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Original Research Paper

Determinants of University Students' Attitudes and Intentions Toward Artificial Intelligence Education

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Abstract: Few studies have investigated students' perceptions towards using intelligence & interactive virtual massive open online course (IMOOCs) although IMOOCs is an adaptive technique to resolve the massive open online course problems. This study aims to investigate the influence of perceived usefulness, perceived ease of use, attitude, subjective norm, and perceived behavioural control on intention to use IMOOCs based on the technology acceptance model and theory of planned behaviour. A total of 216 students were recruited as respondents and further tested the hypotheses proposed based on PLS-SEM. The results show that perceived usefulness positively influences attitude, and perceived ease of use positively influences perceived ease of use and, subsequently attitude. Meanwhile, attitude, subjective norm, and perceived behavioural control positively influence intention towards using IMOOCs. Lastly, theoretical and practical implications as well as limitations are discussed accordingly.

Keywords: Intelligence & Interactive Virtual Massive Open Online Course (IMOOCS), Intention to Use IMOOCS, Massive Open Online Course (MOOC), Technology Acceptance Model, Theory of Planned Behaviour.

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1. Introduction

Millions of students worldwide need and desire an excellent education, yet the typical classroom is capable of holding a certain number of students [1]. Massive Open Online Course (MOOCs) are the modern internet-based teaching aids [2], they are large-scale, open-access classes taught by university faculty via the internet using a variety of techniques like weekly lecture videos, webcasts, online assessments, discussion forums, and even live video that discussions and help sessions [3]. MOOCs provide unrestricted access worldwide [4], open registration, curriculum exchange, and flexible outcomes [5]. MOOCs include open virtual resources, public interaction, and assistance from leading authorities in the field [4]. Additionally, MOOCs build on the dedication of participants based on their learning goals, prior knowledge and skills, and reciprocal advantages [6]. Indeed, MOOCs are used by millions of students worldwide for a wide range of learning purposes, including as corporate e-learning and training, professional development, career development, college preparation, supplemental learning, and lifelong learning [1].

In the context of formal education or distance learning, several academics have been examining how MOOCs might enhance students' academic performance, experience, and attitudes in higher education in recent years [7]. Higher education institutions also cannot ignore the impact of MOOCs on higher education institutions because there is discussion on the advantages and possible negative consequences of MOOCs [5]. For example, MOOCs were first introduced in China in 2013, and by the end of 2023, they had grown to over 27,000 courses, the largest course scale globally. In particular, MOOCs were crucial in advancing educational equity and propelling the digital transformation of online higher education during the COVID-19 pandemic [8, 9].

However, as many facets of students' experiences in MOOCs are examined in the literature, the phenomena is controversial, both in terms of its use and potential consequences on advanced learning [10]. For example, MOOCs are ineffective in meeting leaners' requirements – the poor retention rate of students in MOOCs is one of the main difficulties that academics and practitioners emphasis, [5]. Furthermore, MOOCs have the potential to disrupt the structure of higher education due to their business model, which dismantles the relationship between the three elements that comprise university activities: teaching, research, and granting credit approval for courses [5]. This model may raise serious concerns about higher education, particularly with regard to research and development. On the other hand, other academics contend that MOOCs have the capacity to completely transform the landscape of contemporary education by providing top-notch instruction to a far larger number of students [11]. Furthermore, MOOCs may be used as a platform for global university outreach, opening up new channels for the public to access free, reliable knowledge [3]. This will inspire students and leaners in using this education tool [10].

