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A Mathematics Blended Learning Model to Understand the Learning Satisfaction Context of Higher Education Institutions in Guangxi Province

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Abstract

Blended learning combines the advantages of online and offline teaching, which is a notable educational trend. This study aims to discuss the influencing factors of blended learning satisfaction and, based on customer satisfaction theory, competency theory and flow theory, constructs a model for blended learning satisfaction. We conducted a purposive sampling survey of 528 undergraduate students majoring in mathematics from 16 higher education institutions in Guangxi province, China. Furthermore, data were processed using tests of reliability and validity, confirmatory factor analysis, correlation analysis, and structural equation modeling. Empirical results indicate that in blended learning, teaching competence, student expectations, perceived quality, perceived value, and flow experience all have a significantly positive impact on learning satisfaction. Teaching competence, student expectations, and perceived quality also have a significantly positive impact on perceived value, while perceived quality has a significantly positive impact on flow experience. Moreover, perceived value plays a mediating role in the relationship between teaching competence, student expectations, perceived quality, and learning satisfaction. Flow experience serves as a mediator in the relationship between perceived quality and learning satisfaction. This research is beneficial for enhancing the quality of blended courses and improving the satisfaction of university students with blended learning.

Keywords: *Blended learning; Learning satisfaction; Structural equation model*

1. Introduction

With the rise of online education, there has been a significant transformation in educational teaching methods (Stahl, 2021). Blended learning, as a novel approach, method, and model, embodies the teaching philosophy that places students at the center, effectively achieving the high-quality integration and utilization of educational resources (Finlay et al., 2022). The American Society for Training and Development (ASTD) designates blended learning as one of the ten most crucial emerging trends in the knowledge dissemination industry (Zhan & Li, 2009). According to a survey by the Universities and Colleges Information System Association (U-CISA) in the United Kingdom, blended learning has the highest adoption rate in British universities (50%), followed by assisted E-learning (48%)(Browne et al., 2008). Similarly, the "2017 New Media Alliance China Higher Education Technology Outlook: Horizon Project Regional Report"

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in China also indicates that "the application of blended learning design is one of the key trends in the application of higher education technology" (Gao & Huang, 2017). It is evident that blended learning has been widely accepted by learners and applied in higher education teaching (Anthony et al., 2019; Antwi-Boampong & Bokolo, 2021) and is expected to become the mainstream teaching model in future universities (Du et al., 2022; Yoshida et al., 2022).

Satisfaction with learning serves as an assessment and service target for learners, quantifying various types and levels of learning evaluations to obtain a comprehensive indicator. Therefore, measuring the satisfaction of university students in blended learning holds significant importance for enhancing learning quality. Learning satisfaction reflects students' contentment with instructional content, methods, and instructors. Elevated student satisfaction implies that students perceive value in acquiring knowledge and skills through blended learning, thereby affirming the effectiveness of teaching (Chen & Yao, 2016). Learning satisfaction facilitates optimization of teaching methods and resources. Low satisfaction may indicate areas for improvement, prompting institutions to enhance teaching methods and resources to elevate instructional quality (Agyeiwaah et al., 2022). Increased learning satisfaction contributes to heightened student engagement and involvement. Typically, high satisfaction correlates with students' active participation and commitment. The enhancement of learning satisfaction indicates a greater willingness among students to engage in class discussions, interactions, and independent learning, thereby reinforcing instructional effectiveness (Bacci et al., 2023). Learning satisfaction propels the professional development of educators. Data on learning satisfaction provide teachers with feedback regarding their instructional methods and content. Student satisfaction directly impacts the reputation and competitiveness of educational institutions (Punyanunt-Carter et al., 2017).

Currently, blended learning has emerged as a significant trend in the field of mathematics education (Yoshida et al., 2022). Blended learning provides mathematics majors with expanded learning channels, enabling them to access learning resources anytime and anywhere. Furthermore, blended learning stimulates students' intrinsic motivation for active learning and offers additional learning resources and tools, such as online mathematical software, simulation tools, and multimedia materials. However, currently, the application of blended learning in universities is more prevalent in liberal arts disciplines and less prominent in scientific disciplines. Current research on blended learning in the field of mathematics education primarily focuses on two aspects. Firstly, there is research on mathematics instruction in primary and secondary schools(Alammary, 2019; Balentyne & Varga, 2017; Mukuka et al., 2021). Secondly, some scholars have applied blended teaching specifically to certain mathematics courses (Stahl, 2021). To date, there is a lack of research on the satisfaction of mathematics majors in blended learning. Therefore, this study concentrates on the satisfaction of mathematics majors in blended learning, aiming to provide valuable insights for teaching reforms in mathematics programs across various universities.

2. Literature Review

2.1 Theoretical Approach

2.1.1 Learning Satisfaction

Punyanunt-Carter et al. (2017) define college learning satisfaction as the emotional state in

which students feel content, appreciative, or proud of their attending institution. Bryant and Veroff (2017) posit that learning satisfaction occurs when students experience contentment with their university experiences, either through the realization of anticipated expectations or surpassing idealized states beyond their imagination. Bi and Hong (2021) suggest that learning satisfaction primarily encompasses satisfaction with platform presentation, course resources, teacher cultural competence, and instructional planning. In this study, learning satisfaction is defined as the degree of satisfaction with the blended learning mode and its learning outcomes, following participation in blended learning. Current research on learning satisfaction predominantly focuses on online learning and blended learning contexts(Gao et al., 2020). Particularly during the pandemic, numerous scholars have conducted more in-depth investigations into the satisfaction levels associated with online and blended learning across various countries.(Agyeiwaah et al., 2022; Al-Nasa'h et al., 2021)。

2.1.2 Teaching Competence

Teaching competence refers to the knowledge, skills, and traits that teachers possess to achieve effective instruction. Powell et al. (2020) suggest that teachers in blended teaching environments should possess capabilities across four dimensions: mindset, quality attributes, adaptability skills, and technical skills. Cao (2021) argues that teaching competence includes six aspects: personal traits and motivation, information technology skills, professional competence, instructional abilities, interactive skills, and teaching organization management skills. Feng et al. (2021) propose that teaching competence comprises teaching philosophy, collaboration skills, self-development abilities, and specialized skills for conducting blended teaching. In this study, teaching competence is defined as the individual latent capabilities directly associated with teacher performance in the process of implementing blended teaching.

2.1.3 Student Expectations

Student expectations are a variable introduced specifically for the context of blended learning, drawing inspiration from the "customer expectations" variable in the American Customer Satisfaction Index (A-CSI) model. Zhang and Lin (2014) define student expectations as students' comprehensive expectations of the school's distinctive features and teachers' abilities and virtues, formed based on their actual experiences in the school environment, learning, and life. Jiang (2018) views student expectations as the anticipated outlook students have before engaging in blended learning, encompassing expectations related to learning quality, learning platforms, learning resources, and instructional design. In this study, student expectations are defined as students' expectations regarding teacher course design before participating in blended learning for a specific course. Research on student expectations primarily focuses on expectations related to courses and instruction(Jiang, 2018; Zhang & Lin, 2014), expectations regarding learning outcomes(Yin & Hu, 2023), and expectations for online learning and blended learning(Cicha et al., 2021).

