Key Drivers of Satisfaction, Perceived Usefulness, and Adoption of Flipped Classrooms at a Private University in China

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Abstract

Purpose: The study explores the key factors influencing undergraduates' intention to use flipped classrooms at a private university in Zhanjiang, China. Variables in the proposed conceptual framework include learning outcomes, cognitive engagement, social influence, perceived enjoyment, satisfaction, perceived usefulness, and intention to use. **Research design, data, and methodology:** The researcher adopted a quantitative research approach (n=450), administering surveys to Zhanjiang University of Science and Technology students. Nonprobability sampling involved purposive sampling to select five secondary colleges. Stratification random sampling will be used to obtain a proportional sample size, and convenience sampling will be used to collect questionnaires via Questionnaire Star online. Following this, confirmatory factor analysis (CFA) examines the relationship between potential and observed variables and measures the validity and reliability of the scale. Afterward, the structural equation model (SEM) checks the relationship between potential variables and whether the hypotheses are valid. **Results:** The results revealed that learning outcomes and cognitive engagement significantly affect satisfaction, while social influence and enjoyment significantly influence perceived usefulness. Both satisfaction and perceived usefulness significantly impact the intention to use. Among these factors, perceived usefulness had the strongest effect on intention to use, followed by social influence, enjoyment, and cognitive engagement. **Conclusions:** Policymakers, universities, colleges, and educators should work to establish the flipped classroom as an effective, engaging, and enjoyable learning method.

Keywords: Learning Outcomes, Cognitive Engagement, Social Influence, Perceived Enjoyment, Satisfaction

1. Introduction

At present, curriculum teaching in universities still follows the traditional teaching model, the "teachers talk, students listen" model; students learn knowledge in the classroom and internalize knowledge in extracurricular activities. With advancements in the Internet, video technology, and learning management systems, learning methods such as flipped classrooms, e-learning, and blended learning are all evolving. The flipped classroom model has emerged as one of the most impactful approaches (Lai & Hwang, 2016). The flipped classroom approach consists of two stages of learning, before class, there is the individual learning phase, where students engage with learning materials through various media, including text and video (Bergmann & Sams, 2012). There is the interactive learning

phase in class, where students participate in diverse forms of interactive learning, including discussions, questions and answers, interpretive concepts, and cooperative learning (Long et al., 2017). Hung (2015) believes that flipped classrooms can improve students' learning ability more than traditional methods, avoid low-order "cramming" classroom teaching that lacks challenge and innovation, and open a window for higher-order deep-level teaching with certain challenges and innovation.

Zhanjiang University of Science and Technology (ZUST) is the largest full-time general undergraduate college in western Guangdong Province, China, with unique educational characteristics. In 2021, the Ministry of Education approved it as an independent private general university with 15 second colleges and nearly 24,000 full-time students. The main reasons why the researcher chose to

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study at this university are the convenience of work and the fact that it is a representative private university. Due to their growth environment, most students in private colleges have access to more cutting-edge things and the latest technologies, and it is easy to learn new things. Jin (2012) shows through teaching practice that the implementation of the flipped classroom in the teaching of private universities is not hindered by students. The real question is whether educators can adapt to this new teaching mode and keep up with its progress. This presents a challenge for educators to stay updated and engaged in their teaching methods, ensuring that they provide the best learning experience for their students.

So far, there are limited research exists on students' intention to use the flipped classroom. In domestic and foreign researches, researches on flipped classroom are almost qualitative, and quantitative researches using CFA and structural equation model are rare. Therefore, this study uses a quantitative research approach to examine the factors that affect ZUST students' intention to use flipped classroom, and explores the status quo of college students' learning outcomes, perceived enjoyment and satisfaction through flipped classroom. The empirical study of flipped classroom in this paper broadens the research scope of "how to" flipped classroom. It can provide theoretical support for teachers in the same field to do corresponding educational research. The portability of successful cases of flipped classrooms could be better, and with the change in teaching environment and conditions, the effect could be more satisfactory. Therefore, the flipped classroom of ZUST is taken as an example to promote the teaching reform of front-line teachers and promote the large-scale application of flipped classroom, and to provide corresponding empirical support, value test and reference template for the future policy formulation of Educational Affairs Office. This research provides valuable insights and implications for the future of educational practice, preparing educators for the changes and advancements in the field of education.