Because MOOCs present low completion rates, they are massive thus the participants' profiles are too heterogeneous regarding origin, capacitation, motivation and learning aims [12]. Studies suggesting the use of adaptive techniques to resolve the aforementioned issues is increasing. Intelligent & interactive virtual MOOC (IMOOC) is an intelligent interactive virtual MOOC which is supported by the latest information techniques such as artificial intelligence, extended reality, holographic imaging, etc. IMOOCs are a new type of classroom teaching which is face-to-face, interactive, and immersive teaching between virtual teachers and students. With the help of holographic imaging, digital twin and artificial intelligence technologies, the teachers' realistic "digital avatar" can be directly displayed in the classroom or in front of students, students thus can feel the teacher's "face-to-face on-site" authentic immersive learning experience and can also ask questions in class and conduct intelligent real-time interaction with virtual teachers. Hence, IMOOC making the teaching process of MOOCs more realistic, interactive, and attractive can effectively stimulate students' learning interest and class participation. Teachers can also use these technologies to create more diverse teaching forms and environments to improve teaching quality and teaching effectiveness. Therefore, students' attitudes to and motivation for taking IMOOCs have been studied by various research and it is necessary to explore the feasibility and advantages of IMOOCs as part of the academic programme [5].

2. Literature Review

2.1. Technology Acceptance Model

Technology acceptance model (TAM) is one of the most well-known cognitive framework that has been used extensively by academics to comprehend people's psychology, attitudes, and intentions around the sue of new technology or creative products or services [13]. According to Wang, et al. [14], TAM is drived from well-established psychological theories and frameworks, such has the theory of

reasoned action, theory of planned behaviour, or the rational choice theory, which are used by academics to analyse how individuals behave when embracing new technologies. Accordingly, individuals' attitudes and intentions to adopt new technologies are measured using two primary psychological components: perceived usefulness and perceived ease of use [15]. The reliability and utility of TAM have been demonstrated by prior studies that extensively examined students' attitudes and intentions about the adoption of MOOCs [5] [9] [16].

1) Perceived Usefulness

Perceived usefulness refers to individual subjective opinions on the use of new technology and how much it will improve the performance of products or services [13]. In general, if a new technology has been proven to be a useful tool, individuals are more likely to adopt it with positive attitudes and intentions [14]. Perceived usefulness in the context of MOOCs refers to the degree to which a student believes that using a massive open online course would improve their learning performance [5]. Wang, et al. [16] found that perceived usefulness greatly increased students' MOOCs learning performance while Waleed, et al. [17] showed similar results in Malaysia. Thus, the following hypothesis is proposed for testing:

H1: Perceived usefulness positively influences students' attitudes towards IMOOCs.

2) Perceived Ease of Use

Perceived ease of use refers to the degree to which individual believes that using new items or novel technologies will be simple and free from physical and mental exhaustion [13]. Naturally, people are more likely to adopt new technologies if they face less obstacles when utilising and operating them [14]. Thus, in the literature on MOOCs and education, researchers defined perceived ease of use as the extent to which students believe that massive open online courses are simple to use and would improve their learning outcomes [5]. According to previous studies, students' perceptions, attitudes, and intentions regarding MOOCs use are influenced by perceived ease of use. For instance, Cole and Timmerman [18] found that accessibility is a significant predictor of students' attitudes towards MOOCs, and Shapiro, et al. [3] showed that convenience is a significant predictor of students' ability to use MOOCs. Therefore, we proposed that:

H2: Perceived ease of use positively influences students' attitudes towards IMOOCs.

3) Perceived Ease of Use Towards Perceived Usefulness

In addition, several researchers pointed out that as new technologies are only seen as beneficial if they are simple for people to use, perceived ease of use might either directly or indirectly through perceived usefulness affect people's attitudes and intentions [14]. In other words, students only consider IMOOCs to be user-friendly, simple, and easy to use when they express interest in using them, in addition to MOOCs features. A study by Jaiswal, et al. [13] investigated individuals' attitudes and intentions towards new energy products and the results showed a positive effect of perceived ease of use on perceived usefulness. Therefore, the following hypothesis is proposed for testing:

H3: Perceived ease of use positively influences perceived usefulness towards IMOOCs.

