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Factors Impacting University Student Satisfaction in Flipped Classroom: A case study of a public university in Yunnan Province, China

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Abstract

Student satisfaction is an important factor to improve flipped classroom teaching effect. This study focuses on the effects of teacher-student interaction, student engagement, self-efficacy, support services and adoption intention on student satisfaction in flipped classroom. This study was conducted in a public university in Yunnan Province, with 332 students as the survey objects, and 30 students were selected to participate in strategic planning. The research adopts a mixed research method combining quantitative and qualitative. Quantitative data is obtained through questionnaire survey for statistical analysis, and qualitative data is obtained through interview survey for qualitative analysis. The results of multiple linear regression showed that teacher-student interaction ($P < 0.001$, $\beta=0.3643$), student engagement ($P = 0.033$, $\beta=0.1218$), self-efficacy ($P = 0.01$, $\beta=0.1539$), support service ($P < 0.001$, $\beta=0.2095$)had a significant positive correlation with flipped classroom student satisfaction, while adoption intention ($P = 0.115$, $\beta=0.810$) had no significant correlation with satisfaction. At the same time, the paired sample T-test and interview survey results of variable data before and after the strategic plan show that improving the quality of teacher-student interaction and student participation, improving students' self-efficacy, and optimizing learning support services will improve students' satisfaction with flipped classroom learning and improve the actual effect of flipped classroom.

Keywords: Flipped Classroom, Teacher-Student Interaction, Student Engagement, Self-Efficacy, Support Services, Adoption Intention, Student Satisfaction

Introduction

As a brand-new teaching mode, flipped classroom has received widespread attention from educators worldwide and has become a hot topic in the international education field, especially in higher education. Since the large-scale introduction of flipped classrooms in Chinese universities in 2013, certain achievements have been made in reforming teaching methods and improving academic performance. However, currently in China, there is a tendency to approach education from the perspective of educators, The summative assessment of flipped classrooms based on academic performance lacks relevant research on formative assessment of flipped classrooms, and there is insufficient attention to students' actual feelings

and needs in the learning process of flipped courses, which greatly restricts the effectiveness of flipped classroom application and promotion in universities.

As is well known, student satisfaction is one of the core indicators for measuring the formative assessment of flipped classrooms. This is because student satisfaction not only significantly predicts their learning outcomes and intention to continue learning (Kader et al., 2020), but also promotes communication, cooperation, and sharing among students (Ku et al., 2013), which is crucial for the effective implementation of flipped classrooms. Therefore, from the perspective of students, it is particularly necessary to explore the factors and interaction mechanisms that affect student satisfaction in flipped classrooms, and then propose feasible measures to improve student satisfaction.

Through the study of student satisfaction in flipped classroom and its influencing factors, this study aims to understand the actual feelings, attitudes and needs of students in the flipped classroom learning process, and explore the possible problems and shortcomings of current flipped classroom teaching with students as the center and evaluation subject. This study selects teacher-student interaction, student participation, self-efficacy, support services, and adoption intention as the independent variables of the study. At present, the research on the influencing factors of flipped classroom in Chinese Mainland mainly focuses on teacher-student interaction and student participation, and pays less attention to students' self-efficacy, adoption intention, and support services in the learning process. This also reflects from one aspect that in the selection of influencing factors, there is insufficient emphasis on student subjectivity in relevant domestic research.

In this study, 332 undergraduates from a public comprehensive university in Yunnan Province were selected as samples. The students included all grades from freshman to senior and covered a variety of major categories, and they all took a semester of the Fundamentals of Entrepreneurship course, which was conducted through a flipped classroom format. Through SWOT analysis, the following content were further clarified. First, advantages. It mainly includes four aspects:1) New teaching concepts and models;2)Discipline and Major;3)Rich MOOC resources and a comprehensive online learning platform;4)Teaching and research institutions dedicated to innovation and reform ; Second, weakness.1)Lack of corresponding teaching management system;2)Lack of school-based curriculum;3)Students have weak self-directed learning abilities;4)Adaptation of teachers and students to the new teaching mode, Insufficient Academic Atmosphere. Third ,opportunity.1） The attention of the educational circles to teaching reform;2） Policy support from education management departments;3)Continuously improving practical models and theoretical research;4)The continuous enhancement of online learning system functions. Fourth, threat .1) The widening gap between academic performance and personal development level;2) The widening gap between academic performance and personal development level;3) Collaborative learning is just a formality;4) Difficulty in ensuring the systematization of the knowledge acquired by students.

Research Problem

Student satisfaction is one of the core indicators to evaluate the formative evaluation of flipped classroom. The premise of effective application and promotion of flipped classroom in the field of higher education is to improve students' satisfaction level. Identifying the underlying factors of flipped classroom student satisfaction remains an important area of research. Therefore, this survey aims to increase the level of student satisfaction with flipped classroom learning by designing and implementing an appropriate strategic plan to clarify the important impact of teacher-student interaction, student engagement, self-efficacy, support services, and adoption intentions on student satisfaction.

Research Objectives

1. To investigate the impact of teacher-student interaction on student satisfaction.
2. To investigate the impact of student engagement on student satisfaction.
3. To investigate the impact of self-efficacy on student satisfaction.
4. To investigate the impact of support services on student satisfaction.
5. To investigate the impact of adoption intention on student satisfaction.
6. To assess and analyze the current level of teacher-student interaction, student engag ement, self-efficacy, support services, adoption intention and student satisfaction.
7. To design strategic plan based on analysis of current and expected situation of teacher-student interaction, student engagement, self-efficacy, support services, adoption intention and student satisfaction
8. To verify the quality of the strategic plan by interviewing the respondents.

Research Questions

1. To investigate the significant impact of teacher-student interaction on student satisfaction.
2. To investigate the significant impact of student engagement on student satisfaction.
3. To investigate the significant impact of student self-efficacy on student satisfaction.
4. To investigate the significant impact of support services on student satisfaction.
5. To investigate the significant impact of adoption intention on student satisfaction.
6. What are the current and expected levels of teacher-student interaction, student engagement, self-efficacy, support services, adoption intention and student satisfaction?
7. What strategic plan is appropriate based on the results of the analysis of current and expected situation of teacher-student interaction, student engagement, self-efficacy, support services, adoption intention and student satisfaction?
8. To determine the differences in teacher-student interaction, student engagement, self-efficacy, support services, adoption intention with student satisfaction between the pre and post-Strategic Plan phases.