2. Literature Review

2.1 Learning Outcomes

Learning outcomes are generally defined as multiple evaluations of students' completion of specific learning tasks and their achievement of the intended educational goals. This encompasses changes in learners' understanding, abilities, behaviors, and attitudes after completing the instruction (Novak et al., 2021). According to Chen et al. (2016), factors such as curriculum design, teaching methods, and learning behaviors significantly influence learning outcomes, which serve as a measure to evaluate both students' academic

performance and the quality of instruction.

Various measures have been used to assess learning outcomes in distance education, including achievement indicators, student experience, academic performance, and students' expectations for employability (Balwant, 2019). Francescucci and Rohani (2019) argue that novel educational approaches produce more significant learning outcomes and achieve teaching goals more effectively than traditional educational approaches. Mitchell and Beach (1976) argue that output quality increases subjective expected utility. Therefore, teachers who adopt flipped classrooms must provide high-quality instruction that meets students' expectations for output quality.

Integrating technology-enhanced instruction with in-person teaching, this self-paced teaching method significantly improves learning outcomes and satisfaction (Chen & Chiou, 2014). However, the flipped classroom model, which combines pre-class video with teacher-student interaction, has been shown to have a particularly significant impact on learning effectiveness and satisfaction (Hsieh & Cho, 2011). Rabren et al. (2013) similarly discovered that students are more satisfied with the program when they achieve good learning outcomes. These findings suggest the following hypothesis:

H1: Learning outcomes has a significant impact on satisfaction.

2.2 Cognitive Engagement

Cognitive engagement is a widely used motivational, behavioral indicator that affects the type and amount of student engagement in the classroom. It represents students' effort to study (Manwaring et al., 2017). Students' learning efforts are cognitive engagement (Manwaring et al., 2017). Cognitive engagement describes learners' investment in learning activities, such as using learning techniques, self-control, and determination to master knowledge (Sedaghat et al., 2011). Cognitive engagement is defined as learners' self-assessment of their abilities and ability to complete various assignments and participate in teacher-led learning activities (Skinner & Belmont, 1993).

Student engagement in the classroom is a potent and direct influencer of satisfaction (Murillo-Zamorano et al., 2019). Participation, which involves psychological engagement and effort, can significantly impact students' satisfaction (Reeve & Tseng, 2011). Student participation in the classroom can directly and materially influence satisfaction (Murillo-Zamorano et al., 2019). Moreover, Luo et al. (2019) demonstrated that cognitive engagement plays a crucial role as a mediating variable in the relationship between motivation and student satisfaction in courses dealing with electromagnetic interference. This finding underscores the depth and complexity of the research in our

field.

H2: Cognitive engagement has a significant impact on satisfaction.

2.3 Social Influence

Kim et al. (2008) defines social influence as how individuals are influenced and replicated by the actions of others. Venkatesh et al. (2003) defines social influence as the extent to which an individual feels that others believe they should use a specific technology. Another aspect of social influence is that teachers feel their peers can help them implement the flipped classroom effectively through support, feedback, and encouragement (Long, 2018). Social influence can be explained from three perspectives. The first is to agree with others mentally. The second scenario involves the impact of a public figure on an individual's choice. The third pertains to reaching an agreement with others and openly sharing one's opinions (Kelman, 1958).

Teo et al. (2019) argued that social influence indirectly influences college students' motivation to use learning management systems as influenced by their perception of the system's value. Earlier studies have shown that social influence positively affects perceived usefulness (Venkatesh & Davis, 2000; Yi et al., 2005). If students have yet to use a new system, they will rely on the opinions of teachers, parents, and other influential figures regarding the system's usefulness. In the context of online commerce, consumer behavior is influenced by social factors, thus affecting perceived usefulness (Kim et al., 2009; Venkatesh et al., 2011; Wang & Chiang, 2009). These findings support the formation of the following hypotheses:

H3: Social influence has a significant impact on perceived usefulness.

2.4 Perceived Enjoyment

Davis et al. (1992) described perceived enjoyment as the intrinsic pleasure of using a system, separate from any potential benefit. Perceived enjoyment denotes the level of engaging or enjoyable M-learning (Huang, 2006). It represents a fundamental intrinsic motivation in which the enjoyment of using e-learning systems is a key factor (Chao, 2019). Previous research has shown that enjoying the shopping process significantly affects consumer behavior (Doolin et al., 2005). Perceived enjoyment plays a crucial role in intrinsic motivation for individuals to adopt new technologies (Kulviwat et al., 2007).