2.2. Theory of Planned Behaviour

Some researchers contend that the TAM model only evaluates the positive belief-behaviour interactions since TAM is depending on the technical or technological characteristics of the products or services [14]. Hence, Theory of planned behaviour (TPB) is taken into consideration in this study as an additional significant hypothesis that is employed in conjunction with TAM. Perceived behavioural control is incorporated into the theory of planned behaviour, which is extension of the theory of reasoned action. This is due to the fact that TPB tackles the constraint of the theory of reasoned action, which is that individuals are unable to make decisions based on their own volition [19]. In TPB, the most reliable precursor to identical behaviour is the intention to act, which shows that the person is mentally able to take action [20]. Accordingly, three variables influence an individual's intention towards a particular behaviour: attitude, subjective norm, and perceived behavioural control. Generally, the likelihood of taking action increases with a more positive attitude, subjective norm and strong perceived behavioural control [21]. TPB is therefore widely used theory in marketing [22] - [24], including education literature [16] [25] [26].

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1) Attitude

Attitude is the extent to which an individual believes that their activities are generally good or bad [27]. It is a mental state that influences their reactions to people, objects, and situations [28]. The degree to which people appreciate and are willing to utilise products and services is reflected in their positively or negatively biased perceptions of them [29]. When it comes to MOOCs, there is a general consensus that students approve of this method of teaching [7]. For instance, Wang, et al. [16] reported that learning attitude towards MOOCs significantly influenced their learning performance whereas Alanazi and Caroline [7] reported similar results. However, few research reported that students who have low self-independence in their studies are more inclined to like traditional face-to-face pedagogy [30]. Therefore, this study proposed that:

H4: Attitude positively influences intention towards IMOOCs.

2) Subjective Norm

Subjective norm refers to an individual's sense of social pressure on their particular actions is referred [31]. An individual's intentions might be greater or lower depending on whether their significant others have favourable or negative thoughts about a certain product or service [32]. Subjective norm is the feelings or moral obligation of individuals and an external norm that represents an individual's value system and is influenced by conscious social pressure in a variety of macro-level settings [31]. Thus, an individual's own beliefs and moral obligation to participate in the adoption of IMOOCs activities might be influenced by the way important people see the performance of IMOOCs. For example, Yang and Su [33] revealed students' subjective norm positively influenced their learning behaviours in a MOOC practice-oriented course. Dong, et al. [34] reported that subjective norm significantly influenced the correlation between motivations and intention to learn with MOOCs. Therefore, the following hypothesis is proposed:

H5: Subjective norm positively influences intention towards IMOOCs.

3) Perceived Behavioural Control

Perceived behavioural control refers to an individual's evaluation of the potential difficulties and obstacles connected to performing a certain activity, such as financial resources, time, abilities, and confidence [23]. Perceived behavioural control contains two distinct components – self-efficacy and controllability [35]. Controllability refers to an individual's perception of whether or not a behaviour is easier to achieve than behaviours they believe are difficult and over which they have less control; self-efficacy refers to an individual's perceived confidence and level of ease in performing a specific task [23]. Therefore, people are more inclined to perform certain activities they consider as easy than behaviours they perceive as more challenging and over which they have less control [36]. For example, Yang and Su [33] revealed that perceived behavioural control positively influenced students' learning behaviours in MOOCs. Wang [37] also reported that perceived behavioural control positively influenced behavioural intention towards MOOCs. Therefore, we proposed that:

H6: Perceived behavioural control positively influences intention towards IMOOCs.

3. Methodology

3.1. Sample

A convenience sampling technique was used to recruit samples in this study due to it has certain advantages like easy accessibility, geographical availability at a given time, or the willingness to participate are included for the study [38]. Self-administration questionnaires were posted and distributed to students during classes through online website linkage or QR code from 1st September to 31st October 2024. A pilot test was undertaken with 30 students to certify the questionnaire items' usability and validity and prevent data quality issues, while their participation in the survey was voluntary and they can withdraw at any time. Overall, a total of 216 usable questionnaires were completed and returned which exceeded Kline [39] suggested that a minimum of 200 sample size and between 10 and 20 cases per parameter is required for statistical analysis.

