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Determinants of Students' Blended Learning Engagement and Satisfaction Toward Students at Public Colleges in Hangzhou, China

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Abstract

Purpose: This study investigates key factors influencing student engagement and satisfaction in blended learning at public colleges in Hangzhou, China. The conceptual framework posits causal relationships between teacher structured approach, student self-efficacy, learning assessment, interpersonal skills, perceived usefulness, student learning engagement, and student satisfaction. **Research design, data, and methodology:** The study employed a quantitative research approach (N=500), distributing questionnaires to first- and second-year students at Zhejiang Business College, Hangzhou, China. Non-probability sampling methods were utilized, including judgmental, quota, and convenience sampling. Statistical analyses comprised descriptive statistics, tests of normality, validity and reliability analyses, and goodness-of-fit indices. Confirmatory Factor Analysis and Structural Equation Modeling addressed the research questions. **Results:** Findings indicate that student satisfaction is significantly influenced by student learning engagement and perceived usefulness, while student learning engagement is significantly influenced by student self-efficacy, learning assessment, and teacher structured approach. **Conclusions:** Validating five of six hypotheses, the study achieved its primary research goals. Recommendations include implementing improvements and interventions in higher education to enhance efficiency, interactivity, and student engagement in blended learning environments, better meeting student needs and expectations, thus promoting academic success and personal development.

Keywords : Learning Engagement, Satisfaction, Blended Learning

JEL Classification Code: E44, F31, F37, G15

1. Introduction

Since the beginning of the 21st century, with the rapid development of information technology and the Internet, higher education has increasingly integrated with information technology (Mitchell & Forer, 2010). The advancement and reform of higher education are moving towards deep integration of curriculum and information technology (Gerbic, 2011). To drive this trend, the Ministry of Education of the People's Republic of China issued the "Ten-Year Development Plan for Education Informatization (2011-2020)" in 2012, followed by the "Thirteenth Five-Year Plan for Education Informatization" in 2016 and the "Education Informatization 2.0 Action Plan" in 2018. These plans emphasize the necessity of "Internet + Education" to leverage the transformative impact of information technology and promote comprehensive innovation in educational concepts, models, and systems.

In this context, applications of educational informatization such as flipped classrooms, Massive Open Online Courses (MOOCs), personalized learning resource delivery, and learning analytics have become research hotspots. With the rapid development of artificial intelligence, big data, and blockchain technology, these innovations will profoundly influence future talent needs and educational forms. "Smart environments change teaching methods and deeply impact educational concepts, culture, and ecosystems" (Ministry of Education of the People's Republic of China, 2018).

Blended learning combines the strengths of traditional education and online learning, achieving a dual teaching model of "online + offline." This model is expected to bring significant advancements in higher education (Zhu & Hu,

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2021). The American Society for Training and Development (ASTD) lists blended learning as one of the ten most important trends in the knowledge dissemination industry. The "Horizon Project Regional Report on Higher Education Technology in China 2017" highlights that blended learning design is a key trend in higher education technology applications and is gradually becoming an important direction for university teaching reform. In 2019, the Ministry of Education issued the "Implementation Opinions on the Construction of First-Class Undergraduate Courses," emphasizing that blended courses should be tailored based on regional, school, and course characteristics, emphasizing innovative course content and teaching methods. In 2022 alone, universities in western China implemented 1.26 million blended learning courses, attracting 210 million student participants and significantly enhancing teaching quality and student learning outcomes (People's Daily, 2023). Wu Yan, former Director of the Higher Education Department of the Ministry of Education (Xinhuanet, 2021), stated, "The new integration of science and technology with education will lead a new educational revolution, with blended learning becoming the new norm in future higher education." This viewpoint underscores the importance of blended learning and foresees its increasingly critical role in future higher education.

With the widespread adoption of blended learning, personalized adaptive learning models have also brought new opportunities to higher education. Driven by advancements in education, cognitive science, learning science, computer science, and artificial intelligence, personalized adaptive learning has gradually become a focal point. This technology analyzes each learner's unique characteristics and contexts to provide a tailored learning environment. Educators can better understand individual learning situations by deeply analyzing learners' online learning behavior data and providing personalized information, materials, feedback, and advice (Spector et al., 2014). This personalized learning approach optimizes learning outcomes and enhances learner engagement and satisfaction (Gao & Zhou, 2012). Applying personalized adaptive learning technology is particularly crucial in the blended learning environment. For example, MOOCs, as widely popular educational resources, offer students the opportunity to independently choose learning paths and courses based on personal characteristics, promoting self-assessment and reflection. Educators can more effectively meet students' individualized learning needs by integrating personalized adaptive learning models into blended learning, improving their engagement and satisfaction. The combination of blended learning and personalized adaptive learning enhances learning effectiveness and provides educators with more precise teaching tools, further driving educational reform and innovation.