Abdullah and Ward (2016) argue that Perceived enjoyment is a major external factor influencing perceived usefulness, and it is considered to have a direct and significant impact on perceived usefulness. They emphasize that perceived enjoyment usually precedes perceived

usefulness, as it involves users' desire for entertainment and emotional relief, influencing their intrinsic motivation for deep cognitive engagement and thus their perception of the usefulness of technology (Ha & Stoel, 2009). A large body of empirical research supports this sequence. Building on these reviews, we formulated the following hypotheses:

H4: Perceived enjoyment has a significant impact on perceived usefulness.

2.5 Satisfaction

Oliver (1980) defined satisfaction as the emotional responses people experience regarding the products or services they receive. Stanislaus (2022) added that Satisfaction is an individual's evaluation after a particular purchasing experience within business contexts. In marketing terms, Satisfaction is "a judgment that a product or service attribute, or the product or service as a whole, meets a desirable level of consumption-related fulfillment" (Reynoso, 2010). According to Moore (2011), student satisfaction is defined as "achieving learning success and feeling content with the educational experience."

Student satisfaction with a blended learning course is a culmination of students' attitudes, feelings, and perceptions regarding the benefits they expect to gain from the course (Le et al., 2023). Research shows that pre-class video lectures can effectively enhance academic performance, but such video-supported methods may only sometimes lead to increased Satisfaction in non-video classes (Evans & Cordova, 2015). Satisfaction is a critical factor that influences users' decisions to continue using a system and serves as a vital indicator of the flipped classroom's effectiveness (Stanislaus, 2022), underscoring its importance.

Research indicates that customer satisfaction positively influences the likelihood of future repurchase intentions (Bitner, 1990). Satisfied consumers are more inclined to repurchase a product or service, whereas those who are dissatisfied may avoid using it again (Oliver, 1981). Higher levels of Satisfaction with the services received generally lead to greater intent to keep using those services (Fan et al., 2022). From these findings, we have proposed the following hypothesis:

H5: Satisfaction has a significant impact on intention to use.

2.6 Perceived Usefulness

Perceived usefulness is "the degree to which an individual believes that utilizing a particular system will enhance their job performance." This aligns with the concept of "useful," which implies that a tool or system provides significant benefits within an organizational context, where employees are often rewarded with bonuses, promotions, and other incentives for their effective performance (Pfeffer et

al., 1982). In various scenarios, their perceived usefulness heavily influences the intention to adopt technological tools (Avci & Askar, 2012). Additionally, research indicates that students' perceived usefulness significantly predicts their intent to use learning management systems (Le et al., 2023).

In the flipped classroom model, perceived usefulness arises when students believe online videos and interactive platforms can enhance academic performance (Zhai et al., 2017). Yoshida (2016) emphasized that the perceived usefulness of the flipped classroom model not only improves students' understanding but also raises the overall quality of classroom instruction. Additionally, Dele-Ajayi et al. (2017) discovered that perceived usefulness substantially impacts students' attitudes and their willingness to persist with the flipped classroom method.

Lee (2010) identified perceived usefulness as a crucial determinant of students' behavioral intentions. Mohamed and Lamia (2018) noted that perceived usefulness is a key motivator for adopting flipped classroom models. Ajayi et al. (2017) demonstrated that perceived usefulness significantly influences students' attitudes and willingness to persist with the flipped classroom. Additionally, Teo et al. (2019) discovered that perceived usefulness directly influences the intention to use Web 2.0 technologies in education. Ray et al. (2019) further noted that the perceived usefulness of a curriculum is the primary determinant in the decision to implement a technology-based curriculum. Consequently, the following hypothesis was proposed:

H6: Perceived usefulness has a significant impact on intention to use.

2.7 Intention to Use

In Venkatesh and Davis's (2000) framework, "intention to use" was described as a person's intention and readiness to participate in a particular activity. According to Fishbein and Ajzen (1975), renowned for their Theory of Reasoned Action, "intention to use" represents the motivational factors that drive a person's choice to undertake a certain action. Hunde et al. (2023) proposed that "intent to use" might serve as a valuable alternative in certain contexts, as it reflects an attitude, whereas "use" pertains to the actual behavior.