Research Signifiance

1. It helps to understand students' true feelings, attitudes, and needs towards flipped classrooms, identify potential problems and shortcomings in current flipped classroom teaching, and provide practical basis for targeted implementation of flipped classroom teaching in universities, thereby further improving the effectiveness of flipped classroom application in universities.

2. Helps teachers clarify potential problems and their causes in flipped classroom design, promotes teaching reflection, and ultimately achieves more effective flipping.

3. It helps to improve the learning experience of students in flipped classrooms, enhance their satisfaction level, and promote their self-directed and deep learning

Literature Review

According to the object and question of the study, the literature related to teacher-student interaction, student engagement, self-efficacy, support services, adoption intention and student satisfaction was reviewed in order to grasp the connotation, extension and function of the variables, so as to lay a solid foundation for subsequent research.

Student satisfaction

Nasser et al. (2008) defined student satisfaction as the feeling of pleasure or success experienced by students after receiving educational services, that is, after participating in various educational activities. It is a short-term subjective judgment of students on whether the educational services they receive meet their expectations and needs. Wong et al. (2024) argue d that in the context of schooling, satisfaction reflects students' perception and evaluation of the degree of learning support they receive. Satisfaction is based on students' own experience and experience of educational services. Ong and Quek (2023) emphasized that teacher-student interaction has a positive impact on student satisfaction. Weerasinghe and Fernando (2018) point out that student satisfaction is influenced by many aspects of universities. From the macro perspective, it includes the reputation, image and geographical location of universities; from the micro perspective, it involves teachers, service personnel, curriculum quality, environmental facilities and other factors.

Teacher-Student Interaction

Nguyen and Hudson (2010) believed that teacher-student interaction refers to the communication between students and teachers, as well as the process of raising questions, expressing opinions and discussing with each other in class. Pham and Nghiem (2022) point out that in online education, the quality and effectiveness of teacher-student interaction have the most fundamental impact on teachers' teaching satisfaction, which is unmatched by other factors. Aldrup et al. (2022) emphasized that teacher-student interaction plays a very important role in the multiple elements that constitute educational activities. Thornberg et al. (2022)

believed that improving students' classroom participation, creating a good learning atmosphere, and meeting personalized learning needs are the manifestations of high-quality teacher-student interaction. Previous studies also show that good teacher-student interaction plays a significant role in stimulating students' desire to learn, improving students' sense of self-efficacy and leadership (Xiao et al., 2023).

Student Engagement

Engagement refers to the degree to which students invest time, effort, etc., in an activity (Vinson et al., 2010). Fredricks et al. (2019) pointed out that student engagement is a comprehensive concept that involves different aspects of students' emotions, intellect, and actions. Culpeper and Qian (2020) explained student participation from a different perspective, pointing out that student engagement is a variety of learning activities carried out by students under the condition of "teaching" in the process of education. As an important influencing factor, the lower the degree of student engagement, the stronger the sense of academic burnout, and vice versa (Kapoor & Yadav, 2020). From this perspective, student engagement has a significant impact on educational quality and academic achievement (Boulton et al., 2019).

Self-efficacy

Bandura (1997) believed that self-efficacy is an individual's subjective judgment on whether he or she is capable of completing a certain behavioral process and achieving the expected goal O'Connor and Mahony (2023) argued that self-efficacy is an individual's belief in his or her own ability, and in the context of schooling, it is expressed as a student's confidence in learning new materials or completing learning task. The development of generative artificial intelligence, such as ChatGPT, provides a strong support for teaching and learning activities, thus effectively improving the self-efficacy of teachers and students (Bin-Nashwan et al., 2023).On the other hand, the enhancement of self-efficacy is more effective than that of other students. Will also increase the willingness to use ChatGPT (Rudolph et al., 2023).

Support services

The so-called learner support refers to the strategies that can help them fully develop their potential abilities in all aspects (Warrender et al., 2005). Möwes (2010) defined student support as an institution with the function of meeting students' needs an promoting students' development. In the traditional perception, learning support services are mainly the various resources and help provided by schools to students receiving distance education (Lin et al., 2021).Nowadays, with the development of education, parents have also become an important subject in providing learning support services, especially in online education during the COVID-19 pandemic. For students in lower grades, parents' learning support is an important condition to ensure learning effectiveness (Schuck et al., 2021). For students, the learning support services provided by parents can reduce their academic pressure (Hammer et al., 2021). However, studies have shown that most parents fail to do so for various reasons (Dong et al., 2020).

Adoption intention

Ajzen and Fishbein (1975) believe that intention is an individual's subjective judgment about the possibility of completing a certain task. Adoption intentions can be defined as an individual's level of acceptance of a particular thing (Ajzen & Fishbein, 1988). Al-Qirim et al. (2018) believed that learners' intention to adopt technological tools directly determines the effect of technology-based learning. In the online education system, students' adoption intention, perceived interest and other factors are positively correlated with their satisfaction. In order to build a good learning environment in TEL (technology enhanced learning), the first task that researchers need to do is to understand the students' intention to adopt this learning mode (Park, 2009). The quality of information received by students has a significant impact on their adoption intentions. When the information obtained by students through technical learning is accurate, reliable and easy to understand, then their intention to adopt learning technology will increase, and vice versa (Pushkar & Kailash, 2021).