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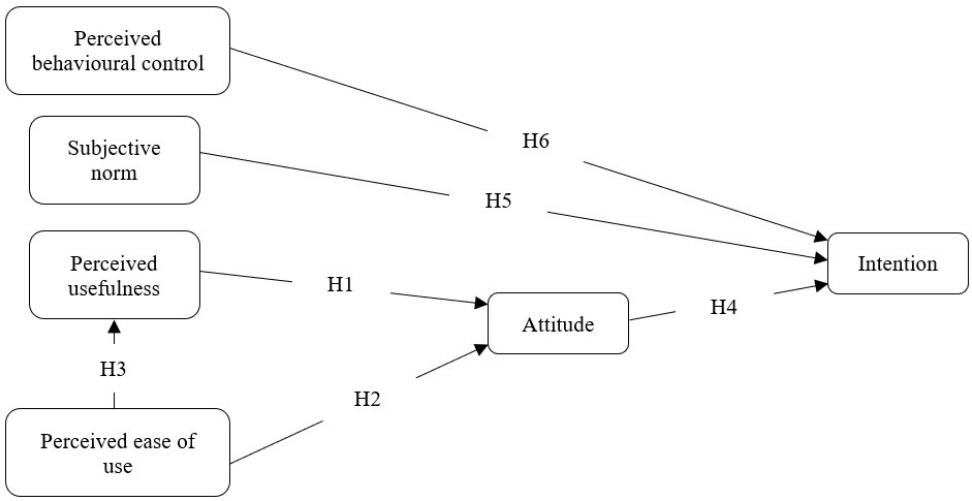

Figure 1. Conceptual Research Framework

3.2. Questionnaire Operationalisation

All of the questionnaire items were adapted from previous studies. Five perceived usefulness items and four perceived ease of use items were adapted from Wang [37] and Yang and Su [33]. Four attitude items were adapted from Wang, et al. [25]; three subjective norm items were adapted from Wang [37]; four perceived behavioural control items were adapted from Yang and Su [33]; and three intention items were adapted from Razmerita, et al. [40]. The last section included demographic characteristics such as gender, age, monthly spending and educational level.

4. Finding and Discussion

4.1. Descriptive Analysis

Out of 216 valid samples, 43.1% of respondents are male and 56.9% of respondents are female. Most of the respondents are aged 21 years old (19.9%), 33.8% of respondents reported their monthly spending between 1000-2000RMB and 2001-3000RMB, and 27.3% of respondents are freshmen. The distributed data are normal since the skewness ranges from -0.514 to +0.098 and kurtosis ranges from -1.628 to -0.82. In addition, KMO and Bartlett's test results show the KMO value is 0.886, $p < 0.05$, indicating sampling adequacy.

Table 1. Demographic Characteristics (N = 216)

Items	Characteristics	Frequency	Percentage (%)
Gender	Male	93	43.1
	Female	123	56.9
Age	18	31	14.4
	19	27	12.5
	20	41	19
	21	43	19.9
	22	37	17.1
	23	18	8.3
	24	15	6.9
	Above 24	4	1.9
Monthly spending	Below 1000RMB	36	16.7
	1001-2000RMB	73	33.8
	2001-3000RMB	73	33.8
	Above 3001RMB	34	15.7
Educational level	Freshmen	59	27.3
	Sophomore	38	17.6
	Junior	45	20.8
	Senior	43	19.9
	Master and above	31	14.4

4.2. Measurement Model Test

Hair et al. [41] suggested that Cronbach's alpha value should be higher than 0.7, factor loadings should be higher than 0.5, and ideally, more than 0.7. To access the convergent validity of the measurement, composite reliability (CR) should be higher than 0.7, average variance extracted (AVE) value should be higher than 0.5. Table 2 shows that convergent validity of the measurement is achieved. For discriminate validity, based on the Fornell-Larcker criterion, each construct's square root of AVE value should be higher than its correlations with other constructs [41]. Based on Heterotrait-Monotrait ratio test, the correlations between all constructs should be less than 0.9 [42]. Table 3 shows that the discriminate validity of the measurement is established.

