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# Effects of the Flipped Classroom Model on the Learning Achievement and Communication Skills of Vocational College Students in Logistics Management

**Xu Shenglin[1], Angkana Karanyathikul[2] and Sombat Kotchasit[3]**

[1]Master student, Curriculum and Instruction Program, Valaya Alongkron Rajabhat University under the Royal Patronage, Pathum Thani Province, Thailand

[2,3]Lecturer, Curriculum and Instruction Program, Valaya Alongkron Rajabhat University under the Royal Patronage, Pathum Thani Province, Thailand

E-mail: 764511530@qq.com, ORCID ID: https://orcid.org/0009-0003-5541-5094

E-mail: angkana@vru.ac.th, ORCID ID: https://orcid.org/0009-0008-6288-6923

E-mail: Sombat @vru.ac.th, ORCID ID: https://orcid.org/0000-0001-8145-6170

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## Abstract

**Background and Aims**: China's logistics market is expanding annually, and vocational education reform continues to deepen. Traditional teaching models have limitations in improving students' academic performance and communication skills. This research examines first-year logistics management students at Guangxi Vocational & Technical College of Industry to investigate the effects of flipped classrooms on their academic performance and communication skills.

**Methodology:** This study employed a one-group pretest-posttest design. The study selected a sample of 50 first-year logistics management students from an initial population of 200 through cluster random sampling. The instructional intervention included a pre-test before, a post-test after, and eight lesson plans totaling 16 instructional hours. Communication skills were assessed using a communication ability evaluation paper, while learning achievement was measured with a learning ability evaluation paper. Data were analyzed using paired-sample t-tests and one-sample t-tests.

**Results:** The post-test mean scores of learning achievement (M = 77.70, SD = 17.33) and communication skills (M = 38.68, SD = 3.67) were significantly higher than the pre-test scores (learning achievement: M = 48.60, SD = 8.51; communication skills: M = 22.54, SD = 4.55) at the .01 level. Both post-test means significantly exceeded the predetermined 70% criterion.

**Conclusion:** The flipped classroom significantly improves vocational students' learning achievement and communication skills. By promoting active learning, peer interaction, and higher-order thinking, this model supports both cognitive development and communication competence. The findings provide empirical support for applying student-centered and constructivist approaches in vocational education contexts.

**Keywords**: Flipped Classroom; Vocational Education; Logistics Management; Learning Chievement; Communication Skills



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## Introduction

With the rapid transformation of China's logistics industry, higher vocational education is facing increasing pressure to cultivate technically skilled professionals who can adapt to evolving job demands. The launch of the Action Plan for Effectively Reducing Overall Social Logistics Costs reflects this transformation, aiming to improve logistics efficiency and enhance industrial competitiveness. Industrial upgrading has further intensified the demand for technically applied talents. According to predictions from the China Federation of Logistics and Purchasing, by 2025, emerging positions such as intelligent dispatching algorithm engineers and drone operators are expected to face significant talent shortages.

Although policy documents such as the Opinions on Promoting the High-Quality Development of Modern Vocational Education emphasize deepening teaching reform and promoting industry–education integration, numerous practical challenges remain. Shi Weiping and Fan Qiyin (2025) argue that vocational institutions still face difficulties in achieving close alignment between educational content and industry demands, thereby limiting the improvement of students' employability. Wang Ningning and Xu Wei (2024) further point out that curriculum design in higher vocational education lacks rationality, and instructional practices need greater effectiveness and influence.

At the student level, logistics management majors in higher vocational colleges mainly come from two groups: graduates from general high schools and graduates from secondary vocational schools. The former usually have relatively strong academic foundations but lack systematic vocational skills training, while the latter possess certain practical skills but relatively weaker theoretical understanding. Overall, higher vocational students tend to have limited abilities in abstract conceptual understanding, despite showing strengths in hands-on operational skills. Drawing on the theory of the zone of proximal development, Ruan Zhigang et al. (2019) emphasize that instructional design in vocational education should align with students' cognitive development patterns in order to enhance learning effectiveness.