Conceptual Framework

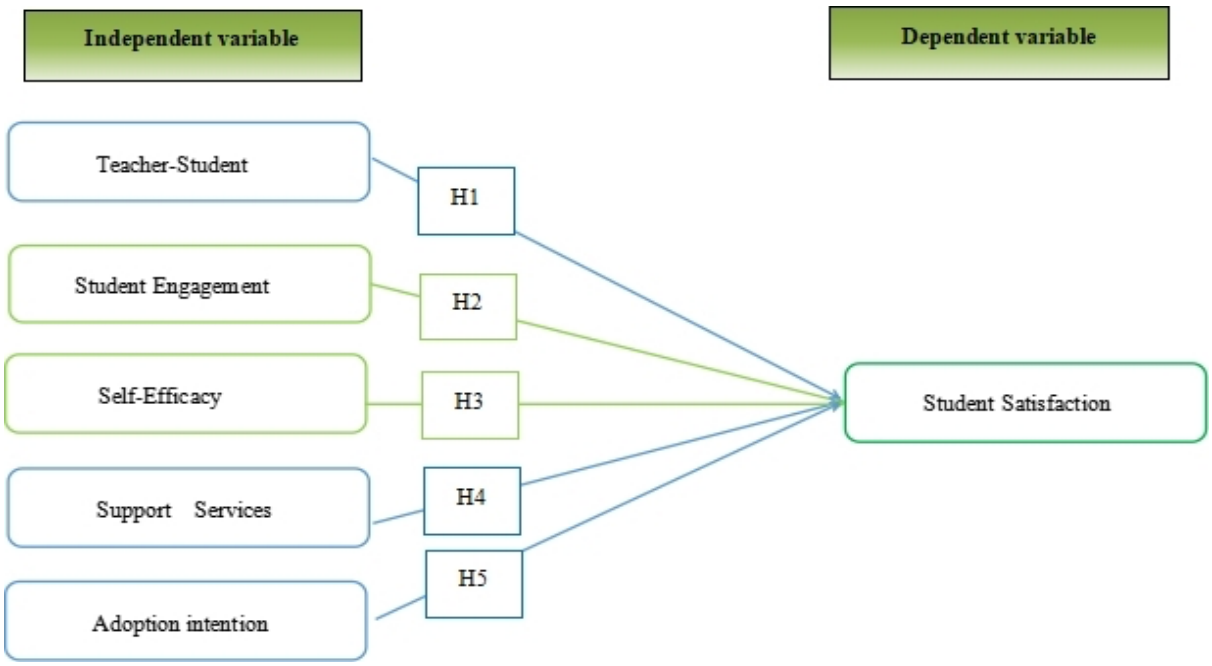
The theoretical framework of this study is based on the American Customer Satisfaction Index theory (ACSI) and the five theoretical frameworks of previous studies. The ACSI index was initially applied to analyze domestic experiences and provide effective basis for the government to formulate economic policies. In recent years, it has also been widely applied in the field of higher education (Fornell et al., 1996). Among the five theoretical frameworks, the first theoretical framework was proposed by Bilal et al. (2021). The researcher investigated the effect of teacher engagement on student satisfaction through a questionnaire survey of 278 teachers and students in Pakistan. The second theoretical framework comes from Gray and DiLoreto (2016) are committed to exploring the relationship between student engagement, course structure, learner interaction, teacher presence, student satisfaction, and student improvement in online education environments. The third theoretical framework was proposed by Maini et al. (2021) . They explored the participation and satisfaction of students in the virtual classroom during the COVID-19 epidemic. The fourth theoretical framework was proposed by Subrahmanyam and Shekhar (2017) . They are committed to exploring the factors that affect student satisfaction and the correlation between student satisfaction, motivation, and loyalty. The fifth theoretical framework comes from Dubey and Sahu (2021) They explored the relationship between students' perceived benefits, adoption intention, and satisfaction with technology reinforcement learning (TEL)

The student-centered teaching model and the flipped classroom emphasize students' active participation and interaction between teachers and students, which puts forward higher requirements for students' learning ability, perseverance and confidence in overcoming learning difficulties, etc. Precisely because of this, the degree and quality of student participation and interaction between teachers and students, the support services students receive during the learning process, as well as their confidence and expectations in overcoming learning difficulties, all have a significant impact on satisfaction. In addition, students'

acceptance and willingness towards the flipped classroom largely influence their attitude, engagement and feelings towards it, as the willingness to adopt it also has a significant impact on students' satisfaction with the flipped classroom. Therefore, these five variables are selected as independent variables. The relationship between the independent variable and the dependent variable is shown in Figure 1.

Figure 1

Conceptual Framework



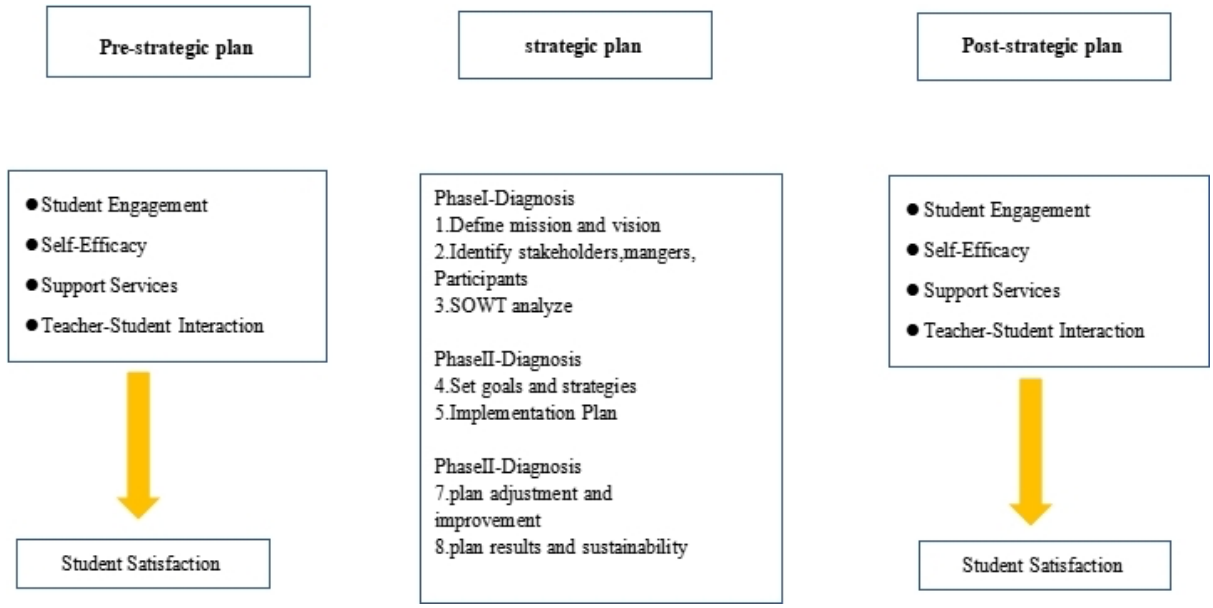
Strategic planning (SP)framework

The SP framework consists of three main phases: pre-SP, SP, and post-SP, as shown in Figure 2. The first stage is pre-strategic planning. The main focus of this phase is to understand the current and real situation of the research object in order to identify areas for change and improvement. First, researcher participated in the flipped classroom teaching process as observer, observing and recording students' reactions, performance and emotional states in the teaching process. Fifteen students were selected for further interviews. Through the qualitative analysis of the observation results and the interview content, the key issues were identified. Secondly, after testing the validity and reliability of the questionnaire, a survey was conducted on all the respondents, namely 332 students Jamovi software was used to conduct multiple linear regression on the questionnaire data to test and revise the conceptual framework. According to the improved conceptual framework, the corresponding strategic planning is formulated and the research hypotheses were formulated. The second stage is the implementation stage of strategic planning. This phase puts the strategic plan into practice and involves the implementation of a series of measures. The third stage is the stage after the

implementation of the strategic plan. This stage mainly adopts quantitative research method, collects data through questionnaire survey, and conducts paired T-test on the data to determine the significance of dependent variables before and after the implementation of the strategic plan and verify the effectiveness of the strategic plan. The strategic plan framework is shown below.