However, blended learning faces numerous challenges in practical application, directly impacting its learning effectiveness and quality. From an institutional perspective, deficiencies in policy guidance, educational environment alignment with blended teaching requirements, support systems, and evaluation mechanisms still need to be improved. Policy guidance needs to be clearer, and there is a disconnect between the educational environment and the demands of blended teaching. The support system for teaching has yet to reach an ideal level, and mechanisms for evaluating the effectiveness of blended teaching require further improvement. Many educators have not mastered effective strategies and methods for blended teaching at the teacher level, leading to confusion about how to integrate online and offline teaching effectively. Teachers need to enhance their ability to integrate and balance elements of blended teaching to guide student learning processes and provide targeted interventions. At the student level, challenges such as attitudes toward learning, learning capabilities, learning strategies, and learning environments constrain the optimization of blended learning. For instance, students may lack proactive learning attitudes (Zhang et al., 2017), need to improve their learning abilities (Bralic & Divjak, 2018), lack effective learning strategies (Ellis & Blinco, 2016), and find it difficult to adapt to the integration of online and offline content (Yang & Tong, 2015). Additionally, inadequate learning communication and collaboration among students further affect the effectiveness of learning outcomes (Vanslambrouck et al., 2019).

Therefore, there is an urgent need for in-depth research on factors influencing student satisfaction in blended learning processes, especially from evaluating the effectiveness of course design and organization from students' perspectives. This research perspective involves personalized learning services aimed at ultimately meeting students' personalized learning needs, enhancing their engagement and satisfaction. This study aims to clarify the determinants of student engagement and satisfaction in blended learning among students at public colleges in Hangzhou, China, providing more targeted guidance for educational practice.

2. Literature Review

2.1 Teacher Structured Approach

Teacher-structured approach (TSA) is a teaching strategy that refers to teachers organizing and guiding student learning activities through clear learning objectives and sequential teaching steps to enhance learning effectiveness and student engagement (Rosenshine, 2012).

This method emphasizes the teacher's role as a leader in the classroom, facilitating effective student learning and understanding through structured curriculum design and teaching activities (Brophy, 2006).

Hattie (2009) points out that the structured teaching approach involves logical and orderly lesson planning and course arrangements, guiding students in gradually mastering and applying subject knowledge. Marzano et al. (2001) further elaborate that this method aims to ensure the coherence of course content and the effectiveness of student learning processes.

According to Evertson and Neal's (2006) research, the structured teaching approach creates an organized and supportive learning environment, including clear learning objectives and standardized teaching processes. Good and Brophy (2008) also emphasize teachers' pivotal role in the teaching process.

Gagné et al. (2005) argue that structured teaching methods involve teachers meticulously designing and arranging courses based on subject requirements and student needs to provide a systematic and effective learning experience. Rosenshine and Meister (1992) describe this method as a teaching strategy tailored to the roles of teachers and the needs of students, promoting academic performance and learning motivation through structured approaches. Joyce et al. (2015) summarizes that structured teaching methods significantly enhance learning outcomes and teaching quality through organized and logical teaching processes. Therefore, this study hypothesizes:

H1: Teacher structured approach has a significant influence on student learning engagement.

2.2 Student Self-efficacy

Student Self-efficacy (SSE) refers to a student's belief in their ability to complete specific tasks or achieve desired outcomes. Bandura (1997) proposed the self-efficacy theory, emphasizing that individuals assess their capabilities through observing others' successful experiences, social comparisons, and self-reflection. He highlighted that students' self-efficacy profoundly impacts their academic achievement and motivation.

Zimmerman (2000) explored self-efficacy from the perspective of social cognitive theory, discussing how self-regulation enhances students' academic performance, especially when facing academic challenges and difficulties. Taking a broader perspective, Luszczynska et al. (2005) defined students' self-efficacy as their confidence in effectively handling various life challenges. Similarly, Caprara et al. (2008) suggested that students' self-efficacy manifests in their confidence in self-regulated learning, perseverance, and academic success.

