pISSN: 1906 - 3296 © 2020 AU-GSB e-Journal.
eISSN: 2773 - 868x © 2021 AU-GSB e-Journal.
https://assumptionjournal.au.edu/index.php/AU-GSB

Determinants of Learning Outcomes in Flipped Classrooms at a University, Yunnan, China

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Received: August 12, 2024. Revised: September 4, 2024. Accepted: February 22, 2025.

Abstract

Purpose: This study aims to investigate the effects of independent variables—such as student engagement, learning motivation, student-instructor interaction, self-efficacy, and social media usage—on the dependent variable of learning performance within a flipped classroom context. Additionally, the study seeks to develop a practical model to enhance students' learning performance in flipped classrooms. **Research design, data, and methodology:** Data for this study were collected through a questionnaire survey. The reliability and validity of the questionnaire were confirmed through the Index of Item-Objective Congruence (IOC) and Cronbach's Alpha, based on a pilot test with 30 participants. Multiple linear regression analysis (MLR) was conducted on data from 118 undergraduates at a University in Yunnan Province to determine the significance of the relationships between the variables. Following this analysis, a strategic plan (SP) was implemented with a group of 30 students over 14 weeks, and a paired sample T-test was conducted on pre- and post-SP data. **Results:** The multiple linear regression analysis revealed that student engagement, learning motivation, student-instructor interaction, and self-efficacy significantly impacted learning performance, while social media usage did not. The paired sample T-test showed significant differences in learning performance between the pre-SP and post-SP stages, suggesting that the strategic plan was effective. **Conclusions:** Interventions aimed at enhancing student engagement, learning motivation, student-instructor interaction, and self-efficacy in a flipped classroom setting can significantly improve students' learning performance.

Keywords: Flipped Classroom, Learning Performance, Higher Education, China

JEL Classification Code: I23, J28, L2

1. Introduction

Around 2013, Chinese universities began widely adopting the flipped classroom model as a key initiative in educational reform. However, due to its late introduction and a lack of substantial research, the implementation of flipped classrooms in domestic institutions often remains at the level of basic imitation, which significantly hampers its effectiveness and broader adoption. Universities in Yunnan Province, being part of an underdeveloped frontier region in China, encounter several challenges in promoting flipped classrooms. These challenges include limited availability of online video resources, low information technology literacy among teachers and students, and insufficient collaborative and self-directed learning skills among students. These issues contribute to the inefficiency and misalignment of flipped classroom teaching, which not only fails to enhance teaching quality but also negatively impacts students' learning performance. Therefore, it is crucial to explore the factors affecting learning performance in flipped classrooms and to develop a practical model that can effectively enhance learning outcomes.

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2. Literature Review

2.1 Learning Performance

Singh and Sarkar (2015) defined learning performance as the extent to which learning goals are achieved, often measured by changes in an individual's knowledge, skills, and attitudes—a definition widely accepted by many scholars. When examining factors related to learning performance, the most commonly explored variables include personal motivation, self-efficacy, learning style, and teaching methods or techniques. Building on previous research, the independent variables identified as influencing learning performance in this study are student engagement, learning motivation, student-instructor interaction, self-efficacy, and social media usage.

2.2 Student Engagement

Astin introduced the concept of student engagement in 1984, defining it as the combination of physical and intellectual effort that students devote to educational activities. Effective engagement not only influences learning performance but also enhances students' comprehension of knowledge. Increased student engagement leads to a deeper understanding of content, greater skill mastery, and improved overall learning outcomes (Martin et al., 2018). Therefore, we propose the following hypothesis:
H1: Student engagement has a significant impact on learning performance.

2.3 Learning Motivation

The concept of learning motivation was initially introduced by Bandura in 1994, who identified it as being influenced by three action-related factors: goal orientation, effort level, and persistence. Since learning motivation impacts the strategies, students use and their commitment to acquiring knowledge and skills, those with higher motivation are more likely to gain extensive knowledge and skills (Blumenfeld et al., 2006; Nguyen et al., 2008).
H2: Learning motivation has a significant impact on learning performance.