2.1.4 Perceived Quality

The perception of teaching quality by blended learners is a crucial factor influencing their overall teaching experience. Jiang (2018) defines perceived quality as the quality of various factors during the blended teaching process. Mariam et al. (2023) suggest that perceived quality pertains to students' perception of the quality of online teaching. In this study, perceived quality is defined as students' experiences and perceptions of the teaching quality during the blended learning process. Currently, scholars have shown a notable interest in the relationship between

perceived quality, perceived value, and satisfaction (Jiang, 2018; Yu & Zhao, 2018). Additionally, there is a connection between perceived quality and the flow experience (Mariam et al., 2023).

2.1.5 Perceived Value

Perceived value primarily refers to an individual's experiential feelings regarding the value of an object. Bi and Hong (2021) suggest that perceived value involves students' feelings after comparing the costs and benefits of traditional classroom learning and online learning. In this study, perceived value is defined as the subjective evaluation students make of a blended course based on their learning gains after participating in blended teaching. Research indicates that perceived quality in online courses positively influences perceived value(Yin & Hu, 2023), and perceived value in flipped classrooms acts as a mediator between perceived quality and student satisfaction (Zhai, 2016).

2.1.6 Flow Experience

The concept of Flow Experience was originally introduced by the renowned psychologist Csikszentmihalyi (Csikszentmihalyi, 1975). Csikszentmihalyi defines flow as the holistic perception that individuals experience when fully engaged in an activity, characterized by complete immersion, focused attention, and the filtering out of irrelevant thoughts and perceptions. Peifer and Engeser (2021) posit that the flow experience is fundamentally an individual's intrinsic experience, a state of complete immersion in an activity accompanied by a disappearance of self-awareness and a deep sense of control. In this study, flow experience is defined as a sense of concentration, control, and enjoyment that learners experience during blended learning. Research indicates that time distortion and focused attention in online learning environments are direct factors contributing to the emergence of flow experience. Furthermore, the enhancement of flow experience promotes the generation of positive learning behaviors, ultimately enhancing learning outcomes (Esteban-Millat et al., 2014).

2.2 Research Framework and Hypotheses

Based on the aforementioned literature review, the research model for this study is illustrated in Figure 2. The variables in the model consist of independent variables (teaching competence, student expectations, perceived quality), a dependent variable (learning satisfaction), and mediating variables (perceived value, flow experience).

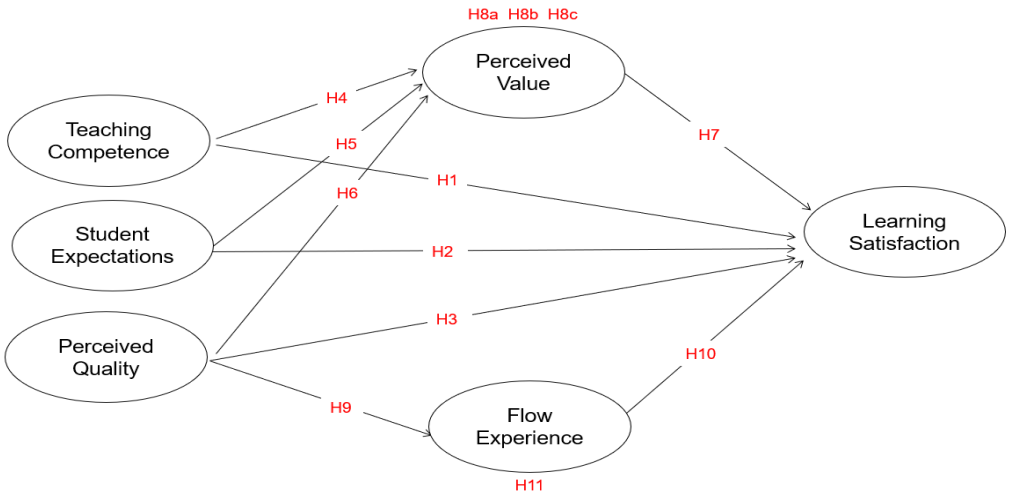

Fig. 1: Research Framework.
Source: Elaborated by this Research.

Teacher's instructional competence significantly and positively influences students' satisfaction (Gopal et al., 2021). Higher levels of teaching competence are associated with increased satisfaction among students (Wajahat & Zia, 2022). Elevated teaching competence implies that educators possess a more extensive knowledge base and a variety of instructional tools, enabling them to deliver higher-quality education (Dali et al., 2017). As instructional quality improves, students find it easier to comprehend and grasp course content, contributing to enhanced academic performance and, consequently, increased learning satisfaction (Suwarni et al., 2020). Therefore, this study proposes the following hypothesis:

H1: *Teaching competence has a significantly positive impact on learning satisfaction.*

Student expectations exert a direct positive influence on learning satisfaction (Yin & Hu, 2023). This is because the realization of expectations is often associated with positive learning experiences and outcomes, including better understanding of course content, achieving higher academic grades, and a more enjoyable learning experience. This sense of fulfillment significantly enhances students' learning satisfaction as they perceive that their investment and expectations have been rewarded (Gopal et al., 2021). Therefore, this study proposes the following hypothesis:

H2: *Student expectations have a significantly positive impact on learning satisfaction.*

Generally, the higher the service quality in higher education, the higher the students' satisfaction levels (Tong et al., 2022). Studies have found that perceived quality among adult learners in blended learning (Chu & Song, 2021), MOOCs perceived quality among university students (Yu & Zhao, 2018), and perceived service quality among e-learners (Sumi & Kabir, 2021) all positively impact learning satisfaction. Therefore, this study proposes the following hypothesis:

H3: *Perceived quality has a significantly positive impact on learning satisfaction.*

Teacher's instructional competence can influence students' perceived value of teaching, with stronger teaching competence leading to higher levels of recognition and importance from students (Huang et al., 2017). Conversely, teachers who employ diverse teaching strategies and

better understand students' needs and characteristics can enhance students' perceived value of the teaching (Thimsen, 2021). Therefore, this study proposes the following hypothesis:

H4: *Teaching competence has a significantly positive impact on perceived value.*

Student expectation can influence perceived value (Jiang, 2018), especially in online learning where expectations significantly impact the perceived value of online learning (Yin & Hu, 2023). If learners have high expectations for their learning outcomes and performance, they are more likely to pay closer attention to the learning content and activities, demonstrating a more serious commitment to their studies. In such situations, learners perceive the importance and significance of their learning, enhancing their awareness and evaluation of the learning content and activities, thereby increasing perceived value (Cavallone et al., 2020). Neelam's study indicates a significant direct relationship between students' expectations of internship value and internship satisfaction (Neelam et al., 2019). Therefore, this study proposes the following hypothesis:

H5: *Student expectation have a significantly positive impact on perceived value.*

In education, perceived quality positively influences perceived value (Jiang, 2018; Yin & Hu, 2023). High-quality educational services are typically associated with positive learning experiences, aiding students in understanding and applying acquired knowledge more easily. Consequently, they are more likely to connect these contents with practical applications and personal growth, perceiving the educational content as valuable (Samudro et al., 2020). Therefore, this study proposes the following hypothesis:

H6: *Perceived quality has a significantly positive impact on perceived value.*

In the field of education, learners' perceived value is positively related to satisfaction (Gao et al., 2020). Existing studies have found that perceived value in online learning(Yin & Hu, 2023), blended learning (Rahman et al., 2015), and flipped classrooms (Zhai, 2016) positively influences learning satisfaction. This is because perceived value involves learners' subjective perceptions of the benefits between their inputs (such as time, effort, and money) and the knowledge and skills they gain. Therefore, this study proposes the following hypothesis:

H7: *Perceived value has a significantly positive impact on learning satisfaction.*

Teaching environments with high perceived quality often provide students with clear learning goals and timely feedback. This helps students adjust their learning strategies and engage more effectively in learning activities, thereby enhancing the flow experience(Mariam et al., 2023). Research indicates that factors such as perceived quality and flow experience can influence user satisfaction in online settings (Wang et al., 2021). In a blended learning environment, learners' perceived quality positively influences the flow experience (Chu & Song, 2021). Therefore, this study proposes the following hypothesis:

H8: *Perceived quality has a significantly positive impact on flow experience.*

When students are in a state of flow, they wholeheartedly concentrate on learning tasks, making the learning process more engaging and memorable, contributing to increased satisfaction with the learning experience (Chu & Song, 2021). Research indicates that flow experience has a positive impact on learning satisfaction (Cui, 2017). Students experiencing "high flow" tend to have higher levels of learning satisfaction compared to those experiencing "low flow."