In addition to professional competencies, logistics management students must also possess strong communication skills in real workplace contexts. They are required to coordinate with drivers, forklift operators, suppliers, and other stakeholders, often within complex and even cross-cultural environments. However, traditional lecture-based teaching remains teacher-centered and primarily focused on knowledge transmission. Under this approach, classroom activities provide limited opportunities for knowledge application, collaborative learning, and communication practice. Although such methods may strengthen logical reasoning and memorization skills, they are less conducive to the development of critical thinking, innovation, and teamwork abilities, which are essential for communication development. Li & Yang (2018) demonstrated through a



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controlled experiment that the flipped classroom model can effectively improve students' communication skills and professional competencies.

Since 2012, the flipped classroom has been widely researched and implemented in China. By shifting basic knowledge acquisition to pre-class self-directed learning and allocating in-class time to interaction and collaborative problem-solving, the flipped classroom restructures the traditional teaching process. Peng & Peng (2024) noted that this model provides students with increased opportunities for peer support and collaborative learning, thereby fostering communication skills and problem-solving abilities. Bergmann and Sams (2012) emphasized that the flipped classroom transforms teachers from knowledge transmitters into facilitators of learning, enabling more targeted guidance and timely feedback. Wu Zhenghong (2015) found that in vocational education contexts, the flipped classroom can not only improve academic achievement but also enhance students' communication abilities.

Although previous studies have yielded valuable findings, empirical research that simultaneously examines both learning achievement and communication skills in higher vocational logistics management courses remains relatively limited. Therefore, this study takes first-year logistics management students at Guangxi Polytechnic of Industry and Technology as the research subjects and introduces the flipped classroom model to explore its effects on students' academic achievement and communication skills within the context of vocational education.

## Objectives

1) To compare the learning achievement and communication skills of vocational college students in logistics management before and after learning through the flipped classroom model.

2) To compare post-intervention learning achievement with a predetermined criterion of 70% of the total score.

3) To compare post-intervention communication skills with a predetermined criterion of 70% of the total score.

## Literature Review

### 1. Flipped Classroom Model

Bergmann and Sams (2012) proposed that the flipped classroom reconstructs the mode of learning by shifting the process of knowledge transmission from inside the classroom to outside the classroom. Students complete the absorption of knowledge through self-directed learning activities such as watching instructional videos and reading materials, while classroom time is devoted to activities such as scenario-based teaching and rapid question-and-answer to help



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students develop higher-level cognition. The proposal of this teaching model represents a subversion of the traditional teaching model and subsequently triggered a surge of research on the flipped classroom. Their work places greater emphasis on the reconstruction of the learning structure, but does not elaborate on how specific classroom activities influence learning.

Bishop and Verleger (2013) further identified the characteristics of the flipped classroom. First, students are able to control their own learning pace, for example by replaying instructional videos multiple times. Second, students engage in interactive learning in the classroom, which is consistent with constructivist learning theory and can help learners achieve deeper levels of cognition. In China, Zhang et al. (2012) systematically summarized the key elements of the flipped classroom, including teacher role positioning, personalized learning spaces, instructional videos, and classroom activities, providing a comprehensive and multidimensional presentation of the components of the flipped classroom. This study helps to develop a systematic understanding of the concept of the flipped classroom.

In terms of practice, Chen Yujie (2024) conducted an experimental study in senior high school English teaching and found that when implementing the flipped classroom, it is necessary to clearly determine whether students have truly understood the core knowledge before engaging in higher-level learning activities in class. The results also demonstrated that the flipped classroom can improve students' academic achievement. Li & Yang (2018) investigated the impact of the flipped classroom on students' communication abilities and found significant improvements in aspects such as establishing harmonious relationships and listening skills.

Overall, existing research on the flipped classroom has developed across three main dimensions: conceptual definition, component construction, and effectiveness verification. However, studies that simultaneously examine higher vocational students' academic achievement and communication ability remain relatively limited, indicating the need for more detailed research.

**2. Communication Skills**

In this study, communication ability is regarded as an outcome variable that can be changed through instructional intervention. Communication is an important concept in both daily life and academic discussions, and scholars from different fields have defined communication in different ways. For example, Weaver (1949) described communication as a process by which one person's mind influences another through the transmission of information. Hovland et al. (1953) argued that communication is the transmission of stimuli intended to influence others' behavior. Other scholars, such as Gode and Andersen, viewed communication as an interactive process through which individuals achieve mutual understanding. The above definitions of communication proposed by scholars from different fields emphasize different aspects, with some focusing on



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the interactive process and others on the outcomes of influence, but they lack a clear specification of the concrete components of communication.