2.4 Student -Instructor Interaction

Nguyen and Nguyen (2010) suggest that student-instructor interaction goes beyond simple exchanges between students and teachers; it also encompasses the process where students ask questions, engage in discussions, and express their opinions during instruction. Schneider and Preckel (2017) highlighted that online interaction is a key component of online learning, positively influencing learning performance through increased engagement. Based on this, we propose the following hypothesis:
H3: Student-Instructor interaction has a significant impact on learning performance.

2.5 Self-efficacy

Bandura (1989) defined self-efficacy as an individual's belief in their ability to successfully execute a specific behavior and achieve a desired outcome. Roick and Ringeisen (2017) observed that students with high self-efficacy experience less test anxiety and tend to perform better academically compared to those who are uncertain about their abilities. Based on this, we propose the following hypothesis:
Bottom of Form
H4: Self-efficacy has a significant impact on learning performance.

2.6 Social Media Usage

Ellison and Boyd (2013) highlight that, from a functional perspective, social media serves as a platform for sharing personal information, networking, and content distribution. Utilizing social media to blend social interaction, leisure, and learning can enhance the connections between students and teachers, as well as among students, making these interactions more multidimensional and diverse. This integration is expected to positively influence student engagement and learning performance during the educational process (Galvin & Greenhow, 2019, 2020; Siemens & Weller, 2011). Therefore, we propose the following hypothesis:Top of Form
Bottom of Form
H5: Social media usage has a significant impact on learning performance.

3. Research Methods and Materials

3.1 Research Framework

This research is based on Biggs' 3P learning model (2003) as its primary theory. It utilizes three theoretical frameworks: Song et al. (2022), Trang et al. (2010), and Lee and Lee (2018). These three frameworks collectively support and enhance the conceptual framework illustrated in Figure 1.

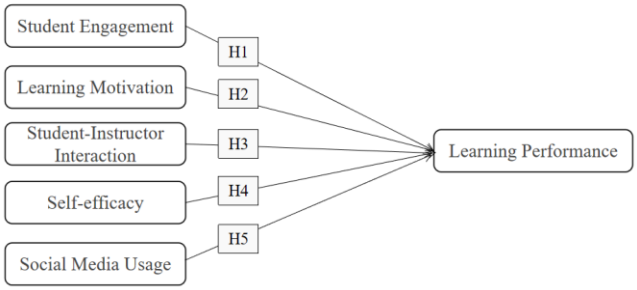

Figure 1: Conceptual Framework

H1: Student engagement has a significant impact on learning performance.
H2: Learning motivation has a significant impact on learning performance.
H3: Student-Instructor interaction has a significant impact on learning performance.
H4: Self-efficacy has a significant impact on learning performance.
H5: Social media usage has a significant impact on learning performance.

3.2 Research Methodology

This study employs both quantitative and qualitative research methods, utilizing questionnaires for data collection, and is organized into four phases. Phase 1 involves distributing validated and reliable questionnaires to the target population (n=118) to gather data for the proposed conceptual framework. All hypotheses are subsequently tested using multiple linear regression. Phase 2 entails conducting pre-strategic planning surveys on the same target population (n=118) based on the supported hypotheses. Phase 3 involves implementing a strategic plan with 30 students participating in flipped classrooms. Phase 4 includes observing, interviewing, and surveying the same 30 students involved in the strategic plan. A paired sample T-test is performed on the questionnaire data to compare the pre-strategic planning and post-strategic planning stages, addressing the research questions and hypotheses outlined earlier.

3.3. Research Population, Sample Size, and Sampling Procedures

3.3.1 Research Population

The subjects of this research paper are two classes of students at a University in Yunnan Province, China, enrolled in the course "Educational Knowledge and Ability." These students are from various academic years, ranging from first to fourth year, and they major in fields such as sports, English, Thai, dance, secretarial studies, computer science, and others. Typically, each class consists of approximately 60 students, resulting in a total of 118 students across both classes, which constitute the research population for this study.

3.3.2 Sample size

Hair et al. (2010) recommended that the sample size for many studies should range from 30 to 500. In line with this research practice, 30 questionnaires were utilized in the initial diagnostic step to assess their reliability, while the sample size for multiple linear regression analysis was set at 80. During the intervention implementation phase, 30 students were chosen as participants. In the post-intervention stage, these 30 students will undergo testing.