Therefore, this study proposes the following hypothesis:

H9: *Flow experience has a significantly positive impact on learning satisfaction.*

Students often evaluate the impact of teaching competence on their learning experience through perceived value. When learners can acquire more knowledge and skills with less time investment, their overall satisfaction increases (Bi & Hong, 2021). When students feel they have gained valuable knowledge and skills through education, they are more likely to feel satisfied. Ultimately, students may assess the quality of educational services through perceived value. If they perceive the acquired knowledge and skills as valuable, they are more likely to be satisfied with educational services. Therefore, perceived value plays a mediating role in the relationship between perceived quality and student satisfaction (Zhai, 2016). Thus, this study proposes the following hypotheses:

H10a*: Perceived value mediates the relationship between teaching competence and learning satisfaction.*

H10b: *Perceived value mediates the relationship between student expectation and learning satisfaction.*

H10c: *Perceived value mediates the relationship between perceived quality and learning satisfaction.*

Flow experience serves as a mediator in various contexts. It acts as a mediator between perceived interactivity, perceived sociability, and the willingness to engage (Zhang et al., 2014). When students enter a state of flow during learning, they are more likely to focus on tasks, enhancing learning efficiency. Therefore, flow experience also plays a mediating role in the relationship between the learning environment and learning outcomes (Mueller & Wulf, 2022). Thus, this study proposes the following hypothesis:

H11: *Flow experience mediates the relationship between perceived quality and learning satisfaction.*

3. Research Method

This study employed an online survey and distributed to participants through social media applications such as WeChat and QQ. The survey distribution period was from October 25, 2023, to November 15, 2023. A purposive sampling method was utilized to survey 528 students majoring in mathematics from 16 undergraduate institutions in Guangxi. Following data cleansing procedures, a total of 466 valid responses were obtained for analysis.

The survey questionnaire consists of two parts: the first part includes basic information about the respondents, and the second part investigates university students' satisfaction with blended learning. Since the measurement tools used in this study are in English, a translation method referred to as back-translation (Sabekti & Setiawan, 2023) was employed. Researchers translated the items into Chinese, forming the survey questionnaire.

The scales used in this study are adapted from established scales found in academic journals. Teaching competence utilizes the Teacher Quality Scale developed by Gopal et al. (2021), comprising 7 items. Student expectations employ the Student Expectation Scale by Gopal et al. (2021), consisting of 5 measurement items. Perceived quality utilizes the Online Teaching Quality Scale developed by Mariam et al. (2023), including 7 measurement items. Perceived value adopts the Perceived Value Scale by Wu et al. (2008), comprising 3 items. Learning satisfaction uses the Blended Learning Satisfaction Scale developed by Gao et al. (2020), with 4 items. Flow experience employs the Online User Flow Experience Scale by Chang and Zhu (2012), consisting of 4 items. A Likert 5-point scale was used for responses, from "strongly

disagree (1)" to "strongly agree (5)".

The pre-test questionnaire was distributed to undergraduate mathematics majors at Nanning Normal University. Results indicated that the questionnaire demonstrated high reliability and validity, making it suitable for further large-scale formal survey research.

This study initiated the data analysis process by conducting data cleaning. Subsequently, two statistical software packages, SPSS 27 and AMOS 24, were employed to perform descriptive statistical analysis, reliability analysis, common method bias examination, normality distribution testing, and correlation analysis. Following these preliminary analyses, confirmatory factor analysis (CFA) was conducted to assess the fit of latent variables, as recommended by (Wang et al., 2020). Finally, a structural equation model (SEM) was applied to validate the research model and hypotheses, with a specific focus on conducting tests for the mediating effects.

4. Results

4.1 Demographic Information

Based on the analysis of 466 valid questionnaires, descriptive statistics were conducted concerning the demographic characteristics of the survey respondents, including gender, grade and major. The results presented in Table 1 indicate a significant gender imbalance, with females constituting 70.6% of the respondents compared to 29.4% males. This disparity can be attributed to the fact that among the 16 undergraduate institutions surveyed, 11 were teacher-training colleges, where there is typically a higher proportion of female students majoring in mathematics. Regarding the distribution by grade level, freshmen, sophomores, and juniors constituted the main groups, accounting for 27.3%, 29.4%, and 38%, respectively. In contrast, seniors comprised the smallest proportion at 5.4%, possibly due to their engagement in internships during their senior year. Furthermore, the majority of institutions in Guangxi offer majors in mathematics and applied mathematics, representing 81.8% of the sample, while programs in statistics, financial mathematics, and information and computational science are less prevalent.

Table 1 Basic Information Statistics of Survey Objects.

Attributes	Category	Frequency	Percent（%）
Gender	Male	137	29.4
	Female	329	70.6
Grade	Freshman year	127	27.3
	Sophomore year	137	29.4
	Junior year	177	38.0
	Senior year	25	5.4
Major	Mathematics and Applied Mathematics	381	81.8
	Statistics	63	13.5
	Financial Mathematics	17	3.6
	Information and Technology Sciences	5	1.1

4.2 Reliability, Validity, and Correlation

In the following research, SRL stands for Teaching competence, QW stands for Student expectation, ZL stands for Perceived quality, JZ stands for Perceived value, XL stands for Flow experience, and MYD stands for Learning satisfaction.

Table 2 shows the means, standard deviation, reliability, factor loadings, Average Variance Extracted (AVE), and Composite Reliability (CR) of the constructs. The overall Cronbach's α value for the sample data is 0.941, surpassing the conventional threshold of 0.8 (Taber, 2018) for each latent variable. Furthermore, the Cronbach's α coefficients for all latent variables and the standard factor loadings for each measurement item are above 0.5 (Hair, 2009), CR value is greater than the standard value of 0.6 (Fornell & Larcker, 1981)，meeting the criteria for establishing high reliability of the questionnaire scale.

In this study, Pearson correlation analysis was employed to compute the correlation coefficients between variables and the square root of the Average Variance Extracted (AVE). As presented in Table 2, all AVE values are greater than 0.5 (Fornell & Larcker, 1981), indicating satisfactory convergent validity of the sample. The results depicted in Table 3 demonstrate that the square root of AVE exceeds the correlation coefficients between each pair of latent variables, confirming that the discriminant validity of the sample meets the required standards.