Table 2. Reliability, Composite Reliability, And Average Variance Extracted from Items

Construct (Cronbach's alpha value)	Item	Factor loading	CR	AVE
Perceived usefulness (α = 0.910)	1. I use IMOOCs because I can get degree for potential future careers.	0.865	0.933	0.735
	2. I use IMOOCs because I can communicate with other leaners during the IMOOCs learning process.	0.864		
	3. I use IMOOCs because I can share knowledge among leaners during the IMOOCs learning process.	0.844		
	4. I use IMOOCs because I can communicate with the instructors or teaching assistant during the IMOOCs learning process.	0.864		
	5. I use IMOOCs because I spend less time and gain more than in a traditional class.	0.849		
Perceived ease of use (α = 0.826)	1. I think I can set learning goals according to my own situation.	0.795	0.884	0.657
	2. I think I have free choice of study path according to my own wishes.	0.812		
	3. I think I can manage my learning progress according to my own learning situation.	0.859		
	4. I think I can learn specific sections of the courses according to my personal needs.	0.775		
Attitude (α = 0.851)	1. I believe using IMOOCs is bad – good.	0.830	0.899	0.691
	2. I believe using IMOOCs is unpleasant – pleasant.	0.834		
	3. I believe using IMOOCs is foolish – wise.	0.816		
	4. I believe using IMOOCs is undesirable – desirable.	0.844		
Subjective norm (α = 0.826)	1. I use IMOOCs because many social media have reported the benefits and advantages of using IMOOCs.	0.862	0.895	0.740
	2. I use IMOOCs because many schools are promoting the use of IMOOCs.	0.883		
	3. I use IMOOCs because people around me (e.g., friends, classmates, teachers) are using IMOOCs.	0.834		
Perceived behavioural control (α = 0.884)	1. I can arrange time on my own to learn courses through IMOOCs.	0.872	0.919	0.740
	2. I can obtain sound information equipment by myself to learn courses through IMOOCs.	0.871		
	3. Learning courses through IMOOCs causes little disturbance to my life.	0.827		
	4. I can master everything that appears during the IMOOCs learning.	0.869		
Intention (α = 0.838)	1. I intend to join the optional work in this IMOOCs.	0.839	0.902	0.755
	2. I am planning to take an active part in the optional work in this IMOOCs.	0.889		
	3. I expect to spend considerable time on optional work in this IMOOCs.	0.879		

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Table 3. Discriminate Validity of The Measurement Model

Fornell-Larcker Criterion						
Construct	1	2	3	4	5	6
1. Attitude	0.831					
2. Perceived ease of use	0.290	0.811				
3. Intention	0.377	0.286	0.869			
4. Perceived behavioural control	0.364	0.366	0.424	0.860		
5. Subjective norm	0.495	0.327	0.446	0.425	0.860	
6. Perceived usefulness	0.441	0.413	0.423	0.446	0.408	0.857
Heterotrait-Monotrait Ratio (HTMT)						
Construct	1	2	3	4	5	6
1. Attitude	-					
2. Perceived ease of use	0.341	-				
3. Intention	0.444	0.351	-			
4. Perceived behavioural control	0.415	0.426	0.481	-		
5. Subjective norm	0.592	0.398	0.525	0.498	-	
6. Perceived usefulness	0.497	0.468	0.485	0.499	0.464	-

4.3. Structural Model Test

The structural model has been assessed as shown in Table 4 and Figure 2. Our results show that perceived usefulness positively influences attitude since $\beta = 0.387$, $p < 0.05$, indicating H1 is accepted. Our results show that perceived ease of use positively but insignificantly influences attitude since $\beta = 0.13$, $p > 0.05$, hence, H2 is rejected. The results of this study show that perceived ease of use positively influences perceived usefulness as $\beta = 0.413$, $p < 0.05$, meaning H3 is accepted. Attitude positively influences intention since $\beta = 0.154$, $p < 0.05$, indicating H4 is accepted. There is a positive correlation between subjective norm and intention as $\beta = 0.26$, $p < 0.05$, meaning H5 is accepted. In addition, our results show that perceived behavioural control positively influences intention since $\beta = 0.257$, $p < 0.05$, indicating H6 is accepted.