Figure 2

SP Framework



Research Methodology

Research Hypotheses

H1: Teacher-Student interaction has significant impact on Student Satisfaction.

H2: Student Engagement has significant impact on Student Satisfaction.

H3: Self-Efficacy has significant impact on Student Satisfaction.

H4: Support Services has significant impact on Student Satisfaction.

H5: Adoption Intention has significant impact on Student Satisfaction.

H6: There is a significant difference between pre-SP and post SP in terms of teacher-student interaction.

H7: There is a significant difference between pre-SP and post SP in terms of student engagement.

H8: There is a significant difference between pre-SP and post SP in terms of self-efficacy.

H9: There is a significant difference between pre-SP and post SP in terms of support services.

H10: There is a significant difference between pre-SP and post SP in terms of adoption intention.

H11: There is a significant difference between pre-SP and post SP in terms of student satisfaction.

Research Design

This study uses qualitative and quantitative methods to investigate the impact of strategic planning on flipped classroom satisfaction of students in a public university in Yunnan Province. Thirty undergraduate students participated in the strategic plan as an experimental group. Quantitative research collected the relevant data of dependent variables and independent variables before and after the strategic plan, and analyzed it through Jamovi 2.3 software. Qualitative research was conducted by conducting pre - and post-strategic planning interviews with randomly selected experimental group participants.

Population, Sample Size, and Sampling Procedures

This study used cluster random sampling method to randomly select 332 students from 9 classes using flipped classroom teaching in a public university in Yunnan, China as the research subjects. The research subjects include different grades from freshman to senior year, with majors covering multiple disciplines such as literature, management, engineering, science, and art. Please refer to the table 1 for details:

Table 1

Research Population

No.	Class	class size	Sample size
1	Class 1	50	50
2	Class 2	40	40
3	Class 3	32	32
4	Class 4	44	44
5	Class 5	40	40
6	Class 6	31	31
7	Class 7	30	30
8	Class 8	33	33
9	Class 9	32	32
Total		**332**	**332**

Firstly, 30 students were selected for the pilot test to determine the reliability of the questionnaire. Then a questionnaire survey was conducted among 332 sample students. Secondly, 15 students from the experimental group were selected for interview. In order to ensure that every student in the experimental group has the same chance to be selected, exclude subjective influence, and make the sample better represent the whole population, this study

selected the interviewed students from the experimental group through simple random sampling. Thirdly, 30 students were selected from 332 students as the experimental group. In order to ensure that participants can devote enough time, focus and effort in the whole process of strategic planning, this study mainly recruits students with strong willingness and interest to participate in the experimental group. After voluntary registration and screening tests, a total of 30 eligible students joined the experimental group. Finally, a questionnaire survey was conducted again among 30 students who participated in the strategic plan, and 6 of them were randomly selected for interview.

Research Instruments

Design of Questionnaire

The questionnaire of this study is designed on the basis of existing research and consists of three parts. The first part is the population variables, which mainly includes the gender, grade and main categories of the respondents. The aim is to understand the characteristics of the interviewees. The second part consists of the factors influencing student satisfaction, which contains 18 questions and is divided into 5 dimensions: teacher-student interaction (4 questions), student participation (4 questions), self-efficacy (4 questions), support services (3 questions), and adoption intention (3 questions). The third part is student satisfaction, a total of 4 questions. The questionnaire is mainly derived from six published articles, as shown in Table 2.

Table 2

Design of Questionnaire

Category	Variable	No. of items	Sample Questions	Reference
Independent Variables	Teacher-Student Interaction (TS)	4	My teacher encouraged me to become actively involved in the course discussions.	Bilal et al. (2021)
	Student Engagement (SE)	4	I frequently interacted with my instructor of this course.	Julie and Melanie (2016)
	Self-efficacy (SEF)	4	I believe I can achieve the expected learning goals	Fornell et al. (1996)
	Support Services (SSE)	3	Adequate video course resources and services	Subrahmanyam and Shekhar (2017)
	Adoption Intention (AI)	3	I will continue to meet my future needs through flipped learning	Pushkar and Kailash (2021)
Dependent Variables	Student Satisfaction (SS)	4	I am satisfied with the content and topics of the learning materials	Hamad (2016)

IOC Results for Validity Analysis

In accordance with IOC's testing procedures, five experts in the field of education in China were invited to evaluate the questionnaire content. These five experts all have a doctorate degree in education and senior titles, and have been engaged in college education and teaching for a long time. They are able to provide professional comments and suggestions on the contents of the questionnaire. After calculating the expert scores, the average score for all questions in this study was higher than 0.67 (Table 3).

Table 3

IOC Results

Variable	No. of Question	Question	IOC (>0.67)	Outcome
Teacher-Student Interaction (TS)	4	1-4	1.00,1.00,1.00,0.80	pass
Student Engagement (SE)	4	5-8	1.00,1.00,1.00,0.80	pass
Self-efficacy (SEF)	4	9-12	1.00,0.80,1.00,1.00	pass
Support Services (SSE)	3	13-15	1.00,0.80,1.00	pass
Adoption Intention (AI)	3	16-18	1.00,1.00,1.00	pass
Student Satisfaction (SS)	4	19-22	1.00,1.00,0.80,0.80	pass
Total	**22**			

Pilot Test for Reliability Analysis

Thirty undergraduate students who were not included in the sample of the study were selected for the pilot test to test the reliability of the questionnaires. The results showed that all items in the questionnaire passed Cronbach's Alpha internal consistency reliability test, and the Alpha coefficient was above 0.70, as shown in Table 4.

Table 4

Results of Pilot Test

Variable	No. of Question	Question	IOC (>0.67)	Outcome
Teacher-Student Interaction (TS)	4	1-4	1.00,1.00,1.00,0.80	pass
Student Engagement (SE)	4	5-8	1.00,1.00,1.00,0.80	pass
Self-efficacy (SEF)	4	9-12	1.00,0.80,1.00,1.00	pass
Support Services (SSE)	3	13-15	1.00,0.80,1.00	pass
Adoption Intention (AI)	3	16-18	1.00,1.00,1.00	pass
Student Satisfaction (SS)	4	19-22	1.00,1.00,0.80,0.80	pass
Total	**22**			

Interview Instrument

The interview tool of qualitative research includes 7 questions, among which the first two questions are comprehensive, aiming to understand the status quo of flipped classroom

learning of respondents, and the last five questions are aimed to understand the impact of teacher-student interaction, student engagement, self-efficacy, support service and adoption intention on student satisfaction. The interview data is open coded, independently coded according to specific words, phrases and paragraphs in the content. On the basis of cluster analysis, different codes are classified into six topics, namely the status quo of flipped classroom learning and the impact of teacher-student interaction, student engagement, self-efficacy, support services and adoption intention on student satisfaction, and the content of each topic is summarized.