Table 2 Reliability and Validity Analysis.

Variables	Items	Mean	SD	Cronbach'sα	Factor loadings	AVE	CR
Teaching competence	SRL1	3.27	1.095	0.930	0.8	0.655	0.930
	SRL2	3.23	1.148		0.813		
	SRL3	3.24	1.138		0.818		
	SRL4	3.27	1.163		0.812		
	SRL5	3.34	1.121		0.803		
	SRL6	3.30	1.130		0.807		
	SRL7	3.26	1.115		0.814		
Student expectation	QW1	3.51	1.029	0.873	0.739	0.581	0.874
	QW2	3.47	1.037		0.798		
	QW3	3.47	1.018		0.72		
	QW4	3.48	0.973		0.765		
	QW5	3.47	1.001		0.787		
Perceived quality	ZL1	3.21	1.050	0.908	0.757	0.586	0.908
	ZL2	3.19	1.029		0.779		
	ZL3	3.18	1.010		0.773		
	ZL4	3.15	1.015		0.808		
	ZL5	3.17	1.013		0.763		
	ZL6	3.18	1.045		0.748		
	ZL7	3.14	1.017		0.73		
Perceived value	JZ1	3.32	1.125	0.816	0.775	0.597	0.816
	JZ2	3.33	1.076		0.772		
	JZ3	3.28	1.119		0.771		
Flow experience	XL1	3.13	1.109	0.859	0.789	0.605	0.860
	XL2	3.12	1.167		0.768		
	XL3	3.15	1.145		0.786		
	XL4	3.14	1.144		0.768		
Learning satisfaction	MYD1	3.47	1.220	0.905	0.817	0.706	0.906
	MYD2	3.38	1.243		0.843		
	MYD3	3.46	1.171		0.85		
	MYD4	3.44	1.161		0.851		

Table 3 Pearson Correlation and Discriminant Validity Analysis.

Variable	SRL	QW	ZL	JZ	XL	MYD
SRL	0.809					
QW	0.548**	0.762				
ZL	0.492**	0.404**	0.766			
JZ	0.474**	0.391**	0.399**	0.773		
XL	0.342**	0.249**	0.419**	0.186**	0.778	
MYD	0.496**	0.451**	0.476**	0.443**	0.386**	0.840

Note: **P<0.01(Sig.), Bolded fonts are AVE root values.

4.3 Common Method Bias and Normality Distribution Detection

This study employed the Harman single-factor test, revealing that the variance explained by the first factor is 37.570%, which is below the 50% threshold established (Podsakoff et al., 2003). Consequently, the sample data is less likely to suffer from common method bias issues.

The analysis in this paper focuses on six variables: teaching competence, student expectations, perceived quality, perceived value, flow experience, and learning satisfaction. Statistical analysis of kurtosis and skewness values was conducted, with skewness values ranging from -0.484 to 0.056 and kurtosis values from -0.983 to -0.307. Clearly, with absolute skewness coefficients smaller than 2 and absolute kurtosis coefficients smaller than 7, the data, while not perfectly normal, is deemed reasonably close to a normal distribution (Kline, 2005). Therefore, the data for each measurement item is approximately normally distributed, suitable for structural equation modeling analysis.

4.4 Path Analysis of Structural Equation Model

Given that the results of confirmatory factor analysis indicate the acceptability of the measurement model, this paper proceeded to run a Structural Equation Model (SEM) in AMOS to test the fit of the structural model. Fit indices for path analysis were assessed according to the empirical rule-of-thumb standards recommended by scholars (Kline, 2005). As demonstrated in Table 4, the structural equation model exhibits a good fit.

Table 4 Model Fit Index.

Fit index	CMIN/ DF	RMR	GFI	AGFI	NFI	IFI	CFI	RMSEA
Standard	<3	<0.08	>0.9	>0.9	>0.9	>0.9	>0.9	<0.08
Value	1.212	.044	.934	.922	.946	.990	.990	.021
Fitting situation	Good	Good	Good	Good	Good	Good	Good	Good

According to the results in Table 5, in the path hypothesis testing, teaching competence significantly positively influences learning satisfaction (β=0.145, p<0.05), student expectations significantly positively influence learning satisfaction (β=0.183, p<0.01), perceived quality significantly positively influences learning satisfaction (β=0.161, p<0.01). Teaching competence significantly positively influences perceived value (β=0.333, p<0.001), student expectations significantly positively influence perceived value (β=0.168, p<0.01), perceived quality significantly positively influences perceived value (β=0.205, P<0.001). Perceived value significantly positively influences learning satisfaction (β=0.238, P<0.001), perceived quality significantly positively influences flow experience (β=0.483, p<0.001), and flow experience significantly positively influences learning satisfaction (β=0.197, p<0.001). Therefore, H1, H2, H3, H4, H5, H6, H7, H8, H9 are all supported. The

structural equation model is depicted in Figure 3.

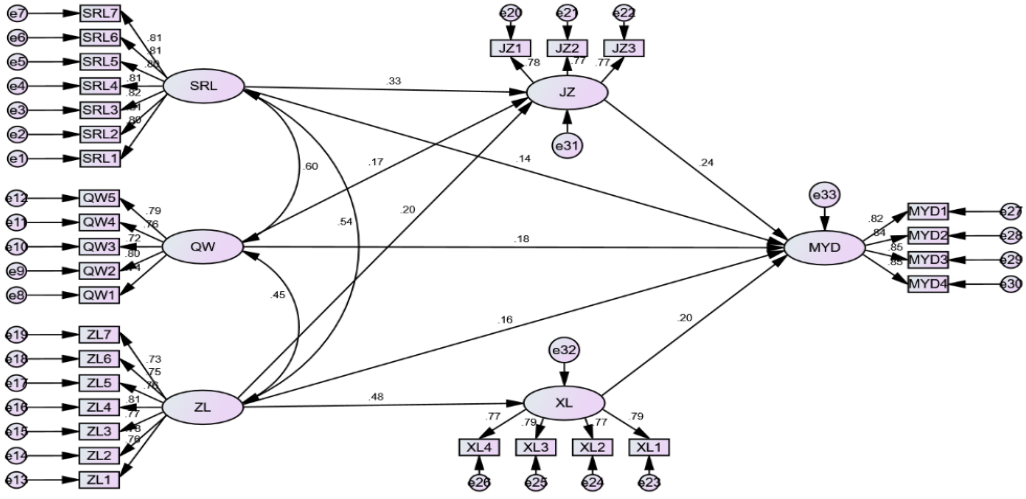

Figure 2. The Path Analysis for the Model
Source: This Study.

Table 5 Results of Structural Model Testing.

Hypothesis	Path			Estimate	S.E.	C.R.	*p*	Results
H1	SRL	→	MYD	0.145	0.068	2.411	0.016	supported
H2	QW	→	MYD	0.183	0.073	3.249	0.001	supported
H3	ZL	→	MYD	0.161	0.073	2.767	0.006	supported
H4	SRL	→	JZ	0.333	0.067	4.973	***	supported
H5	QW	→	JZ	0.168	0.073	2.651	0.008	supported
H6	ZL	→	JZ	0.205	0.064	3.503	***	supported
H7	JZ	→	MYD	0.238	0.065	4.172	***	supported
H8	ZL	→	XL	0.483	0.059	8.962	***	supported
H9	XL	→	MYD	0.197	0.056	3.992	***	supported

Note: *P<0.05, **P<0.01, ***P<0.001, S.E.= standard error, C.R.= Critical Ratio.