User satisfaction with online technology can enhance their intention to use it and their positive attitudes towards it (Wu & Liu, 2007). Venkatesh et al. (2012) identified perceived usefulness as the main factor influencing users' readiness to adopt a technology. Chow et al. (2012) noted that perceived usefulness and ease of use impact the intention to use technology. Doo (2021) emphasized that perceived usefulness positively affects the intention to use flipped learning.

3. Research Methods and Materials

3.1 Research Framework

The conceptual framework of this study is grounded in four principal theoretical models. The first model posits that social influence substantially affects perceived usefulness, which in turn significantly affects the intention to use. Additionally, satisfaction is critical in influencing the intention to use (Fan et al., 2022). The second framework demonstrates that learning outcomes significantly affect satisfaction (Das et al., 2019). The third framework shows that perceived enjoyment significantly influences perceived usefulness (Abdekhoda et al., 2020). The fourth framework supports the idea that cognitive engagement significantly affects satisfaction (Le & Nguyen, 2023). Figure 1 depicts the conceptual framework for this study.
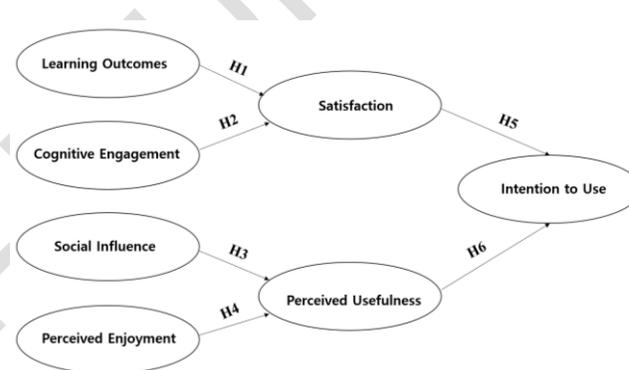

Figure 1: Research Conceptual Framework

H1: Learning outcomes has a significant impact on satisfaction.
H2: Cognitive engagement has a significant impact on satisfaction.
H3: Social influence has a significant impact on perceived usefulness.
H4: Perceived enjoyment has a significant impact on perceived usefulness.
H5: Satisfaction has a significant impact on intention to use.
H6: Perceived usefulness has a significant impact on intention to use.

3.2 Research Methodology

Based on a review of existing literature, 450 valid responses were collected via an online questionnaire. This questionnaire was organized into three primary sections. The first section included screening questions to exclude participants needing more sufficient or appropriate knowledge. The second section measured all variables using a 5-point Likert scale, ranging from very negative to very

positive responses—the third section collected demographic information, including gender, grade, and college. Before distributing the questionnaire to the intended participants, the researchers validated the instrument's internal consistency using Item-Objective Congruence (IOC). They assessed its reliability through a pilot test with 50 participants. The Cronbach's Alpha coefficient was required to be 0.70 or higher to be deemed acceptable.

After obtaining the 450 valid responses, the researchers utilized Jamovi 2.3.21 to analyze the sample data, conducting descriptive analysis of measurement scales, normality assessments, and calculating Cronbach's Alpha (N=450). Subsequently, IBM SPSS Statistics 27 and Amos 23 were utilized for confirmatory factor analysis (CFA) and structural equation modeling (SEM). CFA was conducted to explore the relationships between latent and observed variables and evaluate the measurement scale's validity and reliability. This analysis included assessing the model's goodness of fit, convergence, and discriminant validity. Following this, SEM was employed to investigate the relationships among latent variables and to test the hypotheses. Overall, the study followed established procedures for empirical research.

3.3 Population and Sample Size

The study's target population comprises first-year to fourth-year undergraduates from five secondary colleges at ZUST who have had at least one semester of experience with flipped classrooms in any course. Screening questions were included in the questionnaire to ensure respondents' familiarity with the flipped classroom model. Students without prior experience in flipped classrooms were excluded to maintain the reliability of the study.

The sample size was set according to the statistical methods employed by the researchers, with each method providing a minimum required value (Kerkhoff, 2017). Hence, the researchers used the "Sample Size Calculator for Structural Equation Models," the minimum required sample size for the model structure was determined to be 88, with a recommended minimum of 425. Therefore, 500 respondents were surveyed, and after data screening, 450 responses were deemed valid for inclusion in the study.