3.3.3 Sampling Procedures

This study employed cluster sampling for the questionnaire. Two classes with comparable majors, grade distributions, and scores were selected during the educational knowledge and ability course. The questionnaire was distributed to 118 students via the Questionnaire Star app. The findings from the questionnaire will inform the development of subsequent interventions.

3.4. Research Instruments

3.4.1 Design of Questionnaire

The questionnaire was developed as a vital measurement tool for action research, drawing on references from previous studies. It was informed by relevant research on factors influencing student learning performance, including student engagement, learning motivation, student-instructor interaction, self-efficacy, and social media usage. The questions were validated using the index of item-objective congruence (IOC).

The questionnaire is divided into three sections. The first section addresses the characteristics of the respondents, utilizing a classification scale that includes gender and grade category, allowing respondents to select answers that reflect their individual traits.

3.4.2. Components of Questionnaire

The second section concentrates on factors affecting students' learning performance. It was modified and tailored based on prior studies and the content of this research. This section contains 21 questions divided into five dimensions: student engagement (3 questions), learning motivation (3 questions), student-instructor interaction (3 questions), self-efficacy (4 questions), and social media usage (4 questions). The third section pertains to learning performance,

comprising four questions derived from the research of Young et al. (2003).

3.4.3 IOC Results

Validity refers to how effectively a tool or method measures what it is intended to measure. It assesses both the validity of the data collected through the questionnaire and the appropriateness of the questions formulated based on social science theories and concepts. There are various approaches to testing validity, and this study employed content validity, considering the research background and related factors. Content validity serves as a quality measure that evaluates whether the questionnaire addresses all relevant issues that need to be assessed (Bollen, 1989). Ensuring high content quality guarantees that the appropriate elements are incorporated into the questionnaire design, data collection, and evaluation of survey results. This study utilized the objective agreement index (IOC) for validity assessment and invited three foreign experts to evaluate the questionnaire. All five experts hold doctorates in education and have extensive experience in teaching and educational management, enabling them to provide informed judgment on the questionnaire. The mean scores for all questions in this study exceeded 0.67.

3.4.4 Pilot survey and Pilot test results

In this study, a Pilot Test was conducted to evaluate the reliability of the questionnaire. Cronbach (1951) first introduced the method for limited-range reliability testing, known as Cronbach's Alpha (CA). Internal consistency, as described by Hair et al. (2017), offers a reliable estimate of the relationship among items within the same variable. Reliability is a crucial factor in the effective selection of questionnaire design (Bolarinwa, 2015). According to Sekaran (1992), an acceptable alpha coefficient should be greater than or equal to 0.60.

Table 1: Pilot Test Result

Variables	No. of items	Sources	Cronbach's Alpha	Strength of association
Learning Performance	4	Singh and Sarkar (2015)	0.912	Excellent
Student Engagement	3	Astin (1984)	0.946	Excellent
Learning Motivation	3	Bandura (1994)	0.901	Excellent
Student-Instructor Interaction	3	Nguyen and Nguyen (2010)	0.912	Excellent
Self-efficacy	4	Bandura (1989)	0.908	Excellent
Social Media Usage	4	Ellison and Boyd (2013)	0.896	Good

4. Results and Discussion

4.1 Results

4.1.1 Demographic Profile

The researcher presented the demographic profile of the entire research population (n=117) who participated in the self-development plan, as detailed in Table 2.

Table 2: Demographic Profile

Entire Research Population (n=117)		Frequency	Percent
Gender	Male	36	30.8%
	Female	81	69.2%
Age	One	67	57.3%
	Two	44	37.6%
	Three	6	5.1%
	Four	0	0%

4.1.2 Results of multiple linear regression

The relationship between four independent variables and the dependent variable, learning performance, was analyzed using multiple linear regression in Jamovi. The significance tests revealed that all four P-values were less than 0.05, indicating that these independent variables significantly impacted the dependent variable. However, one P-value was greater than 0.05, suggesting that one independent variable did not significantly affect learning performance. The R-squared value was 0.776, indicating that the independent variables explain 77.6% of the variance in the dependent variable. Among the five independent variables, three were positively correlated with learning performance, while two were negatively correlated. The absolute P-values for student engagement, learning motivation, student-instructor interaction, and self-efficacy were higher than that for social media usage, statistically demonstrating that the first four variables have a greater influence on learning performance.