4.5 Mediating Effect Test

In the AMOS program, Bootstrap technique was employed in this study to conduct mediation effect tests for perceived value and flow experience (Hayes, 2017). The results are presented in Table 6. In the relationship between teaching competence and learning satisfaction, the indirect effect of perceived value (β=0.079, P<0.01), direct effect (β=0.145, p<0.05), and total effect (β=0.224, p<0.01) are all significant. Notably, the Bias-Corrected and Percentile 95% confidence intervals for the indirect effect do not include 0, indicating the existence of the indirect effect. The 95% confidence interval for the direct effect also does not include 0, suggesting the presence of the direct effect. Considering these results, perceived value plays a significant partial mediating role in this path, hence supporting H10a.

In the relationship between student expectations and learning satisfaction, the indirect effect of perceived value (β=0.040, P<0.01), direct effect (β=0.183, p<0.001), and total effect (β=0.223, p<0.001) are all significant. Similar to the previous case, the Bias-Corrected and Percentile 95% confidence intervals for the indirect effect do not include 0, signifying the existence of the indirect effect. The 95% confidence interval for the direct effect also does not

include 0, indicating the presence of the direct effect. Considering these results, perceived value plays a significant partial mediating role in this path, hence supporting H10b.

In the relationship between perceived quality and learning satisfaction, the indirect effect of perceived value (β=0.049, P<0.001), the indirect effect of flow experience (β=0.095, P<0.001), direct effect (β=0.161, p<0.01), and total effect (β=0.305, p<0.001) are all significant. Analogous to the previous scenarios, the Bias-Corrected and Percentile 95% confidence intervals for the indirect effects do not include 0, affirming the existence of the indirect effects. The 95% confidence interval for the direct effect also does not include 0, indicating the presence of the direct effect. In light of these findings, perceived value and flow experience play significant partial mediating roles in this path, thus supporting H10c and H11.

Table 6 Mediation Effect Test.

Parameter	Path	Estimate	Bias-Corrected 95% confidence interval			Percentile 95% confidence interval			
			Lower	Upper	P	Lower	Upper	P	Results
Direct effect	SRL→MYD	.145	.021	.28	.024	.016	.277	.028	
	QW→MYD	.183	.069	.297	.001	.068	.296	.001	
	ZL→MYD	.161	.045	.279	.006	.044	.278	.006	
Indirect effect	SRL→JZ→MYD	.079	.038	.144	.000	.035	.139	.000	supported
	QW→JZ→MYD	.040	.011	.085	.006	.008	.080	.010	supported
	ZL→JZ→MYD	.049	.021	.087	.001	.019	.083	.001	supported
	ZL→XL→MYD	.095	.047	.159	.000	.044	.155	.001	supported
Total effect	SRL→MYD	.224	.100	.350	.001	.101	.351	.001	
	QW→MYD	.223	.112	.341	.000	.109	.338	.000	
	ZL→MYD	.305	.206	.407	.000	.205	.405	.000	

3. 5. Discussion and Conclusions

5.1 Theoretical Implications

Teaching competence significantly and positively influences learning satisfaction. The findings of this study align with the research conducted by Gopal et al. (2021)and Wajahat and Zia (2022), indicating that as the level of teaching competence increases, individuals' learning satisfaction also rises. In the context of blended learning, a high level of teaching competence implies that teachers possess a more extensive knowledge base and a greater array of instructional tools, enabling the delivery of higher-quality education. This contributes to improving students' academic performance, consequently elevating their overall learning satisfaction. Student expectation have a significant positive impact on learning satisfaction. The findings of this study align with the research conducted by Yin and Hu (2023) and Bates and Kaye (2014). Perceived quality has a significant positive impact on learning satisfaction. The research results align respectively with the findings of Chu and Song (2021) and Sumi and Kabir (2021). When students perceive high-quality educational services, they are more likely to be in a positive learning environment. Such a positive environment can stimulate students' interest in learning, aiding them in better engagement with their studies and thereby enhancing learning satisfaction. Perceived value significantly and positively influences learning satisfaction. The results of this study are in concordance with the research conducted by Gao et al. (2020) and Rahman et al. (2015).

Teaching competence has a significant positive impact on perceived value, consistent with the findings of Thimsen (2021). The teaching competence of instructors can influence undergraduate students' perceived value of instruction. The stronger the pedagogical

competence, the higher the level of student recognition and importance attached to it, leading to an elevated perceived value. Student expectations also have a significantly positive impact on perceived value, aligning with the research conducted by Yin and Hu (2023). Perceived quality similarly has a significantly positive impact on perceived value, consistent with the findings of Yin and Hu (2023). High-quality educational services aid students in establishing a sense of identification with the instructional content.

Perceived quality has a significantly positive impact on the flow experience, consistent with the findings of Wang et al. (2021). A high perceived quality in the educational environment often provides clear learning objectives and timely feedback for undergraduate students. This facilitates students in adjusting their learning strategies and immersing themselves more effectively in learning activities, thereby enhancing the flow experience. Flow experience, in turn, has a significantly positive impact on learning satisfaction, aligning with the research conducted by Cui (2017). In blended learning, the flow experience is often accompanied by deep concentration and complete absorption in tasks. This focused attention helps undergraduate students better understand and respond to the learning content, thereby improving learning effectiveness. Additionally, the pleasure and sense of achievement associated with the flow state positively contribute to students' emotional experiences. These positive emotions aid in cultivating a positive attitude towards learning, enhancing students' satisfaction with academic achievements, and increasing overall satisfaction with the learning process.

Perceived value plays a mediating role in the relationship between teaching competence and learning satisfaction, aligning with findings similar to those of Bi and Hong (2021). This constitutes one of the most significant discoveries in the present study. In blended learning, when undergraduate students perceive that the knowledge and skills they acquire hold personal practical value, it directly influences their evaluation of teaching competence. Students who believe that teaching competence provides valuable learning experiences are more likely to express satisfaction. Perceived value, serving as an indicator of learning benefits, bridges the gap between instructional quality and learning satisfaction, emphasizing the cultivation of academic achievements for personal practical significance. This mediating role underscores the critical influence of cognizing academic value in shaping students' satisfaction with teaching competence, thereby highlighting the importance of enhancing students' satisfaction with instructional quality.

Perceived value serves as a mediator in the relationship between student expectations and learning satisfaction, constituting one of the most crucial findings in this study. Scholars such as Jiang (2018) and Yin and Hu (2023) have explored the relationship between student expectations and perceived value, as well as the relationship between perceived value and learning satisfaction. However, they did not investigate the mediating role of perceived value in the connection between student expectations and learning satisfaction. In blended learning, student expectations are closely tied to anticipated learning experiences and perceived value, with the latter encompassing the practicality and relevance of academic content. When students perceive the practical value of learning tasks, they are more likely to connect their personal expectations with actual learning outcomes. This connection directly shapes students' satisfaction with the learning process, as experiences that fulfill expectations enhance satisfaction.

Perceived value serves as a mediator in the relationship between perceived quality and learning satisfaction, consistent with the findings of Zhai (2016). Undergraduate students assess the

quality of educational services by perceiving the personal practical value of knowledge and skills. This cognition directly influences students' satisfaction with educational services.