3.4 Sampling Technique

Multistage sampling is viewed as progressively refining a broad sample to a more specific one (Ackoff, 1955). This method enhances accuracy, lowers costs, and reduces non-response rates. Consequently, this study adopts a multistage sampling technique divided into three stages.

The first stage adopts purposeful sampling, as indicated in Table 1, with data collected from undergraduates in five core secondary colleges at ZUST, all of whom have

experience with flipped classrooms. The second stage utilizes stratified random sampling, determining the sample size for each college based on its proportion of the total student population. The third stage involves convenience sampling, where undergraduates from the five colleges were sampled for convenience.

Data was collected by the researchers from February to July 2024 using Questionnaire Star. Initially, 500 student questionnaires were collected, but 50 were deemed invalid: 3 were from students not enrolled at ZUST, 3 were from students outside the five targeted colleges, and 44 needed to be flipped classroom experience. Consequently, 450 valid questionnaires were retained to ensure the correct target group, undergraduates from the five secondary colleges at ZUST. The online questionnaire was circulated to students via WeChat using posters, QR codes, or links. With the assistance of teachers from the five colleges, the necessary sample data for the research was successfully gathered.

Table 1: Sample Units and Sample Size

College Name	Number of undergraduates	Proportional Sample Size
College of Accounting	2500	104
College of Music and Dance	1100	45
College of Foreign Languages	3000	124
College of Fine Arts and Design	2250	93
College of Management	2000	84
Total	**10850**	**450**

Source: Constructed by author

4. Results and Discussion

4.1 Demographic Information

Table 2 provides a summary of the demographic characteristics of the 450 participants. Male respondents comprise 22.2% of the sample, while female respondents constitute 77.8%. Regarding the grade distribution, the largest group is third-year students, representing 42.7% of the respondents; the next highest group was second-year students, accounting for 30.2%, followed by first-year students at 19.8%, and fourth-year students at 7.3%. In terms of the colleges of the respondents, the College of Foreign Languages is the largest group, comprising 27.5% of the sample; the College of Accounting follows this at 23.1%, the College of Fine Arts and Design at 20.6%, the College of Management at 18.8%, and the College of Music and Dance at 10.0%.

Table 2: Demographic Profile

Entire Research Population (n=450)		Frequency	Percent
Gender	Male	100	22.2%
	Female	350	77.8%
Grade	First Year	89	19.8%
	Second Year	136	30.2%
	Third Year	192	42.7%
	Fourth Year	33	7.3%
College	College of Accounting	104	23.1%
	College of Music and Dance	45	10.0%
	College of Foreign Languages	124	27.5%
	College of Fine Arts and Design	93	20.6%
	College of Management	84	18.8%
Total		**450**	**100%**

4.2 Confirmatory Factor Analysis (CFA)

Confirmatory factor analysis (CFA) was utilized to assess the relationships among items within latent variables and the adequacy of the measurement model.

Convergent and discriminant validity are widely used statistical methods to establish construct validity (Straub, 1989). This study employed factor loading, composite reliability (CR), and average variance extracted (AVE) to measure convergent validity. The results are summarized in Table 4. According to Hair et al. (1998), a factor loading of 0.5 or higher is considered acceptable. In this study, all items had factor loadings above 0.50, ranging from 0.586 to 0.840. For convergent validity, Fornell and Larcker (1981) recommend that composite reliability (CR) should be at least 0.7, and the average variance extracted (AVE) should be at least 0.4. The CR values in this study ranged from 0.808 to 0.842, exceeding the threshold, while the AVE values ranged from 0.479 to 0.640, surpassing the acceptable level. The construct with the highest internal consistency, based on composite reliability, was "intention to use."