Table 4. Structural Relationships and Hypotheses Testing

Hypothesis	Path	Path coefficient	t-value	p-value	Decision
H1	Perceived usefulness ----> attitude	0.387	5.777	0.000	Accepted
H2	Perceived ease of use ---> attitude	0.130	1.932	0.054	Rejected
H3	Perceived ease of use ---> perceived usefulness	0.413	7.648	0.000	Accepted
H4	Attitude ----------> intention	0.154	2.273	0.023	Accepted
H5	Subjective norm ---> intention	0.260	3.346	0.001	Accepted
H6	Perceived behavioural control ---> intention	0.257	3.829	0.000	Accepted

4.4. Discussion

This study accessed students' perceptions towards using IMOOCs. The results showed that perceived usefulness positively influenced attitude. This means that when students perceive use of IMOOCs can be beneficial for their future careers, improve their communication with instructors, teaching assistants, and others, enrich their knowledge and save time are more likely to have a positive attitude towards using IMOOCs. These findings consistent with previous studies showed that perceived usefulness significantly influenced students' attitudes towards MOOCs [16] {17].

Our results showed that perceived ease of use significantly influenced perceived usefulness but insignificantly influenced attitude. These findings mean that students who perceive they can set learning goals based on their own situations, have free choice of study by using IMOOCs, manage their learning progress according to their own situations, and can learn specific courses based on their own interests are more likely to perceive IMOOCs is a useful tool to improve their study and beneficial for their career future. These findings are consistent with Jaiswal, et al. [13] stated that perceived ease of use significantly influenced perceived usefulness. However, our results contrast with certain previous studies that showed that perceived ease of use positively influenced one's attitudes [3, 18].

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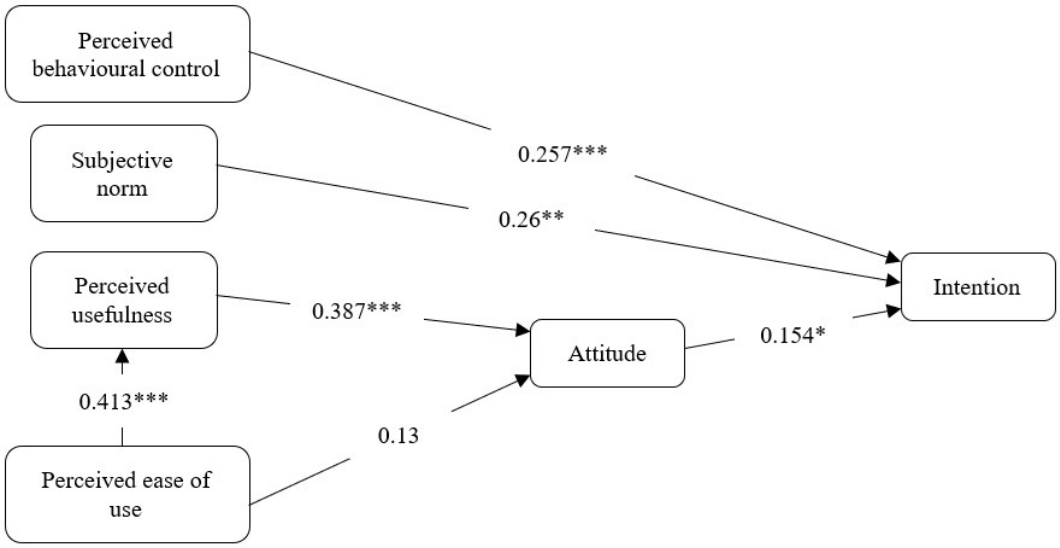
Furthermore, this study showed that attitude, subjective norm, and perceived behavioural control positively influenced students' intention to undertake IMOOCs. This means that students who have a positive overall evaluation of IMMOCs, receive positive feedback and information from social media, close-friends, and classmates, and perceive they can control their abilities (i.e., time, opportunities, convenience) are more likely to display a higher possibility to use IMOOCs in future. Those findings are consistent with previous studies that showed that attitude, subjective norm, and perceived behavioural control positively influenced one's intention to take action [23] [24] [33].