Multon et al. (1991) confirmed a positive correlation between self-efficacy and academic performance, underscoring the importance of educators considering students' self-efficacy when designing educational policies and implementing teaching methods. Schunk and Pajares (2005) noted that students with high self-efficacy are more likely to adopt proactive learning strategies and demonstrate greater resilience and adaptive abilities when confronted with challenges. Pajares (2002) further investigated the impact of gender differences on students' self-efficacy, finding significant disparities between male and female students in self-efficacy beliefs, which may affect their academic performance and choice of learning strategies. Pintrich and De Groot (1990) emphasized the critical role of considering students' self-efficacy in enhancing academic performance in instructional design. Self-efficacy beliefs influence individuals' career choices and academic achievements (Lent et al., 1994). Therefore, this study hypothesizes:

H2: Student self-efficacy has a significant influence on student learning engagement.

2.3 Learning Assessment

Learning assessment is a method of evaluating students' learning processes to provide key information for instructional decisions and improve learning outcomes (Angelo & Cross, 1993). This assessment includes formative assessment, which involves ongoing activities during teaching to enhance instructional strategies, and summative assessment, which occurs at the end of a learning phase to evaluate the achievement of learning objectives (Black & Wiliam, 1998).

Learning assessment encompasses various methods such as tests, projects, observations, and feedback mechanisms, collectively providing educators comprehensive insights into student progress (Harlen, 2007). According to Brown and Harris (2014), self-assessment also plays a crucial role in enhancing students' self-awareness and learning capabilities.

The significance of learning assessment extends beyond measuring students' knowledge mastery. Stiggins (2002) argues that assessment results provide critical data supporting teachers adjusting their instructional strategies to enhance teaching quality. Popham (2008) further emphasizes the necessity of various assessment tools, including standardized tests, performance assessments, and portfolios, to comprehensively evaluate student learning outcomes.

Moreover, Wiliam (2011) points out that the ultimate goal of learning assessment is to provide constructive feedback to students, fostering continuous improvement. This approach to assessment not only quantifies learning outcomes but also contributes positively to students'

developmental processes. Therefore, this study hypothesizes:
H3: Learning assessment has a significant influence on student learning engagement.

2.4 Interpersonal Skills

Interpersonal skills are a broad ability to facilitate effective communication, interaction, and relationship-building in personal and professional environments (Parks & Guay, 2009). These skills are crucial for understanding social dynamics, embracing others' perspectives, and fostering collaborative environments (Masterson & Stamarski, 2020).

In individual development, effective interpersonal skills encompass verbal and non-verbal communication, active listening, empathy, and conflict resolution abilities (Schneider et al., 2012). These capabilities enable individuals to articulate viewpoints clearly, establish trust, and handle interpersonal conflicts constructively (Goleman, 2006).

Interpersonal skills are essential for leadership effectiveness and team cohesion in the workplace. Leaders with strong interpersonal skills can better motivate teams, resolve conflicts, and create inclusive work environments (Riggio & Reichard, 2008).

Fry et al. (2009) state that interpersonal skills significantly impact job performance, satisfaction, and organizational effectiveness. These skills are critical for enhancing students' motivation, increasing their engagement in learning, and promoting academic success. Additionally, Furlong et al. (2011) underscores the importance of interpersonal skills in conflict resolution, providing constructive feedback, demonstrating empathy, and offering support to strengthen positive interpersonal relationships further. Therefore, this study hypothesizes:
H4: Interpersonal skills have a significant influence on student learning engagement.

2.5 Student Learning Engagement

Fredricks et al. (2004) define student learning engagement as the extent of students' psychological investment and commitment to learning, encompassing three dimensions: behavioral, emotional, and cognitive. Behavioral engagement involves students' active participation in learning activities; emotional engagement refers to students' affective reactions to learning experiences; and cognitive engagement pertains to the effort and strategies students employ in academic tasks. Appleton et al. (2006) found that high learning engagement manifests in positive learning attitudes, active participation in class activities, interactions with teachers and peers, and the demonstration of autonomous learning abilities.

Many factors influence student engagement. Appleton et al. (2008) identified school climate, teacher-student relationships, and instructional practices as key determinants of engagement. Lam et al. (2014) emphasized the role of cultural and contextual factors in shaping engagement across different educational settings.

Methods for measuring student engagement include self-report surveys, observational methods, and behavioral assessments (Lam et al., 2014). Valid and reliable assessment tools are crucial for accurately capturing the complexity of engagement and its impact on learning outcomes.

Effective instructional strategies that promote active learning, collaborative tasks, and personalized feedback can enhance student engagement (Reschly & Christenson, 2012). Fostering a positive school environment that values students' voices and choices significantly increases student engagement (Finn & Zimmer, 2012). Therefore, this study hypothesizes:
H5: Student learning engagement has a significant influence on student satisfaction.