Table 3: Confirmatory Factor Analysis Result, Composite Reliability (CR) and Average Variance Extracted (AVE)

Variable	Source of Questionnaire (Measurement Indicator)	No. of Item	Cronbach's Alpha	Factors Loading	CR	AVE
Learning Outcomes (LO)	Chen et al. (2016)	5	0.799	0.686-0.821	0.834	0.504
Cognitive Engagement (CE)	Mitchell and Beach (1976)	5	0.786	0.650-0.754	0.821	0.479
Social Influence (SI)	Kim et al. (2008)	4	0.819	0.641-0.784	0.808	0.514
Perceived Enjoyment (PE)	Davis et al. (1992)	5	0.810	0.608-0.817	0.836	0.507
Satisfaction (S)	Oliver (1980)	4	0.869	0.653-0.772	0.809	0.515
Perceived Usefulness (PU)	Lee (2010)	5	0.810	0.635-0.840	0.834	0.506
Intention to Use (ITU)	Venkatesh and Davis (2000)	3	0.857	0.780-0.833	0.842	0.640

Model fit was evaluated using several goodness-of-fit indices. A chi-square to degrees of freedom ratio of 5 or less is acceptable (Al-Mamary & Shamsuddin, 2015; Awang, 2012). For the goodness-of-fit index (GFI), a value of 0.85 or greater is deemed acceptable. In contrast, for the adjusted goodness-of-fit index (AGFI), a value of 0.80 or above is considered acceptable (Sica & Ghisi, 2007). Wu and Wang (2006) suggest that normed fit index (NFI), comparative fit index (CFI), and Tucker-Lewis index (TLI) values of 0.80 or higher are acceptable. Additionally, a root means square error of approximation (RMSEA) value below 0.08 signifies a good model fit (Pedroso et al., 2016). The measurement model showed the relationship between the latent variables. The model fit was confirmed by the satisfactory values of the goodness-of-fit indices, as detailed in Table 3.

Table 4: Goodness of Fit for Measurement Model

Fit Index	Acceptable Criteria	Statistical Values
CMIN/DF	< 5.00 (Al-Mamary & Shamsuddin, 2015; Awang, 2012)	1.561
GFI	≥ 0.85 (Sica & Ghisi, 2007)	0.915
AGFI	≥ 0.80 (Sica & Ghisi, 2007)	0.898
NFI	≥ 0.80 (Wu & Wang, 2006)	0.901
CFI	≥ 0.80 (Bentler, 1990)	0.962
TLI	≥ 0.80 (Sharma et al., 2005)	0.957
RMSEA	< 0.08 (Pedroso et al., 2016)	0.035
Model Summary		**Acceptable Model Fit**

Remark: CMIN/DF = The ratio of the chi-square value to degree of freedom, GFI = Goodness-of-fit index, AGFI = Adjusted goodness-of-fit index, NFI = Normed fit index, CFI = Comparative fit index, TLI = Tucker-Lewis index, and RMSEA = Root mean square error of approximation

Discriminant validity is confirmed when the square root of the average variance extracted (AVE) for each construct exceeds the correlation coefficients between that construct and others (Fornell & Larcker, 1981). As illustrated in Table 5, the diagonal values, representing the square root of the AVE for each construct, are higher than the correlations between different constructs. This confirms that discriminant validity has been achieved.

Table 5: Discriminant Validity

	LO	CE	SI	PE	S	PU	ITU
LO	**0.710**						
CE	0.573	**0.692**					
SI	0.530	0.569	**0.717**				
PE	0.387	0.329	0.378	**0.712**			
S	0.296	0.330	0.383	0.250	**0.718**		
PU	0.509	0.431	0.486	0.372	0.288	**0.711**	
ITU	0.594	0.589	0.658	0.441	0.439	0.585	**0.800**

Note: The diagonally listed value is the AVE square roots of the variables
Source: Created by the author.

4.3 Structural Equation Model (SEM)

The structural model was evaluated using structural equation modeling to verify its fit and analyze the causal relationships between variables. The structural model before adjustment is shown in Table 6, and model fit was assessed by comparing the statistical values against established acceptable criteria. Similar to the CFA evaluation criteria.

Correlating measurement errors between items within the constructs adjusted the structural model. The adjusted structure model was shown in Table 6 and the goodness-of-fit indices for the revised model were recalculated, as detailed in Table 6. The recalculated statistical values were: CMIN/DF = 2.645, GFI = 0.850, AGFI = 0.823, NFI = 0.830, CFI = 0.886, TLI = 0.874, and RMSEA = 0.061. These results confirm the fitness of the structural model.