Zhang (2003) proposed a triadic structural model of communication ability, dividing communication ability into communication skills, communication cognition, and communication disposition. Zhuo Chengxia (2005) constructed a model composed of six elements: sender and receiver, message, channel, noise, feedback, and environment. The theories proposed by these two scholars further clarify the various constituent elements of communication. The above models provide a theoretical basis for instructional design and the development of behavioral observation rubrics

**3. Learning Achievement**

In this study, learning achievement is defined as the level to which students achieve cognitive learning objectives in the logistics management course, and it is quantified through a final examination. According to the model of school learning proposed by Carroll (1963), instructional quality influences learning processes and is ultimately reflected in students' learning achievement; therefore, learning achievement can be used as an important outcome variable for evaluating teaching effectiveness. This theory establishes the rationality of using learning achievement as an outcome measure. The latest revised version of Bloom's cognitive learning theory was proposed by Anderson and Krathwohl (2001). This theory categorizes cognition into different hierarchical levels, with course objectives and test items corresponding to different levels, and learning achievement reflecting the level of cognitive attainment at those levels. This provides support for using final written examination scores to evaluate the effectiveness of course teaching in this study

**4. Related Research**

The flipped classroom has been continuously practiced both domestically and internationally. van Alten et al. (2019) systematically examined more than 100 studies on the flipped classroom since 2006 and concluded that the flipped classroom has a slight effect on learning achievement. At the same time, they pointed out that different teaching activities, such as the arrangement of in-class activities and assessment methods, can influence the effectiveness of the flipped classroom. This study provides insights into the design characteristics of the flipped classroom and demonstrates its effectiveness, thereby supporting the application of the flipped classroom. Srelan et al. (2020) conducted a comprehensive analysis of studies at the higher education level. By analyzing 198 studies from various disciplines, they concluded that, compared with traditional teaching methods, the flipped classroom improved learning achievement by approximately 0.5 standard deviations, demonstrating its positive effect on learning achievement. At the same time, the authors also noted that teachers' personal characteristics have a significant



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influence on the successful implementation of the flipped classroom. This study provides theoretical support for the instructional design of the present research. In China, Li & Yang (2018) conducted a controlled experiment with 360 students and found that adopting the flipped classroom teaching model can have a positive impact on students' communication ability.

The above studies indicate that the flipped classroom has already exerted a wide influence both domestically and internationally, and that some scholars have explored its relationship with communication ability and learning achievement. However, research on the effects of the flipped classroom on both learning achievement and communication ability in higher vocational logistics management courses remains insufficient; therefore, it is necessary to conduct this study.

**5. Integrative Theoretical Framework**

The present study examines the effects of the flipped classroom model on two outcome variables: learning achievement and communication skills. Rather than treating these outcomes independently, this study integrates constructivist learning theory, cognitive learning theory, and communication competence theory to explain how the flipped classroom may simultaneously influence both domains.

From the perspective of constructivist learning theory, knowledge is actively constructed through social interaction and meaningful engagement. The flipped classroom restructures instructional time by shifting basic knowledge acquisition to the pre-class stage and allocating in-class time to collaborative problem-solving, discussion, and scenario-based activities (Bergmann & Sams, 2012). This structure encourages active participation and interaction, creating a learning environment consistent with constructivist principles.

In terms of cognitive development, the flipped classroom aligns with the revised Bloom's taxonomy (Anderson & Krathwohl, 2001). Pre-class learning materials allow students to complete lower-order cognitive processes such as remembering and understanding at their own pace. Classroom time is then devoted to higher-order cognitive activities, including applying, analyzing, and evaluating. According to Carroll's (1963) model of school learning, effective use of learning time and instructional quality directly influence learning achievement. Therefore, the flipped classroom provides structural conditions that may enhance students' academic performance.