Table 3: The multiple linear regression of five independent variables on learning performance

Variables	Standardized Coefficients Beta value	t-value	p-value	R	R^2
Student Engagement	.602	3.795	<.001	.881	0.776
Learning Motivation	-.417	-3.208	.002		
Student - Instructor Interaction	.463	4.815	<.001		
Self-efficacy	.328	2.797	.007		

Variables	Standardized Coefficients Beta value	t-value	p-value	R	R^2
Social Media Usage	-.117	-1.189	.238		

Note: p-value <0.05*, p-value <0.001**

Multiple linear regression verified the hypothesis. The following finalized research hypotheses are associated with changes in the respective variables of interventional reinforcement.

H6: There is a significant mean difference in Student Engagement between Pre-SP and Post-SP stages.

H7: There is a significant mean difference in Learning Motivation between the Pre-SP and Post-SP stages.

H8: There is a significant mean difference in Student-Instructor Interaction between Pre-SP and Post-SP stages.

H9: There is a significant mean difference in Self-efficacy between Pre-SP and Post-SP stages.

H10: There is a significant mean difference in learning performance between Pre-SP and Post-SP stages.

4.2 Self-development Plan Intervention Stage

The comprehensive design of the SP phase was completed over 14 weeks. The SP plan outlines the schedule and location, the participants involved, the goals and tools for the intervention, and the specific activities to be undertaken.

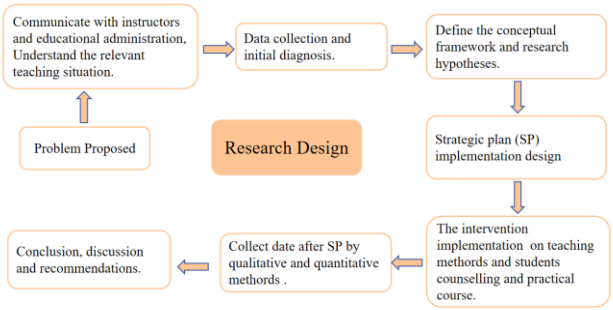

Figure 2: Research Design

4.3 Results Comparison between Pre-IDI and Post-IDI

Table 4 answers research question 8, "Are there differences in student engagement, learning motivation, student-instructor interaction, self-efficacy, and social media usage and learning performance before and after the strategic plan?" Because there was no correlation between social media usage and learning performance in this study, social media usage was not included in the strategic plan.

Table 4: Paired-Sample T-Test Results

Variables	Mean	SD	t-value	p-value
Student Engagement				
Pre-SP	2.94	0.411	-2.48	<.001
Post-SP	4.14	0.408		
Learning Motivation				
Pre-SP	2.89	0.404	-2.15	<.001
Post-SP	3.99	0.415		
Student -Instructor Interaction				
Pre-SP	2.91	0.410	-1.80	<.001
Post-SP	3.97	0.458		
Self-efficacy				
Pre-SP	2.97	0.434	-.2.47	<.001
Post-SP	4.11	0.352		
Learning Performance				
Pre-SP	3.04	0.148	-3.33	0.002**
Post-SP	4.12	0.320		

The independent variable of student engagement showed post-SP (M=4.14, SD=0.408) and pre-SP (M=2.94, SD=0.411) values, with P<0.001. The mean difference between the later and earlier periods was 1.47, indicating a significant mean difference in student engagement before and after SP. For the independent variable of learning motivation, the post-SP stage recorded a mean of 3.99 (SD=0.415) compared to 2.89 (SD=0.404) in the pre-SP stage, with P<0.001 and a mean difference of 1.10. This demonstrates a significant mean difference in learning motivation before and after SP. In terms of student-instructor interaction, the post-SP mean was 3.97 (SD=0.458) while the pre-SP mean was 2.91 (SD=0.410), with P<0.001 and a mean difference of 1.06, indicating a significant mean difference before and after SP. For self-efficacy, the post-SP mean was 4.11 (SD=0.352) and the pre-SP mean was 2.97 (SD=0.434), with P<0.001 and a mean difference of 1.14, showing a significant mean difference before and after SP. Lastly, the dependent variable of learning performance had a post-SP mean of 4.12 (SD=0.320) and a pre-SP mean of 3.04 (SD=0.148), with P<0.001 and a mean difference of 1.08, indicating a significant mean difference in learning performance before and after SP.