Table 6: Goodness of Fit for Structural Model

Fit Index	Acceptable Criteria	Statistical Values
CMIN/DF	< 5.00 (Al-Mamary & Shamsuddin, 2015; Awang, 2012)	2.645
GFI	≥ 0.85 (Sica & Ghisi, 2007)	0.850
AGFI	≥ 0.80 (Sica & Ghisi, 2007)	0.823
NFI	≥ 0.80 (Wu & Wang, 2006)	0.830
CFI	≥ 0.80 (Bentler, 1990)	0.886
TLI	≥ 0.80 (Sharma et al., 2005)	0.874
RMSEA	< 0.08 (Pedroso et al., 2016)	0.061
Model Summary		Acceptable Model Fit

Remark: CMIN/DF = The ratio of the chi-square value to degree of freedom, GFI = Goodness-of-fit index, AGFI = Adjusted goodness-of-fit index, NFI = Normed fit index, CFI = Comparative fit index, TLI = Tucker-Lewis index, and RMSEA = Root mean square error of approximation

4.4 Research Hypothesis Testing Result

The correlation strength between the independent and dependent variables proposed in the hypotheses was assessed using regression or standardized path coefficients. The findings in Table 7 show that all hypotheses were validated with significance at p = 0.05. Perceived usefulness strongly affected the intention to use, followed by satisfaction. Additionally, social influence and perceived enjoyment were significant predictors of perceived usefulness in the flipped classroom model. Cognitive engagement and learning outcomes significantly drove satisfaction with the flipped classroom.

Table 7: Hypothesis Results of the Structural Equation Modeling

Hypothesis	(β)	t-value	Result
H1: LO→S	0.201	3.541*	Supported
H2: CE→S	0.323	5.556*	Supported
H3: SI→PU	0.478	8.208*	Supported
H4: PE→PU	0.225	5.652*	Supported
H5: S→ITU	0.246	5.348*	Supported
H6: PU→ITU	1.243	9.002*	Supported

Note: *** p<0.001, ** p<0.01, * p<0.05
Source: Created by the author

Learning outcomes significantly affect satisfaction, as evidenced by a standardized path coefficient of 0.201 and a t-value of 3.541 in hypothesis H1. This result is consistent with the findings of Chen et al. (2018). Zhang et al. (2006), and Hsieh and Cho (2011). The visual and reusable characteristics of multimedia aids positively correlate with learning outcomes, thereby enhancing satisfaction. The flipped classroom model, including pre-class videos, integrates teacher-student interaction and technical support activities, positively influencing learning outcomes and improving learning satisfaction. Cognitive engagement also significantly affects satisfaction, demonstrated by a standardized path coefficient of 0.323 and a t-value of 5.556 in hypothesis H2. This result aligns with Murillo-Zamorano et al.'s (2019) and Luo et al. (2019) studies. Student engagement at the classroom level directly and significantly affects satisfaction, and cognitive engagement influences students' satisfaction with courses such as electromagnetic interference.

These social factors primarily influence perceived usefulness by assuming that the standardized path coefficient in H3 is 0.478 and the T-value is 8.208. This finding aligns with the studies of Terzis and Economides (2011) and Cheung and Lee (2012). During the initial stages of technology adoption, social influence can greatly affect perceived usefulness, particularly in the evaluation process of computers. Students who may have never used a mobile device before will value the opinions of teachers, parents, or others who influence their behavior regarding the system's usefulness (Cheung & Lee, 2009). Perceived enjoyment significantly affects perceived usefulness, with a standardized path coefficient of 0.225 and a t-value of 5.652 in hypothesis H4. Davis et al. (1992) confirmed that users who derive pleasure from new technologies are more likely to intend to use them.

Satisfaction significantly influences the intention to use, demonstrated by a standardized path coefficient of 0.246 and a t-value of 5.348 in hypothesis H5. Both satisfaction and perceived usefulness were shown to positively affect the intention to use (Fan et al., 2022). Perceived usefulness has the most significant effect on the intention to use, with a standardized path coefficient of 1.243 and a t-value of 9.002 in hypothesis H6. This result corroborates the findings of Vogelsang et al. (2017), Mohamed and Lamia (2018), and Davis (1985). Perceived usefulness has a positive and significant influence on the intention to use blended learning and flipped classrooms, serving as a key motivator for the intent to use flip models.