2.6. Perceived Usefulness

Perceived usefulness is a core concept within the Technology Acceptance Model (TAM), used to measure the extent to which users believe using a particular technology will enhance their job performance (Davis, 1989). Chiu and Wang (2008) further elucidate this concept, stating that perceived usefulness reflects learners' beliefs about the effectiveness of educational technology in promoting learning and improving academic performance.

According to the research by Gefen and Straub (2000), perceived usefulness is widely applied in information systems as a critical factor in predicting user acceptance and usage of new technologies. Venkatesh and Davis (2000) further note that perceived usefulness influences initial usage intentions and significantly impacts continued usage behavior.

Several factors influence perceived usefulness. Igbaria et al. (1995) found that external variables such as system characteristics, user training, and technical support significantly affect users' perceived usefulness. Additionally, Venkatesh and Bala (2008) proposed that perceived ease of use and enjoyment indirectly impact perceived usefulness.

In educational technology, perceived usefulness is a vital factor influencing students' adoption of online learning tools and platforms. Lee et al. (2005) discovered that students' perceived usefulness of online learning platforms significantly affects their learning satisfaction and outcomes. The study by Sánchez and Hueros (2010) further supports this view, indicating that perceived usefulness is a

key determinant of students' acceptance of online learning. Therefore, this study hypothesizes:

H6: Perceived usefulness has a significant influence on student satisfaction.

2.7 Student Satisfaction

Student satisfaction is a key indicator for measuring the perceived quality of students' educational experiences (Elliott & Healy, 2001). It encompasses a wide range of factors, from teaching quality to campus facilities, representing students' overall satisfaction with their educational experiences. It reflects not only students' satisfaction with course content, teaching methods, and the learning environment but also their evaluations of school management, service facilities, and overall educational experience (Oliver, 1997).

Astin (1993) noted that student satisfaction encompasses academic, social, and personal growth satisfaction. Wilson (2008) further divided student satisfaction into course satisfaction, teacher satisfaction, support service satisfaction, and campus environment satisfaction.

Various factors influence student satisfaction. Terenzini and Pascarella (1980) found that the quality of teaching, the relevance of course content, and the availability of learning resources significantly impact student satisfaction. Kotler and Fox (1995) stated that the school's reputation, students' social interactions, and the quality of management services also significantly affect student satisfaction.

Student satisfaction measures include surveys, focus group interviews, and case studies (Elliott & Shin, 2002). Typically, scales are used to assess students' satisfaction with different dimensions, and data analysis is employed to identify the key factors influencing student satisfaction (Douglas et al., 2008).

According to Harvey (2003), improving student satisfaction can enhance students' academic performance and boost the school's competitiveness and reputation. Carey (1991) suggests that schools should regularly assess student satisfaction to improve teaching methods and service facilities, thereby enhancing the overall quality of education.

3. Research Methods and Materials

3.1 Research Framework

The conceptual framework is developed based on existing research frameworks and incorporates three theoretical models. Firstly, Maini et al. (2021) investigated students' perceptions of using virtual meeting applications for online classes, exploring how the preparedness of teachers and students during the COVID-19 lockdown affected student engagement and satisfaction in synchronous online classes. The study found that six factors significantly influenced student engagement and satisfaction in synchronous online courses: teachers' structured teaching approach, technical preparedness, teachers' self-efficacy, students' technical preparedness, autonomy, and self-efficacy. Secondly, Song et al. (2022) examined the experiences of business students in Malaysian private higher education institutions using a case-based learning approach, analyzing the impact of these experiences on student engagement and academic performance. The study revealed that learning assessments, analytical skills, interpersonal skills, and interdisciplinary learning significantly influenced student engagement, and there was a positive correlation between student engagement and academic performance. Lastly, Cheng (2022) analyzed data from 363 students at a comprehensive university in Taiwan, uncovering quality factors that affect engagement, satisfaction, and continued usage intentions in massive open online courses (MOOCs). The study showed that students' perceptions of knowledge quality, system quality, interface design quality, learner-instructor interaction quality, and collaboration quality positively influenced their perceived usefulness, confirmation, and engagement in MOOCs. These factors collectively explained student satisfaction and ultimately impacted their continued usage intentions. The conceptual framework of this study is illustrated in Figure 1.