Based on the results of the paired sample T-tests, there are significant differences in student engagement, learning motivation, student-instructor interaction, self-efficacy, and learning performance before and after the implementation of the strategic plan.

5. Conclusions, Recommendations and Limitations

5.1 Conclusions & Discussions

Building on previous studies, the researchers developed a conceptual framework that includes five independent variables: student engagement, learning motivation, student-instructor interaction, self-efficacy, and social media usage, along with one dependent variable, learning performance. Data was collected using both quantitative and qualitative research methods through questionnaires. The reliability and validity of the questionnaire were assessed, and the results met the research requirements. Multiple linear regression analysis was conducted on the 118 valid questionnaires collected, revealing that four of the independent variables showed significant correlations with the dependent variable, while social media usage did not. Following this, 30 subjects participated in a 14-week strategic planning activity, and a paired sample t-test was performed on the post-implementation data to evaluate the effectiveness of the strategic plan. Based on these findings, the research results are summarized, and relevant countermeasures and recommendations are proposed.Top of Form

The strategic plan developed by the researcher comprises five modules: support for learning resources, improvement of teaching methods, enhancement of learning abilities, a peer assistance system, and the use of feedback technology. According to the research findings, the strategic plan implemented in this study can positively influence the independent variables in various ways, ultimately enhancing learning performance. Thus, the strategic plan is considered valuable. However, there are challenges and difficulties associated with its implementation. Firstly, there are higher expectations for teachers' teaching abilities and skills. Secondly, to facilitate student learning, teachers must provide additional learning resources, which may increase their workload and potentially diminish their enthusiasm for implementing the strategic plan. Thirdly, gamified teaching strategies could negatively impact classroom instruction. Finally, improving students' learning abilities is a gradual process that cannot be achieved overnight; it requires time and resources, which may increase the overall costs of implementing the strategic plan. These challenges can be addressed through appropriate methods and strategies.

In conclusion, the strategic plan outlined in this study can enhance students' learning performance and holds significant potential for widespread application.

5.2 Recommendations

The results indicate that the strategic plan implemented in this study positively influences students' learning performance. The following suggestions will be offered across five areas:

First, it is essential to promote teacher professional development. Teachers should continuously update their educational philosophies, enhance their proficiency in using modern educational technology, and strengthen their training in teaching skills such as questioning, providing feedback, guiding students, and evaluating performance.

Second, it is important to cultivate students' multifaceted learning abilities. This includes improving students' self-directed learning skills, their ability to articulate and summarize problems, and their capacity for reflection and evaluation.

Third, fostering a positive relationship between teachers and students is crucial. Teachers should show care and respect for their students, encourage open expression, value students' perspectives, create a relaxed learning environment, and promote student participation.

Fourth, enhancing technical support is vital. The integration of information technology is a key feature of the flipped classroom model, so teachers should actively provide high-quality online learning resources to support students' self-study. Additionally, there should be a focus on utilizing online learning platforms to expand opportunities for interaction between teachers and students.

Fifth, it is necessary to reform the evaluation of learning performance. Moving away from traditional summative assessments based solely on paper-and-pencil tests, evaluations should combine process assessment with summative assessment to foster students' holistic development.

5.3 Limitations for Future Research

First, regarding sample size and demographics, this study primarily focused on a specific group of undergraduate students at Yunnan X University. Future research should aim to diversify the sample by including students from various schools, educational backgrounds, cultural contexts, and age groups to assess the generalizability of the findings.

Second, concerning the number and content of variables, this study emphasizes five independent variables and one dependent variable, focusing more on the "learning" aspects of students and less on the "teaching" aspects of instructors. Future studies could investigate additional independent variables and their content to provide a more comprehensive understanding of the factors influencing the dependent variable, learning performance.

Finally, regarding research methods, while quantitative approaches can objectively and accurately describe and analyze the relationships between variables, they often overlook the "emotion," "value," and "meaning" behind the data or models. Therefore, future research should also incorporate qualitative analysis to enhance understanding.

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