Flow experience also acts as a mediator in the relationship between perceived quality and learning satisfaction, similar to the research conducted by Mueller and Wulf (2022) in the context of learning outcomes. This constitutes one of the most crucial findings in the present study. The flow state makes undergraduate students more prone to concentrate on tasks in blended classrooms, enhancing learning efficiency and directly promoting learning performance and satisfaction. Flow, accompanied by positive emotions such as pleasure and a sense of achievement, creates positive learning experiences that directly impact students' satisfaction with

This study, grounded in customer satisfaction theory, comprehensively considers multiple factors such as teaching competence, student expectations, perceived quality, perceived value, and flow experience. It constructs a model for satisfaction in blended learning, contributing to a more holistic understanding of how students form satisfaction in such learning environments. The study notably underscores the mediating roles of perceived value and flow experience in the process of influencing learning satisfaction. This highlights the importance of paying increased attention to these mediating factors in both research and practical applications, delving deeper into their substantial impacts on the learning experience and satisfaction.

5.2 Practical Implications

Recognizing the significance of teaching competence, student expectations, and perceived quality in influencing learning satisfaction, educators can tailor their instructional design for blended courses more effectively, ultimately improving the overall quality of teaching. The confirmation of the mediating roles of perceived value and flow experience in learning satisfaction provides robust guidance for educational institutions to prioritize and enhance the overall student learning experience, thereby elevating satisfaction levels.

The research outcomes offer substantial support for the future development of blended learning. Institutions can leverage these findings to optimize blended learning environments, fostering better integration and enjoyment of the learning process for students. In conclusion, this study serves as a crucial reference for both the theoretical development and practical application of satisfaction in blended learning. It offers valuable insights for enhancing educational quality and improving the overall student learning experience.

5.3 Conclusions

This study, based on the research findings related to factors influencing learning satisfaction and employing quantitative research methods, has garnered rich data with a well-fitting model. Empirical results indicate that, in the context of blended learning, teaching competence, student expectations, perceived quality, perceived value, and flow experience significantly and positively impact learning satisfaction. Notably, teaching competence, student expectations, and perceived quality also exhibit significant positive effects on perceived value. Additionally, perceived quality demonstrates a significant positive influence on flow experience. Concurrently, perceived value acts as a mediator in the relationships between teaching competence, student expectations, perceived quality, and learning satisfaction, while flow experience similarly serves as a mediator in the relationship between perceived quality and

learning satisfaction.

In summary, the findings of this research provide in-depth theoretical insights into the mechanisms influencing blended learning satisfaction. Teaching competence, student expectations, perceived quality, perceived value, and flow experience play positive roles in shaping students' satisfaction with blended learning, with the mediating effects of perceived value and flow experience being particularly pronounced. These research outcomes not only contribute to the academic understanding of blended learning satisfaction but also offer valuable insights for educational practice.

For the educational community, this research contributes to the enhancement of the quality of blended courses and provides guidance for educators to meet students' learning needs and enhance satisfaction. Furthermore, by gaining a deeper understanding of students' experiences in blended learning, educational institutions can better adjust teaching strategies to create more engaging and effective learning environments. Overall, this study provides substantial theoretical support for advancing the development of blended learning and holds promise as a crucial reference for future improvements and innovations in blended education.

Due to limitations in time and resources, this study has the following constraints. First, database bias: Some databases do not support downloads, making it impossible to obtain all relevant data. This may affect the integrity and representativeness of the results, leading to research biases. Second, respondent type: The study data is collected only from students, meaning the results represent only the perspectives and experiences of students. If blended learning also involves the roles of teachers, school administrators, or parents, the viewpoints and experiences of these stakeholders should also be considered. Third, sample representativeness: The study only includes undergraduate mathematics majors in Guangxi, which may not be sufficient to represent the satisfaction of all undergraduate mathematics majors in China. Students from different regions, disciplines, and backgrounds may have different experiences and opinions. Therefore, caution should be exercised in generalizing the results to a broader population.

Future research could further expand the scope by selecting universities with different regional characteristics as research subjects, conducting a more comprehensive and systematic investigation into the current status of blended teaching in higher education. This would enhance the universality of research findings. Regarding the factors influencing student satisfaction, future research could consider incorporating additional variables, such as individual internal factors of students. Additionally, careful planning of the timeline and schedule for various tasks is necessary in the early stages of research to ensure a well-prepared approach.

Data Availability Statement

The datasets presented in this article are not readily available because they involve the interests of collaborators, as well as some privacy issues, and some data are confidential. However, further individual scholars or experts are welcome to request these datasets for academic references or other needs; requests to access these datasets should be directed to Luling Duan: duan.luling@rmutr.ac.th

Author Contributions

L.D and S.J: conceptualization and writing—original draft preparation.

L.D and S.J: methodology, formal analysis, and writing—review and editing.

All authors have read and agreed to the published version of the manuscript.

Conflict of Interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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References

Agyeiwaah, E., Baiden, F. B., Gamor, E., & Hsu, F. C. (2022). Determining the attributes that influence students' online learning satisfaction during COVID-19 pandemic. *Journal of hospitality, leisure, sport & tourism education*, *30*, 100364. http://doi.org/10.1016/j.jhlste.2021.100364.

Al-Nasa'h, M., Awwad, F. M. A., & Ahmad, I. (2021). Estimating students' online learning satisfaction during COVID-19: A discriminant analysis. *Heliyon*, *7*(12), e08544. http://doi.org/10.1016/j.heliyon.2021.e08544.

Alammary, A. (2019). Blended learning models for introductory programming courses: a systematic review. *Plos one*, *14*(9), e0221765. http://doi.org/10.1371/journal.pone.0221765.

Angelova, B., & Zekiri, J. (2011). Measuring customer satisfaction with service quality using American Customer Satisfaction Model (ACSI Model). *International Journal of Academic Research in Business and Social Sciences*, *1*(3), 232-258. http://doi.org/10.6007/ijarbss.v1i2.35.

Anthony, B., Kamaludin, A., Romli, A., Raffei, A. F. M., Nincarean A/L Eh Phon, D., Abdullah, A., . . . Baba, S. (2019). Exploring the role of blended learning for teaching and learning effectiveness in institutions of higher learning: An empirical investigation. *Education and Information Technologies*, *24*, 3433-3466. http://doi.org/10.1007/s10639-019-09941-z.

Antwi-Boampong, A., & Bokolo, A. J. (2021). Towards an institutional blended learning adoption model for higher education institutions. *Technology, Knowledge and Learning*, 1-20. http://doi.org/10.1007/s10758-021-09507-4.

Bacci, S., Fabbricatore, R., & Iannario, M. (2023). Multilevel IRT models for the analysis of satisfaction for distance learning during the Covid-19 pandemic. *Socio-Economic Planning Sciences*, *86*, 101467. http://doi.org/10.1016/j.seps.2022.101467.

Balentyne, P., & Varga, M. A. (2017). Attitudes and achievement in a self-paced blended mathematics course. *Journal of Online Learning Research*, *3*(1), 55–72. https://www.learntechlib.org/primary/p/173313/.

Bates, E. A., & Kaye, L. K. (2014). "I'd be expecting caviar in lectures": The impact of the new fee regime on undergraduate students' expectations of higher education. *Higher education*,

67, 655-673. http://doi.org/10.1007/s10734-013-9671-3.