Results and Discussion

Demographic Profile

The experimental group of this study included 30 undergraduates from a public university in Yunnan Provinces and their relevant demographic information is as follows:

Table 5

Demographic Profile

Gender	Frequency	Percentage	Valid Percent	Cumulative
Female	19	63.30	63.30	63.30
Male	11	36.70	36.70	100.00
Total	30	100.00	100.00	

Results of Multiple Linear Regression

The results of multiple linear regression (MLR) analysis based on Jamovi 2.3 show that teacher-student interaction, student participation, self-efficacy and support services significantly affect student satisfaction, while adoption intention and student satisfaction have no significant correlation. As can be seen from Table 6. The four hypotheses H1-H4 are supported, while H5 is not.

Table 6

The Multiple Linear Regression Results of Five Independent Variables（n=332）

Variables	Standardized Coefficients Beta	t	P-value	VIF	R	R Square
Teacher-Student Interaction (TSI)	.3634	6.87	<.001	2.91	.834	.695
Student Engagement (SE)	.1218	2.14	.033	3.37		
Self-efficacy (SFE)	.1539	2.58	.010	3.67		
Support service (SSE)	.2095	3.76	<.001	3.26		
Adoption Intention (AI)	.0810	1.58	.115	2.97		
Dependent Variable: Student Satisfaction (SS)						

It can be seen from the table that, except for the adoption intention, all the P-values are less than 0.05 and the r-square value is 0.695, indicating that the independent variable explains

69.5% of the variation of the dependent variable. According to the standardized regression coefficient β value, the interaction between teachers and students has the highest β value 0.3634, indicating that this dimension has the greatest impact on student satisfaction. In the variance inflation factor (VIF) analysis, the values of all five dimensions are less than 5, indicating that there is no multicollinearity between the independent variables.

H1: Teacher-Student interaction has significant impact on Student Satisfaction. (β=0.3634, P＜0.001)

H2: Student Engagement has significant impact on Student Satisfaction. (β=0.1218, P=0.033)

H3: Self-Efficacy has significant impact on Student Satisfaction. (β=0.1539,P=0.01)

H4: Support Services has significant impact on Student Satisfaction. (β=0.2095,P＜0.001)

Strategic planning phase

According to the results of multiple linear regression analysis, a two-stage strategic plan was designed before and during class, as shown in Figure 3. In both phases, the researchers operated on four variables of teacher-student interaction, student engagement, self-efficacy, and support services. The project lasted for 12 weeks, and 30 students participated in the strategic plan. They were selected from 332 respondents and all of them had a strong willingness to participate in the strategic plan. After the strategic plan was completed, the researcher collected the relevant data of the experimental group members and conducted the paired sample T-test with the corresponding data before the strategic plan. At the same time, 5 students were randomly selected from the experimental group for interview.

Comparison between Pre-SP and Post-sp Quantitative Data

Quantitative Data Analyses Results

The paired sample t-test was used to compare quantitative results on all five variables to identify whether there were any differences between pre-post SP phases.

Table 7

Paired Sample Test Result

Variables		N	Mean	Std. Deviation	t-value	df	p-value
Pair 1	Pre-TSI	30	3.33	0.573	-8.58	29.0	<.001
	Post-TSI	30	4.18	0.382			
Pair 2	Pre-SE	30	3.09	0.551	-10.03	29.0	<.001
	Post-SE	30	4.34	0.391			
Pair 3	Pre-SEF	30	3.00	0.491	-11.51	29.0	<.001
	Post-SEF	30	4.22	0.346			
Pair 4	Pre-SSE	30	3.18	0.617	-8.06	29.0	0.009
	Post-SSE	30	4.22	0.513			

Variables		N	Mean	Std. Deviation	t-value	df	p-value
Pair 5	Pre-AI	30	4.29	0.620	-2.82	29.0	<.001
	Post-AI	30	4.59	0.580			
Pair 6	Pre-SS	30	3.11	0.453	-8.34	29.0	<.001
	Post-SS	30	4.02	0.404			

Table 7 shows that there was a statistically significant disparity in the level of Teacher-Student interaction between the post-SP stage (M=4.18, SD=0.382) and the pre-SP stage (M=3.33, SD=0.573). This difference was supported by a t-value of -8.58, and the p value is less than 0.001. The disparity in means was -0.85. Thus, hypothesis five supported that there is a significant difference in Teacher-Student interaction between the pre- and post-SP stage.

There was a statistically significant disparity in the level of Student Engagement between the post-SP stage (M=4.34, SD=0.391) and the pre-SP stage (M=3.09, SD=0.551). This difference was supported by a t-value of -10.03, and the p value is less than 0.001. The disparity in means was -1.25. Thus, hypothesis five supported that there is a significant difference in Student Engagement between the pre- and post-SP stage.

There was a statistically significant disparity in the level of Self-efficacy between the post-SP stage (M=4.22, SD=0.346) and the pre-SP stage (M=3.00, SD=0.491). This difference was supported by a t-value of -11.51, and the p value is less than 0.001. The disparity in means was -1.22 Thus, hypothesis five supported that there is a significant difference in Self-efficacy between the pre- and post-SP stage.

There was a statistically significant disparity in the level of Support service between the post-SP stage (M=4.59, SD=0.580) and the pre-SP stage (M=4.29, SD=0.620). This difference was supported by a t-value of -8.06, and the p value is less than 0. 001.The disparity in means was -1.04. Thus, hypothesis five supported that there is a significant difference in Support service between the pre- and post-SP stage.

There was a statistically significant disparity in the level of Adoption Intention between the post-SP stage (M=4.59, SD=0.513) and the pre-SP stage (M=4.29, SD=0.617). This difference was supported by a t-value of -2.82, and the p value is 0. 009.The disparity in means was -0.3. Thus, hypothesis five supported that there is a significant difference in Adoption Intention between the pre- and post-SP stage.