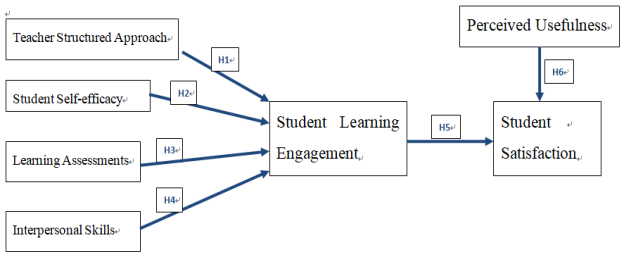

Figure 1: Conceptual Framework

H1: Teacher structured approach has a significant influence on student learning engagement.

H2: Student self-efficacy has a significant influence on student learning engagement.

H3: Learning assessment has a significant influence on student learning engagement.

H4: Interpersonal skills have a significant influence on student learning engagement.

H5: Student learning engagement has a significant influence on student learning engagement.

H6: Perceived usefulness has a significant influence on student learning engagement.

3.2 Research Methodology

To achieve the research objectives, the researcher employed a rigorous quantitative research method and selected a sample of 500 first- and second-year students from Zhejiang Business College in Hangzhou, China. These students had experienced at least one semester of blended learning at the college and completed the survey through an online platform (Wenjuanxing). Non-probability sampling methods were used for sample selection, including judgment, quota, and convenience sampling. The questionnaire design included screening questions, individual demographic information, and a 5-point Likert scale.

Before data collection, the researcher validated the questionnaire using the Item-Objective Congruence (IOC) index and conducted a Cronbach's alpha reliability test with 50 pilot participants. After data collection, the researcher analyzed the data using SPSS and AMOS software, employing descriptive statistics, normality tests, validity analysis, reliability analysis, and goodness-of-fit indices to ensure data reliability. Finally, the researcher used Confirmatory Factor Analysis (CFA) and Structural Equation Modeling (SEM) techniques to address the research questions.

3.3 Population and Sample Size

The target population refers to individuals with common characteristics in a specific research environment (Banerjee & Chaudhury, 2010). This study's target population comprises first- and second-year students majoring in Electronic and Information Engineering, Tourism Management, Accounting, and E-Commerce at Zhejiang Business College who have experienced at least one semester of blended learning. Based on an expected effect size of 0.2, statistical power set at 0.8, and considering seven latent and 28 observed variables, the significance level is set at 0.05. Calculations using the Danielsoper online tool suggest a minimum sample size of 425 for this study. Combining insights from similar past research and the team's experience, a sample size 500 was optimal.

3.4 Sampling Technique

In this study, the researcher selected several non-probability sampling methods based on the research objectives, population attributes, and resource limitations. First, judgment sampling was used to select first- and second-year students who had blended learning experiences from four major subjects at ZJBC as a sample. Next, quota sampling was used to determine the proportion of each subject in the total sample of 500 students. The specific sampling details are detailed in Table 1, clearly showing the number of students selected from each subject. Finally, the researcher sent the questionnaire online through convenience sampling to more effectively reach the target respondents willing to participate.

Table 1: Sample Units and Sample Size

Four main subjects	Student population	Proportional Sample size
Electronic and Information Engineering students	287	86
Tourism Management students	392	117
Accounting students	464	138
E-Commerce students	533	159
Total	**1676**	**500**

Source: Constructed by author

4. Results and Discussion

4.1 Demographic Information

The researcher distributed 500 questionnaires and collected demographic information from the respondents, including gender and grade, as shown in Table 2. Regarding gender distribution, there were 161 female respondents, accounting for 32.2% of the total, and 339 male respondents, accounting for 67.8%. Regarding grade distribution, there were 119 first-year students, 23.8% of the total, and 381 second-year students, 76.2% of the total.

Table 2: Demographic Profile

Demographic Information(n=500)		Frequency	Percentage
Gender	Male	339	67.8%
	Female	161	32.2%
Grade	freshmen	119	23.8%
	Sophomore	381	76.2%

4.2 Confirmatory Factor Analysis (CFA)

This study conducted a confirmatory factor analysis (CFA), as shown in Figure 2 and Table 3. The results showed that the Cronbach's alpha values for all constructs exceeded 0.8 (Hair et al., 2003), indicating good internal consistency of the items. The factor loadings of individual items were all above 0.60 (Hair et al., 1998), with most items having factor loadings over 0.70, ranging from 0.674 to 0.854, demonstrating the high reliability of the items. The composite reliability (CR) values for all items were above the threshold of 0.7 (Fornell & Larcker, 1981), ranging from

0.773 to 0.851. The average variance extracted (AVE) values were also above the threshold of 0.4 (Fornell & Larcker, 1981), ranging from 0.463 to 0.590 (see Table 3). Therefore, the measurement model has good reliability and convergent validity, indicating that all items within each variable are significant.

