MOOC; MT: Motivation to use MOOC; IT: Intention to use MOOC.

DISSCUSSION

This study employs Structural Equation Modeling (SEM) to investigate the factors influencing the use of Massive Open Online Courses (MOOCs) among college students in the five southwestern provinces of China: Chongqing, Sichuan, Yunnan, Guizhou, and Tibet. Utilizing the Technology Acceptance Model (TAM) and the Theory of Planned Behavior (TPB), the research examines the relationships between perceived ease of use, perceived usefulness, perceived value, attitude, motivation, and intention to use MOOCs, ultimately impacting educational engagement. The findings reveal positive influences between these variables, with perceived usefulness serving as a mediating variable. Attitude mediates the relationship between perceived ease of use and motivation, as well as between perceived value and intention to use MOOCs. The study underscores the critical role of these constructs in promoting effective engagement with digital learning platforms, aiming to address the educational disparities in these regions. The results emphasize the need for targeted strategies to enhance digital literacy and resolve issues related to educational access and quality.

Theoretical implication

This research extends the application of the Technology Acceptance Model (TAM) and the Theory of Planned Behavior (TPB) to understand MOOC adoption among college students in Southwest China. By integrating these models, the study contributes significantly to the theoretical literature by validating their constructs in a non-Western context, thereby addressing a gap identified by recent studies like Rodrigue and Kuyken (2024). This study also enriches the discourse on educational technologies by highlighting the crucial mediating roles of perceived usefulness and attitudes, aligning with Cheng (2023), who emphasized the importance of these variables in educational contexts.

Moreover, the research underlines the interaction between ease of use, usefulness, and perceived value as key drivers of MOOC engagement, corroborating with findings from Vezne et al. (2023). By delineating the influence of these constructs on user attitudes and

motivations, the study provides a nuanced understanding of how different elements contribute to the decision-making process of MOOC users, thereby enhancing theoretical models of e-learning acceptance and sustainability in higher education, which contributes valuable insights into the decision-making processes of learners in emerging educational contexts, providing strategic implications for the design and promotion of e-learning platforms that cater to the needs and expectations of a diverse student body.

Practical implication

This study offers substantial practical implications for various stakeholders involved in the development and dissemination of MOOCs in China, particularly within regions characterized by diverse educational demands like Southwest China. For educational policymakers and institution administrators, the findings emphasize the necessity of enhancing the perceived usefulness and ease of use of MOOC platforms. By focusing on these aspects, educational leaders can develop targeted interventions aimed at improving the instructional design of MOOCs, such as incorporating interactive elements and user-friendly interfaces that align with local educational expectations and technological proficiency levels. Additionally, this study suggests the importance of integrating cultural and regional specificities into the course content, which can increase relevance and uptake among students in these areas.

For MOOC developers and educational technology firms, the insights from this research underline the potential benefits of adopting a user-centric approach in the design and marketing of e-learning platforms. Understanding the pivotal role of user attitudes and perceived value in the decision-making process can guide the creation of more engaging and effective learning environments (Seo and Um, 2023). Developers should consider strategies to enhance the social value of MOOCs, such as community-building features and recognition of academic achievements through certificates or credits that are recognized by local educational institutions. Furthermore, by partnering with universities and colleges to offer courses that are tailored to the curricular needs and professional aspirations of students in less urbanized regions, MOOC providers can significantly expand their user base and contribute to the educational advancement of these communities.

CONCLUSION

This study enriches the academic dialogue by extending the Technology Acceptance Model (TAM) to provide significant theoretical and practical insights into the factors influencing MOOC usage among college students in Southwest China. It confirms the significant relationships between perceived ease of use, perceived usefulness, and the subsequent attitudes towards MOOCs, underlining the critical role these perceptions play in fostering acceptance and continued engagement with MOOC platforms. The findings underscore the importance of these variables in enhancing the effectiveness of MOOCs, providing valuable information for educators and developers aiming to optimize educational outcomes through online platforms. These insights are crucial for stakeholders' intent on addressing the educational challenges in less urbanized regions, offering a pathway to more inclusive and accessible digital education.

However, this study is not without its limitations, which provide avenues for future research. The sample is geographically confined to Southwest China, which may limit the generalizability of the findings to other contexts or countries. Future studies could expand the demographic scope to include diverse populations and settings to enhance the external validity of the findings. Moreover, while this research highlights the mediating roles of attitudes and perceived usefulness, it does not explore other potential mediating or moderating factors, such as cultural influences, socioeconomic status, or prior experience with MOOCs. Further exploration of these aspects could provide a more comprehensive understanding of the dynamics influencing MOOC usage. Longitudinal studies could also be conducted to assess how perceptions of MOOCs evolve over time, deepening our understanding of the long-term impacts of educational technologies on learning behaviors and outcomes.

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