Simultaneously, communication competence theory emphasizes that communication skills develop through repeated practice, feedback, and interactive engagement (Zhang, 2003; Zhuo, 2005). The interactive classroom activities embedded in the flipped classroom—such as group discussion, role-playing, and collaborative tasks—offer authentic contexts for communication practice. Through these activities, students refine message expression, feedback processing, and interpersonal coordination, thereby strengthening communication competence.



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Taken together, these theoretical perspectives suggest that the flipped classroom model provides both cognitive and social mechanisms that support improvements in learning achievement and communication skills. Based on this integrated framework, the present study empirically examines whether implementing the flipped classroom model leads to significant improvements in these two outcome variables among vocational logistics management students.

## Conceptual Framework

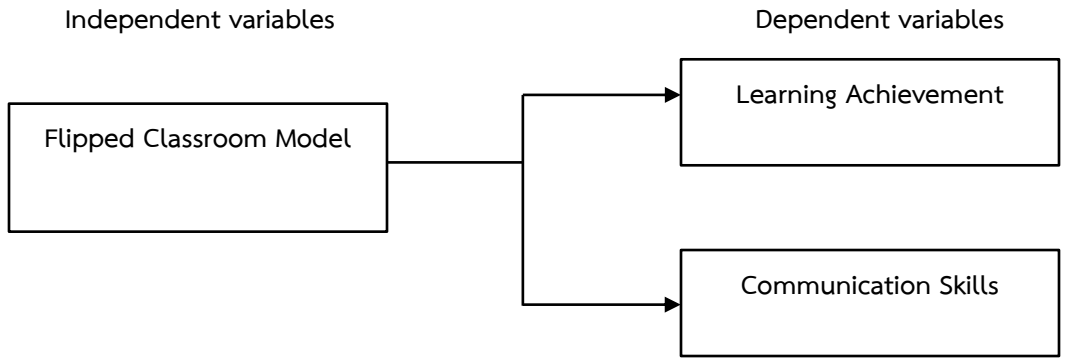



**Figure 1** Conceptual Framework

## Methodology

In the research, the following actions were taken.

### Sample

Participants were 50 first-year logistics management students selected through cluster random sampling from a total population of 200 students at Guangxi Vocational and Technical Institute of Technology. The population consisted of four intact classes. One class was randomly selected as the experimental group to ensure natural classroom settings were maintained. All students in the selected class participated in the study. There were no exclusion criteria, and participation was based on normal class enrollment. This sampling approach was adopted to preserve instructional authenticity and minimize disruption to regular teaching arrangements.

### Research Design

This study employed a one-group pretest–posttest design to examine the effects of the flipped classroom model on students' learning achievement and communication skills.

### Instruments:

1. Lesson Plans: Eight validated lesson plans structured around flipped classroom principles. All items of the lesson plan were evaluated at high to very high levels



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2. Learning Achievement Test: A 100-point multiple-choice test assessing knowledge recall, understanding, application, and analysis. Item Objective Congruence (IOC) ranged from 0.6 to 1.00. The reliability coefficient was 0.76

3. Communication Skills Evaluation Form: A 50-point instrument assessing appropriateness and effectiveness in communication. Item Objective Congruence (IOC) ranged from 0.6 to 1.00. The reliability coefficient was 0.93

**Procedures:**

Pre-test administration using learning achievement and communication skills tests. Implementation of the flipped classroom intervention over 16 hours. Post-test administration using the same instruments.