*Notes: * denotes p < 0.05, ** denotes p < 0.01, *** denotes p < 0.001.*

Figure 2. Results of the Study

4.5. Theoretical Contributions

The current study elicits certain theoretical contributions. First, most of the previous studies focused on how students' perceptions towards using MOOCs. However, researchers indicated that using MOOCs has certain disadvantages such as low completion rates. Thus, IMOOCs as an adaptive technique may resolve the MOOCs' problems. This study's results showed that students generally have positive attitudes and subjective norm, high perceived behavioural control, and perceived IMOOCs is a useful study tool that led to high intention to use IMOOCs.

Second, although IMOOCs are an extension technical tool of MOOCs, few studies have investigated how students' perceptions towards using IMOOCs. The current study merges the theory of planned behaviour and the technology acceptance model to predict students' attitudes and intentions towards using IMOOCs. The results of this study showed that components of TPB (i.e., attitude, subjective norm, and perceived behavioural control) positively influenced intention. Besides, our results showed that only perceived usefulness directly influenced attitude; perceived ease of use positively influenced perceived usefulness and, subsequently attitude towards using IMOOCs.

4.6. Practical Implications

Because our results showed that perceived usefulness positively influenced attitude, teachers, lecturers, teaching assistants, and IMOOCs staffs need to advertise that using IMOOCs is an advantageous choice for students to achieve a higher level of their courses such as using IMOOCs will be beneficial for students' future careers, improve their communications with teaching assistants, instructors, and other learner, and saving time on study in various courses. Meanwhile, since perceived ease of use positively influenced perceived usefulness. Hence, all educators, teaching assistants, and IMOOCs staffs need to publicise that using IMOOCs is easy to use based on their own interests and situations, and students can manage their learning goals and progress according to their own learning situations.

In addition, our results showed that attitude, subjective norm, and perceived behavioural control positively influenced intention to use IMOOCs in future. Therefore, lecturers, teachers, teaching assistants, and IMOOC staffs should advertise using IMOOCs is a wise and desirable choice for students' studies and future career development. Meanwhile, they need to inform that using IMOOCs can provide various information and courses for every student, each student can access IMOOCs easily and they can arrange time to use IMOOCs to study in a specific course according to their own situation.

4.7. Limitations

Although intention is a robust antecedent of actual behaviour, however, some researchers argue that intention is not always equivalent to actual behaviour [43] [44]. Hence, future studies may investigate students' perceptions towards using IMOOCs from students who are using or used IMOOCs as study tools. Second, this study's samples were only recruited from one university in China, thus, the results of this study cannot represent all students' attitudes and intentions towards using IMOOCs. In addition, this study is a cross-sectional one, thus, the conclusive on the causality of relationships in this study cannot be determined. Future studies can replicate and expand the current research framework to increase its reliability and accuracy.

5. Conclusion

The students' perceptions, attitudes and intentions towards using IMOOCs have not been fully examined empirically in the literature, even though there is number of studies on students' intention to use MOOCs have been based on various antecedents. This study investigated how perceived usefulness, perceived ease of use, subjective norm, perceived behavioural control, and attitude affect students' intentions to use IMOOCs.

Results show that perceived ease of use positively influences perceived usefulness, further attitude, and finally intention. Subjective norm and perceived behavioural control have been proven to be valuable predictors of intention. The results of this study can be considered to be one of the pioneer studies that examined the influence of components of TAM and TPB on students' intentions to use IMOOCs. The current study may provide a comprehensive explanation of students' intentions based on TAM and TPB, which will contribute to the growth of IMOOC-related educational literature. Future studies may duplicate current studies' findings and research frameworks in other regions or countries, and researchers are needed to investigate the influence of other demographic or psychological factors on students' intentions to use IMOOCs.

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