There was a statistically significant disparity in the level of Student satisfaction between the post-SP stage (M=4.02, SD=0.404) and the pre-SP stage (M=3.11, SD=0.453). This difference was supported by a t-value of -8.34 and the p value is less than 0.001. The disparity in means was -0.91. Thus, hypothesis five supported that there is a significant difference in Student satisfaction between the pre- and post-SP stage.

The quantitative results above indicated statistically significant differences between the pre-and post-SP stages across all variables. Additionally, the quantitative data supported hypothesis 6-11.

Qualitative Data Analyses Results

Table 8

Comparison of Summary Interview Results between Pre-SP and Post-SP Stages

Interview Questions	Pre-Strategic planning	Post-Strategic planning
	Answer	Answer
Are you willing to take the initiative to answer questions?	Most students' express unwillingness to actively answer questions, but the specific reasons are vague.	Respondents stated that they will actively respond when they know the answer. Some respondents also expressed that even if they are not very clear about the answer, they will give some feedback instead of being silent.
Are you willing to actively ask questions?	Most students are unwilling to ask questions or do not know what to ask. Some students, even if they have questions, are more willing to ask their classmates outside of class.	The interviewees expressed that they would seek advice from the teacher regarding their questions and also raise questions about the content in the classroom.
Does actively participating in the learning process contribute to improving satisfaction?	Almost all students recognize the importance of active participation, but when asked why their level of participation is not high, many students provide vague answers.	Respondents believe that continuous and in-depth involvement in the learning process can help them truly master the course and change their evaluation of the course.
Does teacher-student interaction contribute to improving satisfaction?	The vast majority of students believe that interaction with teachers is very necessary and important, but few students are willing to actively interact with teachers in the classroom.	Respondents said their thinking skills improved and they had fun when they had in-depth discussions with teachers around specific issues
Does self-efficacy contribute to improving satisfaction?	Compared to self-efficacy, students are more familiar with the similar concept of self-confidence. Most of them believe that confidence is a necessary condition for achieving learning success, but in many aspects, they often lack confidence.	Respondents stated that self-efficacy is very important, and when they feel they can complete learning tasks, they will actively participate in the learning process
Does Support service contribute to improving satisfaction?	The majority of respondents agreed that good support services would improve their learning experience, but the specific services were not specified	Most respondents said that "guide plan", "mind map", "independent learning ability cultivation" and so on are important to improve the learning experience
Does Adoption	To this question, most respondents	Respondents said that the level of

Table 8 lists the contents of the interviews before and after SP. It can be seen that there are significant differences in students' cognition and inclination after the strategic plan. From questions 1-6, students understand the concept and role of independent variables, and their learning attitudes and tendencies have significantly changed, which indicates that the strategic plan is effective.

Summary of Data Analyses Results

In summary, the results of quantitative analysis show that the dependent variable and the four independent variables with significant relationship with it are significantly different before and after the strategic plan, which indicates that hypotheses 6, 7, 8, 9 and 11 are supported. In qualitative analysis, interviews gave positive feedback and provided support for quantitative analysis.

Conclusions and Recommendations

Conclusions

This study focuses on the significant effects of teacher-student interaction, student participation, self-efficacy, support services and adoption intention on student satisfaction in flipped classrooms. The conceptual framework of this study is based on the American Customer Satisfaction Index Theory (ACSI) and the five theoretical frameworks of previous studies, which is divided into pre-strategic planning stage, strategic planning stage and post-strategic planning stage. Based on the conceptual framework, 11 hypotheses are proposed to verify the significant influence of independent variables on dependent variables and the effectiveness of intervention methods. As shown in Table 9, in the first stage, we sent questionnaires to the target sample (n=332) for data collection. The target sample was undergraduates from a public university in Yunnan, China. Item-object Congruence (IOC) and pilot tests examine the validity and reliability of research tools before data collection. For the quantitative analysis of data, Jamovi2.3 was used for multiple regression analysis to evaluate H1-H5. In the second phase, a 12-week strategic program was conducted with 30 students. In the third stage, the difference in average scores before and after SP (H5, H6, H7, H8, H9, H11) was compared using the paired sample T-test, and six students were interviewed. The results showed that the 12-week intervention design had a significant positive effect on students' satisfaction with flipped classroom. Qualitative analysis of the interview to a certain extent supplements and strengthens the results of quantitative analysis. Therefore, H5-H11 are verified.

Table 9

Juxtaposed Table of Quantitative and Qualitative Data

Independent Variables	Descriptive Statistical Result			Quantitative Result Based on Multiple Linear Regression and Paired Sample T-Test	Themes From Qualitative Results Based on SP
	Standard	P-Value	Pre-SP Mean		
Teacher-Student Interaction (TSI)	0.382	<.001	33.3	H1 is supported. H6 is supported.	The improvement of the quality of teacher-student improves student satisfaction

Independent Variables	Descriptive Statistical Result			Quantitative Result Based on Multiple Linear Regression and Paired Sample T-Test	Themes From Qualitative Results Based on SP
	Standard	P-Value	Pre-SP Mean		
Student Engagement (SE)	0.551	<.001	3.09	H2 is supported. H7 is supported.	The degree of student participation improves the level of student satisfaction
Self-efficacy (SFE)	0.346	<.001	3.00	H3 is supported. H8 is supported.	Students' self-efficacy is crucial to their satisfaction
Support service (SSE)	0.513	<.001	3.18	H4 is supported. H9 is supported.	Good support services and environment can increase student satisfaction
Adoption Intention (AI)	0.620	.009	4.29	H5 is not supported. H10 is supported.	Students with high adoption intentions also have relatively high satisfaction

Recommendations

To a certain extent, flipped classroom is the practice form of the "student-centered" concept advocated by Dewey in the information age, and technical factors play a very important role in improving the effectiveness of flipped classroom and student satisfaction. On the other hand, the full combination of technical factors and flipped classroom requires a team of teachers who have information literacy and adapt to the requirements of flipped classroom teaching, as well as diversified teaching forms, contextualized teaching processes and diversified evaluation systems adapted to the flipped classroom model. Because of this, this study takes technology, teachers, teaching forms, teaching situations and evaluation system as the most fundamental factors to improve students' satisfaction in flipped classrooms, and discusses them as follows.