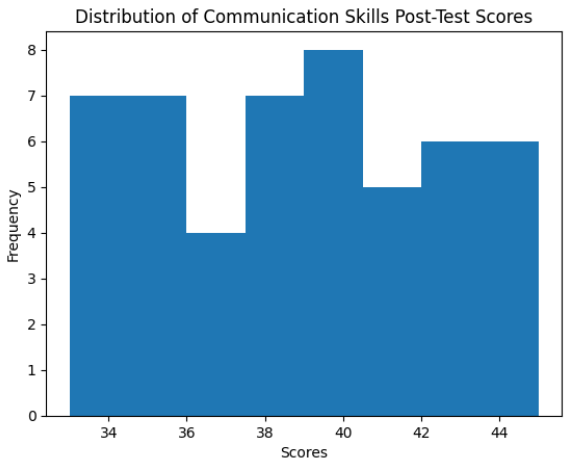
**Data analyzed**

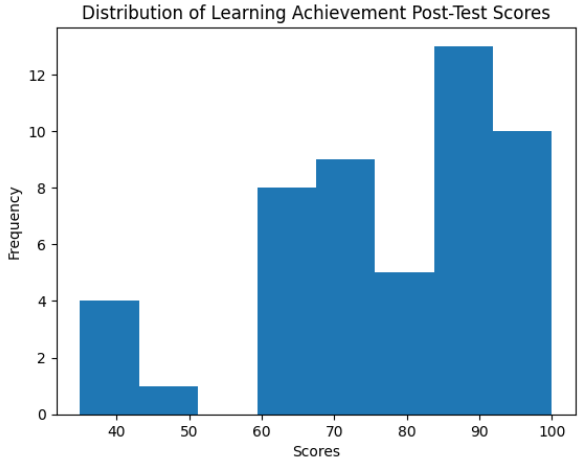
Paired-sample t-tests were used to compare pretest and posttest scores, and one-sample t-tests were used to compare posttest scores with the predetermined criterion.

## Result

### 1. Distribution Analysis

Distribution analyses were conducted to examine the normality assumption. For communication skills (N = 50), the mean was 38.68 (SD = 3.67), with negligible skewness (0.020) and slight platykurtosis (−1.060). For learning achievement (N = 50), the mean was 77.70 (SD = 17.33), with moderate negative skewness (−0.745) and near-normal kurtosis (−0.106).




Although Shapiro–Wilk tests indicated statistical deviations from normality for both variables (communication skills: W = 0.949, p = .030; learning achievement: W = 0.925, p = .004), histogram inspection revealed no substantial departures from symmetry. Given the sample size (N = 50) and



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the robustness of parametric procedures, paired-sample and one-sample t-tests were deemed appropriate.

2. Compare the learning achievement and communication skills of vocational college students in logistics management before and after learning through the flipped classroom model.

**Table 1** The results of comparing the communication skills of vocational college students in the logistics management major before and after learning through the flipped classroom model

| Group | Full scores | n | Pretest scores | | Post-test scores | | *t* | *p* |
|---|---|---|---|---|---|---|---|---|
| | | | *M* | *SD* | *M* | *SD* | | |
| Experimental group | 50 | 50 | 22.54 | 4.69 | 38.68 | 4.02 | 17.95 | .000 |

Post-test scores (M = 38.68, SD = 4.02) were significantly higher than pre-test scores (M = 22.54, SD = 4.69), $t_{49} = 17.95$, $p < .01$.

**Table 2** The results of comparing learning achievement of vocational college in logistics management major before and after learning through the flipped classroom model

| Group | Full scores | n | Pretest scores | | Post-test scores | | *t* | *p* |
|---|---|---|---|---|---|---|---|---|
| | | | *M* | *SD* | *M* | *SD* | | |
| Experimental group | 100 | 50 | 48.60 | 8.51 | 77.70 | 17.33 | 12.84 | .000 |

Post-test scores (*M* = 77.70 *SD* = 17.33) were significantly higher than pre-test scores (*M* = 48.6, *SD* = 8.51), $t_{49} = 12.84$, $p < .01$.

3. Compare post-intervention learning achievement and communication skills with a predetermined criterion of 70% of the total score.

**Table 3** The results of the comparison of communication skills of vocational college in logistics management major after learning through flipped classroom with the determined criterion of 70 percent of score.(Full score = 50)

| Group | n | criterion score | *M* | *SD* | *t* | *p* |
|---|---|---|---|---|---|---|
| Experimental group | 50 | 35 | 38.68 | 3.67 | 7.10 | .000 |



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The post-test mean also significantly exceeded the 70% criterion ($t_{49}$ = 7.10, $p$ < .01).

**Table 4** The results of comparing the mean score of learning achievement of students after learning through the flipped classroom model with the determined criterion set at 70 percent of full scores.

| Group | n | criterion score | *M* | *SD* | *t* | *p* |
|---|---|---|---|---|---|---|
| Experimental group | 50 | 70 | 77.7 | 17.33 | 3.14 | .0028 |

The post-test mean also significantly exceeded the 70% criterion ($t_{49}$ = 3.14, $p$ < .01).