Bi, J., & Hong, L. (2021). A Study on the Factors Influencing the Satisfaction of Blended Learning among Applied Undergraduate University Students *Science and Education Wenhui (First Ten Days)*(09), 40-44. http://doi.org/10.16871/j.cnki.kjwha.2021.09.014.

Browne, T., Hewitt, R., Jenkins, M., & Walker, R. (2008). *2008 Survey of Technology Enhanced Learning for higher education in the UK.*

Bryant, F. B., & Veroff, J. (2017). *Savoring: A new model of positive experience*. Psychology Press.

Cao, Y. Y. (2021). Research on the Competency Model of SPOC Blended Teaching in a Smart Learning Environment *Journal of Hangzhou Dianzi University (Social Science Edition),*, *17* (03), 68-72. http://doi.org/10.13954/j.cnki.hduss.2021.03.012.

Cavallone, M., Manna, R., & Palumbo, R. (2020). Filling in the gaps in higher education quality: An analysis of Italian students' value expectations and perceptions. *International journal of educational management*, *34*(1), 203-216. http://doi.org/10.1108/IJEM-06-2019-0189.

Chang, Y. P., & Zhu, D. H. (2012). The role of perceived social capital and flow experience in building users'continuance intention to social networking sites in China. *Computers in Human Behavior*, *28*(3), 995 − 1001. http://doi.org/10.1016/j.chb.2012.01.001.

Chen, W. S., & Yao, A. Y. T. (2016). An empirical evaluation of critical factors influencing learner satisfaction in blended learning: A pilot study. *Universal Journal of Educational Research and Experiments*, *4*(7), 1667–1671. http://doi.org/10.13189/ujer.2016.040719.

Chu, H. Y., & Song, Z. Q. (2021). A Study on the Factors Influencing Adult Learner Satisfaction under the POC Academic English Blended Teaching Model: An Empirical Analysis Based on Structural Equation Modeling. *China Adult Education*(22), 35-39. http://doi.org/CNKI:SUN:ZCRY.0.2021-22-007.

Cicha, K., Rizun, M., Rutecka, P., & Strzelecki, A. (2021). COVID-19 and higher education: First-year students' expectations toward distance learning. *Sustainability*, *13*(4), 1889. http://doi.org/10.3390/su13041889.

Csikszentmihalyi, M. (1975). *Beyond boredom and anxiety : the experience of play in work and games*. https://doi.org/10.2307/2065805

Cui, C. Y. (2017). *Research on the influencing factors of MOOC learners' willingness to continue learning* Liaoning Normal University. https://kns.cnki.net/KCMS/detail/detail.aspx?dbname=CMFD201801&filename=1017115938.nh

Dali, P. D., Daud, K., & Fauzee, M. S. O. (2017). The Relationship between Teachers' Quality in Teaching and Learning with Students' Satisfaction. *International Journal of Academic Research in Business and Social Sciences*, *7*(7), 603-618. https://www.xueshufan.com/publication/2977555568

Du, L., Zhao, L., Xu, T., Wang, Y., Zu, W., Huang, X., . . . Wang, L. (2022). Blended learning vs traditional teaching: The potential of a novel teaching strategy in nursing education-a systematic review and meta-analysis. *Nurse Education in Practice*, *63*, 103354. http://doi.org/10.1016/j.nepr.2022.103354.

Esteban-Millat, I., Martínez-López, F. J., Huertas-García, R., Meseguer, A., & Rodríguez-Ardura, I. (2014). Modelling students' flow experiences in an online learning environment. *Computers & education*, *71*, 111-123. http://doi.org/10.1016/j.compedu.2013.09.012.

Feng, X. Y., Wu, Y. J., Pang, X. Y., & T., C. J. (2021). Blended Teaching Reform: Are Teachers Ready - A Study on the Development Framework and Readiness of Teacher Blended Teaching Reform. *China's Audiovisual Education*, *01*, 110-117. http://doi.org/CNKI:SUN:ZDJY.0.2021-01-016.

Finlay, M. J., Tinnion, D. J., & Simpson, T. (2022). A virtual versus blended learning approach to higher education during the COVID-19 pandemic: The experiences of a sport and exercise science student cohort. *J Hosp Leis Sport Tour Educ*, *30*, 100363. http://doi.org/10.1016/j.jhlste.2021.100363.

Fornell, C. (1992). A National Customer Satisfaction Barometer: The Swedish Experience. *Journal of Marketing*, *56*(1), 6-21. http://doi.org/10.1177/002224299205600103.

Fornell, C., & Larcker, D. F. (1981). Evaluating structural equation models with unobservable variables and measurement error. *Journal of marketing research*, *18*(1), 39-50. http://doi.org/10.1177/002224378101800104.

Gao, B. W., Jiang, J., & Tang, Y. (2020). The effect of blended learning platform and engagement on students' satisfaction——the case from the tourism management teaching. *Journal of hospitality, leisure, sport & tourism education*, *27*, 100272. http://doi.org/10.1016/j.jhlste.2020.100272.

Gao, Y., & Huang, R. H. (2017). Interpretation and Enlightenment of "2017 New Media Alliance China Higher Education Technology Outlook: Horizon Project Regional Report". *Research on Audiovisual Education*, *04*, 15-22. http://doi.org/10.13811/j.cnki.eer.2017.04.002.

Gopal, R., Singh, V., & Aggarwal, A. (2021). Impact of online classes on the satisfaction and performance of students during the pandemic period of COVID 19. *Education and Information Technologies*, *26*(6), 6923-6947. http://doi.org/10.1007/s10639-021-10523-1.

Hair, J. F. (2009). Multivariate data analysis.

Hayes, A. F. (2017). *Introduction to mediation, moderation, and conditional process analysis: A regression-based approach*. Guilford publications.

Huang, R., Zhang, J., Mok, I. A. C., Zhao, W., Zhou, Y., & Wu, Z. (2017). Perceived professional knowledge and competence of mathematics specialists and its development in China. *International Journal for Lesson and Learning Studies*, *6*(4), 321-335. http://doi.org/10.1108/IJLLS-12-2016-0056.

Jiang, X. H. (2018). Research on the influencing factors of blended teaching from the perspective of student satisfaction. *Shandong Normal University*. https://kns.cnki.net/KCMS/detail/detail.aspx?dbname=CMFD201901&filename=1018212061.nh

Kline, T. J. (2005). *Psychological testing: A practical approach to design and evaluation*. Sage publications.

Mariam, S., Khawaja, K. F., Qaisar, M. N., & Ahmad, F. (2023). Blended learning sustainability in business schools: Role of quality of online teaching and immersive learning experience. *The International Journal of Management Education*, *21*(2), 100776. http://doi.org/10.1016/j.ijme.2023.100776.

Mcclelland, D. C. (1973). Testing for Competencies Rather than for Intelligence. *American Psychologist*, *28*(1), 1. http://doi.org/10.1037/h0034092.

Mueller, F. A., & Wulf, T. (2022). Blended learning environments and learning outcomes: The mediating role of flow experience. *The International Journal of Management Education*, *20*(3), 100694. http://doi.org/10.1016/j.ijme.2022.100694.

Mukuka, A., Shumba, O., & Mulenga, H. M. (2021). Students' experiences with remote learning during the COVID-19 school closure: implications for mathematics education. *Heliyon*, *7*(7). http://doi.org/10.1016/j.heliyon.2021.e07523.