Strengthen the application of information technology in flipped classroom. The emergence of flipped classroom is closely related to the development of information technology and its application in education. Therefore, strengthening the application of information technology in flipped classroom is an important link to improve flipped classroom teaching effect and student experience. On the one hand, the network communication platform should be developed according to the learning requirements of flipped classroom. It should be emphasized here that the platforms used in China such as "wechat" and "Dingding" are based on social applications or enterprises, rather than educational applications, and their functions and attributes do not match the requirements of flipped classroom teaching. Therefore, it is necessary to develop a corresponding communication platform according to the characteristics and needs of the education field. On the other hand, it is necessary to improve the intelligence

of technical tools, such as ChatGPT, Deep seek and other tools to realize the intelligence of students' extra-curricular learning, and provide students with learning materials and guidance that are more in line with their individual basis and needs

Accelerate the construction of the teaching staff. The flipped classroom emphasizes student-centeredness, autonomous learning and the individualized development of students. This undoubtedly requires teachers to possess corresponding educational concepts, knowledge and abilities. Therefore, in accordance with the characteristics of the flipped classroom, it is necessary to strengthen teachers' information literacy, enhance their teaching design ability, and build a teaching staff that meets the requirements of flipped classroom teaching.

Explore various forms of classroom teaching. To achieve students' autonomous learning and individualized development, it is necessary to break through the single classroom teaching system and explore diversified classroom teaching forms. Flexibly apply different teaching forms such as the Design teaching method, the Dalton system, and the Trump system to the classroom to enrich the forms and contents of interaction between teachers and students and promote the development of students' individuality.

Enhance the contextualization of the teaching process. Flipped classroom emphasizes the acquisition and internalization of knowledge through problem discussion. In order to enable students to discuss problems more effectively, it is necessary to place problems in a specific context, in which the background and reasons of the problems are included and the key clues to solve the problems are hidden. Only in this way can students' thinking is enhanced and obtain effective support, and the discussion of problems can continue to deepen along a certain track, so as to make knowledge acquisition and thinking development possible. In this study, case teaching method was mainly used to present specific problem situations for students, and have received good results.

Form a diversified evaluation system different from the traditional classroom which focuses on the final evaluation. Flipped classroom should form a diversified evaluation system. On the one hand, emphasis is placed on diagnostic evaluation and process evaluation. The former can help teachers understand students' learning situation and existing foundation, so as to provide a realistic basis for the design of teaching process. The latter can stimulate students' learning motivation and promote the development of students. On the other hand, it is necessary to establish a growth portfolio and take the development and change of students in a certain period of time as the basis for evaluation, so as to make the evaluation more scientific and objective.

This study is based on the American customer satisfaction theory, combined with the characteristics of flipped classroom and related research, constructs a conceptual framework, and adopts a combination of qualitative and quantitative research methods to explore. In terms of practical contribution, this study has formed a brand-new theoretical framework to explain student satisfaction in flipped classroom, which provides reference for other related and similar studies. Meanwhile, the theoretical framework, strategic plan and relevant suggestions and measures of this study provide an explanatory framework and practical path for improving student satisfaction in flipped classroom. It is helpful to promote the application and promotion

of flipped classroom in the field of higher education.

Limitation and Future Study

This study has some limitations and needs further exploration in the future.

First of all, due to the insufficient knowledge reserve of researchers in the field of educational technology, the depth of exploration and discussion in technical support and service is insufficient, and the effect of the proposed measures is limited. Future studies need to further explore the path of combining technology and flipped classroom, especially the application of artificial intelligence in flipped classroom, and explore the feasible model of "AI+ flipped classroom".

Secondly, this study mainly studies the flipped classroom teaching process of "Foundation of Entrepreneurship" course and lacks comparison and exploration of the teaching process of different types of courses, which may lead to insufficient generalization of research conclusions and suggested measures. The next research should strengthen the comparative study on the teaching process of different types of courses and students' satisfaction. In particular, it focuses on the comparative study between science and engineering courses and humanities courses in the process of applying flipped classroom.

Thirdly, the independent variables in this study are mainly set around the teaching process, but the factors outside the teaching process, such as teaching management, course types, teaching facilities and equipment, are not paid enough attention. These factors also play an important role in students' learning experience and satisfaction. Therefore, it is necessary to further expand and adjust the types of independent variables in future studies, so as to have a more comprehensive understanding of the factors and interaction mechanism affecting students' satisfaction in flipped classrooms.

Finally, the students who participated in the strategic plan were highly voluntary, and this particular sample attribute made them unrepresentative of the population as a whole. At the same time, due to objective reasons, the duration of this study is short, which may lead to incomplete data collection. All these problems restrict the generalization of research conclusions to a certain extent. In the future, the atmosphere of students participating in the strategic plan will be further expanded, and the research time will be extended to enhance the generalization of the research conclusions.

References

Ajzen, I., & Fishbein, M. (1975). A Bayesian analysis of attribution processes. *Psychological Bulletin, 82*(2), 261-277. https://doi.org/10.1037/h0076477

Ajzen, I., & Fishbein, M. (1988). Theory of reasoned action-theory of planned behavior. *University of South Florida, 20*(7), 67-98.

Aldrup, K., Carstensen, B., & Klusmann, U. (2022). Is empathy the key to effective teaching?. A systematic review of its association with teacher-student interactions and student Outcomes. *Educational Psychology Review, 34*(3).

Al-Qirim, N., Rouibah, K., Tarhini, A., Serhani, M. A., Yammahi, A. R., & Yammahi, M. A. (2018). Towards a personality understanding of information technology students and their IT learning in UAE university. *Education and Information Technologies, 23*(1), 29-40.

Bandura, A. (1997). Self-efficacy: the Exercise of Control, Freeman, New York. behavior: the moderating role of cross-cultural factors. *Journal of International Consumer Marketing, 35*(2), 1-19.

Bilal, A. R., Fatima, T., Bin Dost, K., & Imran, M. K. (2021). I am engaged; therefore, my students are satisfied! Unleashing the role of teachers' interaction and sensitivity based on self-determination perspective. *International Journal of Educational Management, 35*(1), 341-361.

Bin-Nashwan, S. A., Sadallah, M., & Bouteraa, M. (2023). Use of ChatGPT in academia: academic integrity hangs in the balance. *Technology in Society, 75*(10), 23-27

Boulton, C. A., Hughes, E., Kent, C., Smith, J. R., & Williams, H. T. P. (2019). Student engagement and wellbeing over time at a higher education institution. *PLoS One, 14*(11), 22-37.

Culpeper, J., & Qian, K. (2020). Communicative styles, rapport, and student engagement: an online peer mentoring scheme. *Applied Linguistics, 41*(5),756-786.

Dong, C., Cao, S., & Li, H. (2020). Young children's online learning during COVID-19 pandemic: chinese parents' beliefs and attitude*s. Children and Youth Services Review, 11*(8), 10-15.