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

Variables	Source of Questionnaire (Measurement Indicator)	No. of Item	Cronbach's Alpha	Factors Loading	CR	AVE
Teacher Structured Approach (TSA)	Maini et al. (2021)	4	0.842	0.719-0.825	0.843	0.575
Student Self-Efficacy (SSE)	Rodriguez (2004)	4	0.835	0.718-0.772	0.836	0.561
Learning Assessments (LA)	Baker (2012)	4	0.820	0.674-0.808	0.824	0.541
Interpersonal Skills (IS)	Tarver (2023)	4	0.840	0.712-0.844	0.843	0.574
Student Learning Engagement (SLE)	Finn and Zimmer (2012)	4	0.836	0.718-0.784	0.837	0.563
Perceived Usefulness (PU)	Davis (1989)	4	0.849	0.719-0.854	0.773	0.463
Student Satisfaction (SS)	Kanwar and Sanjeeva (2022)	4	0.853	0.752-0.809	0.851	0.590

This study used confirmatory factor analysis (CFA) to evaluate the fit of the measurement model. It used a series of goodness-of-fit indices to evaluate the fit between the model and the observed data. These indices include chi-square statistic (CMIN/df), goodness-of-fit index (GFI), adjusted goodness-of-fit index (AGFI), normed fit index (NFI), comparative fit index (CFI), Tucker-Lewis index (TLI), and root mean square error of approximation (RMSEA). The results showed that the values of all indices were within an acceptable range (see Table 5 for details), which further proved the validity and adaptability of the model and provided a solid foundation for subsequent analysis.

Table 4: Goodness of Fit for Measurement Model

Fit Index	Acceptable Criteria	Statistical Values
CMIN/DF	< 5.00 (Al-Mamary & Shamsuddin, 2015; Awang, 2012)	758.863/329 or 2.307
GFI	≥ 0.85 (Sica & Ghisi, 2007)	0.911
AGFI	≥ 0.80 (Sica & Ghisi, 2007)	0.890
NFI	≥ 0.80 (Wu & Wang, 2006)	0.887
CFI	≥ 0.80 (Bentler, 1990)	0.932
TLI	≥ 0.80 (Sharma et al., 2005)	0.922
RMSEA	< 0.08 (Pedroso et al., 2016)	0.051
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 = normalized fit index, CFI = comparative fit index, TLI = Tucker Lewis index, and RMSEA = root mean square error of approximation

If the square root of the AVE of a construct is greater than the correlation coefficient between the construct and other constructs, it indicates discriminant validity (Hair et al., 2014). As shown in Table 4, The square root of the AVE of all constructs in this study (on the diagonal) is greater than the correlation coefficient between the constructs. Therefore, it can be confirmed that discriminant validity has been confirmed.

Table 5: Discriminant Validity

Variable	TSA	SSE	LA	IS	SLE	PU	SS
TSA	**0.758**						
SSE	0.223	**0.749**					
LA	0.156	0.238	**0.736**				
IS	0.181	0.215	0.168	**0.758**			
SLE	0.258	0.386	0.351	0.184	**0.750**		
PU	0.219	0.216	0.212	0.209	0.258	**0.680**	
SS	0.308	0.424	0.284	0.353	0.445	0.373	**0.768**

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

4.3 Structural Equation Model (SEM)

Structural equation modeling (SEM) shows the paths and relationships between latent variables, which can be direct or indirect (Byrne, 2010). Figure 3 shows the structural model of this study. Through this tool, we can gain a deeper understanding of the complex interactions between variables, which will help advance the development of the research field. This study also used a series of goodness-of-fit indicators to evaluate the goodness of fit of the structural equation model (SEM). The results are shown in Table 6: CMIN/DF = 2.863, GFI = 0.879, AGFI = 0.857, NFI = 0.853, CFI = 0.899, TLI = 0.889, RMSEA = 0.061. These indicator values all meet the threshold requirements; that is, they have reached an acceptable level, thus confirming the applicability 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)	984.775/344 or 2.863
GFI	≥ 0.85 (Sica & Ghisi, 2007)	0.879
AGFI	≥ 0.80 (Sica & Ghisi, 2007)	0.857
NFI	≥ 0.80 (Wu & Wang, 2006)	0.853
CFI	≥ 0.80 (Bentler, 1990)	0.899
TLI	≥ 0.80 (Sharma et al., 2005)	0.889
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 = normalized fit index, CFI = comparative fit index, TLI = Tucker Lewis index, and RMSEA = root mean square error of approximation

4.4 Research Hypothesis Testing Result

In structural equation modeling, standardized path coefficients, or regression coefficients, can be used to evaluate the relationships between variables, including independent and dependent variables.