Neelam, N., Bhattacharya, S., Kejriwal, V., Bhardwaj, V., Goyal, A., Saxena, A., . . . Choudaha, G. (2019). Internship in a business school: expectation versus experience. *Higher Education, Skills and*

Work-Based Learning, *9*(1), 92-106. http://doi.org/10.1108/HESWBL-03-2018-0025.

Novak, T. P., Hoffman, D. L., & Yung, Y. F. (2000). Measuring the customer experience in online environment: A structural modeling approach. *Marketing Science*, *19*(1), 22-44. http://doi.org/10.1287/mksc.19.1.22.15184.

Peifer, C., & Engeser, S. (2021). *Advances in flow research*. Springer.

Podsakoff, P. M., MacKenzie, S. B., Lee, J. Y., & Podsakoff, N. P. (2003). Common method biases in behavioral research: a critical review of the literature and recommended remedies. *Journal of applied Psychology*, *88*(5), 879. http://doi.org/10.1037/0021-9010.88.5.879.

Powell, A., R abbit, B., & Kennedy, K. (2020). iNACOL blended learning teacher competency framework. https://files.eric.ed.gov/fulltext/ED561318.pdf

Punyanunt-Carter, N. M., De, L. C. J. J., & Wrench, J. S. (2017). Investigating the relationships among college students' satisfaction, addiction, needs, communication apprehension, motives, and uses & gratifications with Snapchat. *Computers in Human Behavior*, *75*, 870-875. http://doi.org/10.1016/j.chb.2017.06.034.

Rahman, N. A. A., Hussein, N., & Aluwi, A. H. (2015). Satisfaction on blended learning in a public higher education institution: what factors matter? *Procedia-Social and Behavioral Sciences*, *211*, 768-775. http://doi.org/10.1016/j.sbspro.2015.11.107.

Sabekti, T. S., & Setiawan, A. I. (2023). How to Improve Employee Performance through the Role of Work Engagement Mediation Empirical Studies on Public Sector Organizations. *Asian Journal of Engineering, Social and Health*, *2*(3), 205-218. http://doi.org/10.46799/ajesh.v2i3.45.

Samudro, A., Sumarwan, U., Simanjuntak, M., & Yusuf, E. (2020). Assessing the effects of perceived quality and perceived value on customer satisfaction. *Management Science Letters*, *10*(5), 1077-1084. http://doi.org/10.5267/j.msl.2019.11.001.

Stahl, G. (2021). Redesigning mathematical curriculum for blended learning. *Education Sciences*, *11*(4), 165. http://doi.org/10.3390/educsci11040165.

Sumi, R. S., & Kabir, G. (2021). Satisfaction of e-learners with electronic learning service quality using the servqual model. *Journal of Open Innovation: Technology, Market, and Complexity*, *7*(4), 227. http://doi.org/10.3390/joitmc7040227.

Suwarni, S., Moerdiono, A., Prihatining, I., & Sangadji, E. M. (2020). The effect of lecturers' competency on students' satisfaction through perceived teaching quality. *KnE Social Sciences*, 1-14. http://doi.org/10.18502/kss.v4i9.7311.

Taber, K. S. (2018). The use of Cronbach's alpha when developing and reporting research instruments in science education. *Research in science education*, *48*, 1273-1296. http://doi.org/10.1007/s11165-016-9602-2.

Thimsen, T. J. (2021). Identifying teaching methods used by clinical instructors in nuclear medicine. *Radiologic Technology*, *92*(4), 354-366. http://www.radiologictechnology.org/content/92/4/354.short

Tong, Y., Wang, H., Zhu, K., Zhao, H., Qi, Y., Guan, J., . . . Wu, Y. (2022). Satisfaction with community health education among residents in China: results from a structural equation model. *Frontiers in Public Health*, *10*, 905952. http://doi.org/10.3389/fpubh.2022.905952.

Wajahat, A., & Zia, S. (2022). The Moderating Role of Learning Performance on Teaching Competencies and Student Satisfaction. *Reviews of Management Sciences*, *4*(1), 1-15. http://doi.org/10.53909/rms.04.01.094.

Wang, D., Fan, Q., & Ma, Y. (2020). An interactive maximum likelihood estimation method for multivariable Hammerstein systems. *Journal of the Franklin Institute*, *357*(17), 12986-13005. http://doi.org/10.1016/j.jfranklin.2020.09.005.

Wang, M., Lu, M. X., J., S., & Yang, H. J. (2021). Research on the Factors Influencing User Stickiness of Video Websites Based on ECT Theory and FLOW Theory - Taking Bilibili as an Example *Information Engineering*(01), 80-92. http://doi.org/CNKI:SUN:QBGC.0.2021-01-008.

Wen, T., & Chu, X. N. (2021). The impact of esports user flow experience on perceived value and user stickiness. *Packaging Engineering*(10), 80-89. http://ijicic.org/ijicic-170522.pdf

Wu, J. H., Hsia, T. L., Liao, Y. W., & Tennyson, R. (2008). What determinates student learning satisfaction in a blended e-learning system environment? https://aisel.aisnet.org/pacis2008/149

Yin, M., & Hu, D. (2023). Research on the Impact of Perception of Online Course Quality on College Students' Satisfaction with Online Learning *Journal of Xinyang Normal University (Philosophy and Social Sciences Edition)*(01), 41-48. http://doi.org/CNKI:SUN:XYSZ.0.2023-01-007.

Yoshida, Y., Uno, T., Tanaka, H., Hakosaki, I., Shigeta, K., & Yano, R. (2022). Cognitive changes with psychomotor skill acquisition through blended learning among nursing students: A qualitative study. *Nurse Education in Practice*, *65*, 103486. http://doi.org/10.1016/j.nepr.2022.103486.

Yu, N. L., & Zhao, Y. C. (2018). The Impact of Perceived Quality of MOOC on Learning Satisfaction among College Students: The Mediating Role of Learning Motivation. *Journal of Education at Renmin University of China*, *01*, 113-124. http://doi.org/CNKI:SUN:RDXK.0.2018-01-011.

Zhai, X. S. (2016). *Research on the influencing factors and mechanism of learner satisfaction in Flipped classroom* doctoral dissertation, University of Science and Technology of China.

Zhai, X. S., & Lin, L. L. (2014). Factor analysis of learner satisfaction in Flipped classroom: an empirical study based on college English teaching. *China Audio Visual Education*(04), 104-109+136. http://doi.org/CNKI:SUN:ZDJY.0.2014-04-018.

Zhan, Z. H., & Li, X. H. (2009). Blended learning: Definition, Strategy, Status Quo and Development Trend - Dialogue with Professor Curtis Bunk of Indiana University in the United States. *Audio Visual Education in China*, *12*, 1-5. http://doi.org/CNKI:SUN:ZDJY.0.2009-12-003.

Zhang, B., & Lin, J. B. (2014). Empirical Analysis of Factors Influencing University Teaching Satisfaction: From the Perspective of Student Expectations and Perceived Quality. *Fudan Education Forum*, *12*(04), 59-65. http://doi.org/doi:10.13397/j.cnki.fef.2014.04.011.

Zhang, H., Lu, Y., Gupta, S., & Zhao, L. (2014). What motivates customers to participate in social commerce? The impact of technological environments and virtual customer experiences. *Information & Management*, *51*(8), 1017-1030. http://doi.org/10.1016/j.im.2014.07.005.