Dubey, P., & Sahu, K. K. (2021). Students' perceived benefits, adoption intention and satisfaction to technology-enhanced learning: Examining the relationships. *Journal of Research in Innovative Teaching & Learning, 14*(3), 310-328.

Fornell, C., Johnson, M. D., Anderson, E. W., Cha, j., & Bryant, B. E. (1996). The American customer satisfaction index: nature, purpose, and findings. T*he Journal of Marketing, 60*(4), 7.

Fredricks, J. A., Reschly, A. L., & Christenson, S. L. (2019). Interventions for student engagement: overview and state of the field. *Handbook of Student Engagement Interventions, Academic Press, 15*(6),1-11.

Gray, J. A., & DiLoreto, M. (2016). The effects of student engagement, student satisfaction, and perceived learning in online learning environments. *International Journal of Educational Leadership Preparation, 11*(1), 98-119.

Hamad, R., & Rehkopf, D. H. (2016). Poverty and Child Development: A Longitudinal Study of the Impact of the Earnted Income Tax Credit. *American Journal of Epidemiology, 183*, 775-784. https://doi.org/10.1093/aje/kwv317

Hammer, M., Scheiter, K., & Sturmer, K. (2021). New technology, new role of parents: how parents' beliefs and behavior affect students' digital media self-efficacy. *Computer in Human Behaviour, 116*(4), 10-16. doi: 10.1016/j.chb.2020.106642.

Julie, A. G., & DiLotero, M. (2016). The Effects of Student Engagement, Student Satisfaction, and Perceived Learning in Online Learning Environments. *NCPEA International Journal of Educational Leadership Preparation, 11,* 1-20.

Kader, M. A. R. A., Aziz, N. N. A., & Dangi, M. R. M. (2020). Mediating effects of English proficiency on the association between religiosity commitment, study habits, self-study concept, and perceived stress. *Humanities and Social Sciences Reviews, 8*(5), 219-232.

Kapoor, V., & Yadav, J. (2020). Impact of resilience on academic burnout-student engagement relationship: an empirical study. *International Journal of Advance Science and Technology, 29*(10), 6475-6487.

Ku, H.-Y., Tseng, H. W., & Akarasriwor, C. (2013). Collaboration factors, teamwork satisfaction.and student attitudes toward online collaborative learning. *Computers in Human Behavior, 29*(3), 922-929.

Lin, C. L., Jin, Y. Q., Zhao, Q., Yu, S. W., & Su, Y. S. (2021). Factors influence students switching behavior to online learning under COVID-19 pandemic: a push-pull-mooring model Perspective. *Asia-Pacific Education Researcher, 30*(3), 229-245.

Maini, R., Sehgal, S., & Agrawal, G. (2021). Today's digital natives: An exploratory study on students' engagement and satisfaction towards virtual classes amid COVID-19 pandemic. *The International Journal of Information and Learning Technology, 38*(5), 454-472.

Möwes, D. L. (2010). *Implementing best practice: Student support model at the Polytechnic of Namibia's centre of open and lifelong learning*. The NADEOSA conference, North-West University, Potchefstroom, South Africa.

Nasser, R. N., Khoury, B., & Abouchedid, K. (2008). University students' knowledge of services and programs in relation to satisfaction: A case study of a private university in Lebanon. *Quality Assurance in Education, 16*(1), 80-97.

Nguyen, H. T. M., & Hudson, P. (2010). Preservice EFL teachers' attitudes, needs, and experiences about teaching writing and learning to teach writing before their practicum: A case study in Vietnam. *The Asian EFL Journal Quarterly, 12*(2), 43-67.

O'Connor, Y., & Mahony, C. (2023). Exploring the impact of augmented reality on student academic self-efficacy in higher education. *Computers in Human Behavior, 149*(10), 63-79.

Ong, S. G. T., & Quek, G. C. L. (2023). Enhancing teacher–student interactions and student online engagement in an online learning environment. *Learning Environments Research, 26*(3),681-707.

Park, S. Y. (2009). An analysis of the technology acceptance model in understanding university students' behavioral intention to use e-learning. *Educational Technology and Society, 1*(3), 150-162.

Pham, T. N., & Nghiem, V. H. (2022). Online teaching satisfaction amid the covid-19 pandemic: Predicting students'intention to continue online learning post-COVID-19 pandemic: extension of the unified theory f acceptance and usage technology. *Journal of Applied Research in Higher Education,15*(3), 681-697.

Pushkar, D., & Kailash, K. S. (2021). Investigating various factors that affect students' adoption intention to technology-enhanced learning. *Education, 4*(7), 41-44.

Rudolph, J., Tan, S., & Tan, S. (2023). ChatGPT: bullshit spewer or the end of traditionalassessments in higher education?. *Journal of Applied Learning and Teaching, 6*(1), 34-38.

Schuck, R. K., Lambert, R., & Wang, M. (2021). Collaborating with parents during COVID-19 online teaching: special educator perspectives. *Education, 3*(13), 3-14.

Subrahmanyam, A., & Shekhar, B. R. (2017). Where do you find loyalty in the contemporary university scene?.*Journal of Applied Research in Higher Education, 9*(3), 443-465.

Thornberg, R., Forsberg, C., Hammar Chiriac, E., & Bjereld, Y. (2022). Teacher–student relationship quality and student engagement: a sequential explanatory mixed-methods study. *Research Papers in Education, 37*(6), 840-859.

Vinson, D., Nixon, S., Walsh, B., Walker, C., Mitchell, E., & Zaitseva, E. (2010). Investigating the relationship between student engagement and transition. *Active Learning in Higher Education, 11*(2), 131-143.

Warrender, A., Birkhead, C., Harper, F., Crawley, J., Cartwright, M., Llyod, P., Kendall, P., Barker, P., Hewlett, R., & Columpus, S. (2005). Providing effective learner support for part-time learners. *WCLSRNL Support, 6*(2), 11-14.

Weerasinghe, I. M. S., & Fernando, R. L. S. (2018). Critical factors affecting students' satisfaction with higher education in Sri Lanka. *Quality Assurance in Education, 26*(1), 115-130.

Wong, Z. Y., Liem, G. A. D., Chan, M., & Datu, J. A. D. (2024). Student engagement and its association with academic achievement and subjective well-being: a systematic review and meta-analysis. *Journal of Educational Psychology, 116*(1), 48-75.

Xiao, M., Tian, Z., & Xu, W. (2023). Impact of teacher-student interaction on students' classroom well-being under online education environment. *Education and Information Technologies, 28*(11), 1-23.