## Discussion

This study examined the effects of the flipped classroom model on learning achievement and communication skills among vocational logistics management students. The findings indicate statistically significant improvements, demonstrating both statistical and practical effectiveness of the flipped classroom model. These results suggest that the flipped classroom model can function as an effective instructional strategy in vocational education contexts.

With regard to learning achievement, the observed improvement may be explained by the instructional restructuring inherent in the flipped classroom model. According to Carroll's (1963) model of school learning, effective use of instructional time and instructional quality are central determinants of academic performance. In this study, foundational knowledge acquisition was shifted to the pre-class stage, allowing students to regulate their learning pace and review materials as needed. Classroom time was then devoted to higher-order cognitive activities such as application and analysis, which aligns with the revised Bloom's taxonomy (Anderson & Krathwohl, 2001). This structured alignment between cognitive levels and instructional activities may account for the improvement in academic performance, consistent with previous meta-analytic findings (van Alten et al., 2019; Strelan et al., 2020).

In terms of communication skills, the flipped classroom emphasized interaction, collaboration, and scenario-based activities. Communication competence develops through practice, feedback, and social engagement (Zhang, 2003; Zhuo, 2005). The interactive classroom environment provided repeated opportunities for message expression, feedback processing, and interpersonal coordination. Compared with traditional teacher-centered instruction, the student-



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centered structure of the flipped classroom appears more conducive to communication development, supporting findings reported by Li & Yang (2018).

However, several factors should be considered when interpreting these results. First, improvements may partially reflect testing familiarity effects, as students completed similar assessment formats in both pre-test and post-test stages. Increased familiarity with test structure or question types could have contributed to performance gains, independent of instructional impact.

Second, the effectiveness of the flipped classroom may have been influenced by instructor-related factors. The teacher's experience, enthusiasm, classroom management skills, and familiarity with flipped instructional strategies likely played a role in shaping student engagement and learning outcomes. Therefore, the observed effects may not solely reflect the instructional model itself, but also the quality of its implementation.

Third, the findings should be understood within specific boundary conditions. The intervention was implemented in a logistics management course characterized by practical and workplace-oriented content. The effectiveness of the flipped classroom may vary depending on subject matter, student academic readiness, institutional support, and cultural context. As Deslauriers et al. (2019) noted, active learning approaches do not uniformly produce superior outcomes across all settings. Thus, the success of the flipped classroom depends on contextual alignment between instructional design, learner characteristics, and course objectives.

Overall, the present findings provide empirical support for the use of the flipped classroom in vocational logistics education, while also highlighting the importance of implementation quality and contextual factors.

**Research Limitations**

Several limitations should be acknowledged. First, the one-group pretest–posttest design without a control group limits causal inference. Improvements may be partially attributable to natural academic progression or testing familiarity. Future research should adopt randomized controlled designs to strengthen causal claims.

Second, the sample was drawn from a single vocational institution with a relatively small sample size, which may limit generalizability. Expanding the study to multiple institutions and diverse student populations would enhance external validity.

Third, the intervention duration was limited to 16 instructional hours. Longitudinal research is needed to determine whether the observed improvements are sustained over time.

Finally, the study relied primarily on quantitative instruments. Although reliability and validity indices were acceptable, incorporating qualitative data—such as classroom observations



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or student interviews—would provide deeper insight into learning processes and interaction dynamics.

## Recommendation

### Recommendations for practice

1. The flipped classroom should be integrated into course instruction as a long-term teaching model. Teachers should make full use of their individual teaching strengths and ensure teaching quality through collaborative learning, formative assessment, and timely feedback.

2. Classroom teaching should place greater emphasis on students' active learning. Course activities should focus on higher-order cognitive tasks such as case analysis and scenario-based simulations.

### Recommendations for future research

1. Future studies may further explore the underlying mechanisms through which the flipped classroom influences learning achievement and communication skills by integrating constructivist learning theory, cognitive learning theory, and related theoretical perspectives

2. Given the limited sample size of the present study, future research may expand the sample size and further refine the measurement instruments for assessing the effects of the flipped classroom on learning achievement and communication skills.

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