5. Conclusion and Recommendation

5.1 Conclusion

This study examines the factors influencing students' intention to use flipped classrooms at a private university in Zhanjiang, China. Three theoretical models (TAM, UTAUT, and IS) and four main theoretical frameworks were utilized to establish the conceptual framework. The researchers formulated six hypotheses to address the research question, investigating whether learning outcomes, cognitive engagement, social influence, perceived enjoyment, satisfaction, and perceived usefulness have direct or indirect effects on the intention to use flipped classrooms. Questionnaires were developed and distributed to students with flipped classroom experience, specifically targeting the five secondary colleges of ZUST. Confirmatory factor analysis (CFA) was used to evaluate the validity and reliability of the conceptual model. In contrast, structural equation modeling (SEM) was utilized to examine the factors influencing undergraduates' intention to use flipped classrooms. The data analysis confirmed the validity of the six hypotheses and provided answers to the research questions.

The research results can be summarized as follows. Firstly, cognitive engagement significantly impacts satisfaction more than learning outcomes. If student satisfaction is considered an indicator of educational success for institutions and individuals, then enhancing student motivation and engagement is crucial. The flipped classroom achieves the desired results by providing pre-class videos and related learning diagnostics, leading to positive learning outcomes that enhance student satisfaction with the course. Secondly, social influence significantly affects perceived usefulness, followed by perceived enjoyment. University leaders and educators can increase social influence by boosting students' intention to use flipped classrooms. Students are more likely to find an interactive, clear, and understandable system useful and engaging. Lastly, perceived usefulness is the most significant predictor of the intention to use, outweighing satisfaction. The study's data and supporting literature indicate that perceived usefulness is critical in adopting a flipped classroom. When students recognize the benefits of new approaches and believe that flipped classroom can enhance their performance and skills, they are more likely to adopt this method intensively. These findings should be considered by policymakers, universities, schools, and educators when adopting the flipped classroom model as a new instructional method. The study indicates that new learning methods like flipped classrooms should be effective, engaging, and enjoyable.

5.2 Recommendation

The researcher identified key factors influencing the intention to use (ITU) flipped classrooms (FC) in the five major secondary colleges of ZUST. These factors include learning outcomes (LO), cognitive engagement (CE), social influence (SI), perceived enjoyment (PE), satisfaction (S), and perceived usefulness (PU). It is essential to develop and promote these key factors to enhance the intention to use FC in higher education.

This study identified perceived usefulness as the most significant predictor of the intention to use the FC. Therefore, emphasizing the promotion of the system's usefulness is crucial. This indicates that undergraduates are more likely to use FC if they perceive it as a beneficial tool to enhance their academic performance. For example, incorporating individualized learning styles and tracking services into FC is essential and allows students to select FC options based on different content and levels according to their needs. Regarding learning outcomes, integrating content, pedagogy, and technology through video use in the FC can boost student motivation and enhance learning outcomes (Orús et al., 2016). Students who completed pre-class readings and watched videos typically had a basic understanding of the topic before the lecture. This foundational knowledge increased interest when encountering new material or examples. The results suggest that learning outcomes significantly impact students' course satisfaction.

Regarding social influence, organizing training and communication activities can facilitate sharing of learning experiences and feedback on using FC as a better learning solution. Students can learn from peers who have successfully utilized and benefited from FC. Such practices can enhance social influence and increase students' intention to participate in FC environments. Regarding cognitive engagement, this underscores the crucial role of learner motivation in fostering engagement in instruction, so educational institutions and teachers should prioritize motivational factors to enhance student engagement and satisfaction with FC.

5.3 Limitation and Further Study

The study has several limitations from different perspectives. First, the research period was limited to six months due to work commitments, with most of the work, such as literature review and questionnaire analysis, conducted during the winter and summer vacations. Second, the scope of the research is specific to a private university in Zhanjiang, focusing on undergraduates from five secondary colleges who have had at least one semester of FC experience, thereby limiting the generalizability of the research findings. Third, the research framework has certain limitations due to the complexity and diversity of the field. Some relevant variables, such as perceived ease of use, facilitating conditions, and self-efficacy, were not included in the conceptual framework but may significantly influence the intention to use FC. Additionally, empirical research constraints and contextual limitations impact the applicability of the findings across different scenarios and backgrounds. Future research could address these issues by expanding the sample size, refining measurement methods, and enhancing the conceptual framework to improve research quality and broaden the applicability of the results.

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