Table 7: Hypothesis Results of the Structural Equation Modeling

Hypothesis	(β)	t-value	Result
H1: TSA→SLE	0.193	3.940*	Supported
H2: SE→SLE	0.385	7.208*	Supported
H3: LA→SLE	0.309	5.863*	Supported
H4: IS→SLE	0.086	1.799	Not Supported
H5: SLE→SS	0.478	8.598 *	Supported
H6: PU→SS	0.300	6.072*	Supported

Note: * $p<0.05$
Source: Created by the author

The results in Table 7 indicate that five of the six hypotheses were supported. Student satisfaction is strongly influenced by student learning engagement (β=0.478), followed by perceived usefulness (β=0.300). Student learning engagement is significantly affected by student self-efficacy (β=0.385), learning assessment (β=0.309), and teacher-structured approach (β=0.193), in that order.

The results in Table 7 can be detailed as follows:

H1 demonstrates that the teacher-structured approach is a key factor influencing student learning engagement, with a standardized path coefficient of 0.193 and a t-value of 3.940. Goodwin (2018) and Greene and Azevedo (2007) also confirm that teachers can effectively enhance student learning engagement through clear teaching goals and plans, organized classroom guidance, positive feedback, encouragement, and learning support.

In H2, the analysis results show that student self-efficacy has the strongest positive impact on learning engagement, with a standardized path coefficient of 0.385 and a t-value of 7.208. The studies by Zimmerman and Cleary (2009) and Pajares (2003) indicate that students with high self-efficacy often exhibit confidence in their learning abilities, a positive attitude towards learning, and characteristics such as initiative and persistence. These factors collectively encourage students to participate more actively in learning activities.

In H3, learning assessment significantly affects student learning engagement, with a standardized path coefficient of 0.309 and a t-value of 5.863. The research by Black and Wiliam (1998) and Alshumaimeri (2019) finds that effective learning assessment, including timely feedback, clear learning goals, encouragement of independent learning, and promotion of reflection, is a key factor in motivating students to engage more actively in learning.

The results of H4 show that interpersonal skills do not significantly impact student learning engagement, with a standardized path coefficient of 0.086 and a t-value of 1.799. Therefore, this hypothesis was not supported. While this result contradicts the studies by Zhang et al. (2004) and Hew and Cheung (2014), it is consistent with the findings of Martin and Bolliger (2018). This may be because online learning relies on educational technology tools, reducing the impact of interpersonal skills. Additionally, online learning encourages students to manage their learning autonomously, relying more on personal learning skills and autonomy than interacting with others. This result indicates the complexity of the impact of interpersonal skills in blended learning environments, suggesting that their impact may vary depending on the context.

H5's research shows that student learning engagement significantly impacts learning satisfaction, with a standardized path coefficient of 0.478 and a t-value of 8.598. The studies by Astin (1993) and Carini et al. (2006) also support this finding, suggesting that when students are more actively engaged in learning activities and exhibit greater interest in learning, they tend to experience higher satisfaction.

H6's results indicate that perceived usefulness is one of the significant factors affecting learning satisfaction, with a standardized path coefficient of 0.300 and a t-value of 6.072. According to the research by Al-Fraihat et al. (2020) and Chen and Tseng (2012), when students perceive those educational tools, resources, or technologies benefit their learning, they are generally more inclined to feel satisfied with the educational environment.

5. Conclusion and Recommendation

5.1 Conclusion

This paper focuses on the key factors that affect student engagement and satisfaction in blended learning in public colleges in Hangzhou, China. The researcher constructed a conceptual framework covering seven key variables and six hypotheses to study how teacher-structured approach (TSA), student self-efficacy (SSE), learning assessment (LA), interpersonal skills (IS), and perceived usefulness (PU) affect student learning engagement (SLE) and learning satisfaction (SS). The questionnaire survey was completed by 500 students from Zhejiang Business College in Hangzhou, China. The target sample was first- and second-year students who had experienced at least one semester of blended learning in four major subjects of the college.

Confirmatory factor analysis (CFA) was conducted to measure and verify the validity and reliability of the conceptual model, and the influencing factors affecting student learning engagement and satisfaction in blended learning were analyzed by applying structural equation modeling (SEM).

The following are the main findings of the study:

First, student self-efficacy has the strongest positive impact on their learning engagement. Students confident in their learning ability are more likely to participate actively in academic activities, consistent with the research results of scholars such as Zimmerman and Cleary (2009) and Pajares (2003). Secondly, learning assessment ranks second among the factors affecting learning engagement. The study supports the views of scholars such as Black and Wiliam (1998) and Alshumaimeri (2019) that accurate assessment can effectively improve students' learning motivation and engagement. Third, the teacher-structured approach also significantly affects student learning engagement. The results show that teachers can significantly improve students' engagement by setting clear teaching goals, maintaining good classroom organization, and using effective guidance strategies (Goodwin, 2018; Greene & Azevedo, 2007). However, this study failed to confirm the significant impact of interpersonal skills on student learning engagement, which is different from some previous research results (Zhang et al., 2004) but consistent with the analysis of Martin and Bolliger (2018). This may be because students rely more on personal learning skills and autonomy in a blended learning environment than interaction with others.

The study found that learning engagement significantly impacts student satisfaction. The findings of Astin (1993) and Carini et al. (2006) also support the finding that students who actively participate in learning activities are generally more satisfied with their learning experience. In addition, students' perception of the usefulness of educational tools and resources was identified as an important factor affecting learning satisfaction. This is consistent with studies such as Al-Fraihat et al. (2020) and Chen and Tseng (2012).

In summary, this study revealed that a structured approach, student self-efficacy, and effective learning assessment are key factors in improving student learning engagement in a blended learning environment. At the same time, student learning engagement and the perceived usefulness of educational resources significantly affect their learning satisfaction. These findings provide important guidance for designing and optimizing blended learning environments.

5.2 Recommendation

This study proposes the following key recommendations to assist government policymakers and university administrators in effectively enhancing student engagement and satisfaction in a blended learning environment. First, it is essential to place a high emphasis on and enhance students' self-efficacy. By encouraging and supporting students' participation in academic activities and establishing achievement recognition and reward systems, students' confidence in their learning abilities can be significantly boosted, motivating them to engage more actively in blended learning. Second, optimizing the learning assessment mechanism is crucial. Implementing diverse assessment methods, including self-assessment, peer assessment, and teacher assessment, along with providing timely feedback regularly, can help students adjust their learning strategies and enhance their motivation. Third, teachers should adopt a structured teaching approach in classroom instruction. Setting clear instructional goals, ensuring good classroom organization, and implementing effective personalized guidance strategies can improve teaching effectiveness and student engagement.

Additionally, there should be a focus on enhancing students' perception of the usefulness of educational tools and resources. Designing engaging and interactive learning platforms, such as virtual laboratories, online discussions, and rich multimedia resources, can make learning more dynamic and interactive, stimulating students' interest and enthusiasm. Lastly, government policymakers and university administrators should formulate supportive policies for blended learning. Optimizing the allocation of educational resources to support teachers' professional development and technical training, establishing dedicated blended learning development centers or online platforms, and providing mechanisms for resource sharing and best practice exchange are essential. These measures will help create a conducive learning environment that supports students, further enhancing their engagement and satisfaction in a blended learning context.

5.3 Limitation and Further Study

Despite making progress in exploring factors influencing student engagement and satisfaction in blended learning among students from public colleges in Hangzhou, China, this study acknowledges several inherent limitations. Firstly, the research was confined to first and second-year students at a specific college in Hangzhou, limiting its applicability to broader educational contexts and different types of schools across various regions. Secondly, the sampling methods employed, such as judgmental and convenience sampling, may have introduced biases, potentially impacting the representativeness and reliability of the findings. Additionally, the reliance on self-reported data from students introduces the possibility of subjective recall and social desirability biases, affecting the accuracy and authenticity of

the data; despite including multiple key variables in the research framework, other potential variables influencing the study outcomes must be fully accounted for. Future research directions could expand the geographical and grade-level scope of the sample, encompassing diverse regions and student cohorts, to enhance the external validity and generalizability of the findings. Moreover, employing diverse sampling methods like stratified random sampling could minimize sampling biases, ensuring the sample's representativeness and the reliability of the study outcomes. Furthermore, integrating quantitative and qualitative research methods could deepen understanding of the factors influencing student engagement and satisfaction in blended learning environments, thereby facilitating a more comprehensive evaluation of educational strategies' effectiveness.

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