

Instructional Design Using Constructivism and Blended Learning Approach to Enhance the Problem–Solving Ability of Undergraduate Students in China

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Abstract

The purposes of this research were the following: 1) to study the current state and problems in the problem–solving ability of first–year undergraduate students in China, and 2) to develop an instructional model using constructivism and a blended learning approach to enhance the problem–solving ability of undergraduate students in China. This study used a sequential mixed–methods approach, employing semi–structured interviews with five teachers who taught the “Situation and Policy Course” and questionnaires administered to 320 first–year undergraduates from Hebei Academy of Fine Arts and Hebei University of Communications, selected through purposive sampling. Interview data were analyzed using thematic content analysis, while quantitative data were analyzed using descriptive statistics. The research results showed as follows: 1) Students had problems combining theoretical knowledge with practical applications and lacked analytical and strategic planning skills. Current assessment practices focused primarily on memorization. However, students reported that blended learning had contributed to increased motivation, engagement, and flexibility. They also proposed the inclusion of group–based learning and diverse learning resources to improve skills for practical problem–solving. 2) The researchers used the findings to design an instructional model using constructivism and a blended learning approach. The instructional model consisted of six components: the introduction to the model, theoretical foundations, principles, objectives, procedures, and measurement and assessment. The procedures were divided into three phases with six steps: self–directed learning, group task preparation, group presentation, interactive discussion,

peer/teacher feedback, and homework and reflexive learning. This model was verified by five experts, with an IOC of 0.8–1.0 and an average appropriateness of 4.35, which was interpreted as a high level of suitability. According to expert recommendations, this model was revised to improve student-centered learning principles, flexibility, and orientation. Ultimately, these results support the effective development of real-world problem-solving skills.

Keywords: Constructivism; Blended Learning Approach; Problem-Solving Ability; Instructional Model

Introduction

Many Chinese students still have difficulty applying theoretical knowledge to real-life situations. This is primarily due to an educational system that prioritizes teacher-centered learning and rote memorization, limiting opportunities for students to acquire critical thinking and problem-solving techniques (Tan, 2016). In addition, existing studies have indicated that although Chinese higher education reforms emphasize competency-based learning, instructional practices remain misaligned with these goals, creating a research gap regarding how learning models can effectively enhance students' problem-solving skills. Traditional teaching approaches are no longer effective in meeting learners' diverse needs and the core competencies required in the twenty-first century.

Constructivism, which emphasizes that learning is an active and contextualized process in which students construct new knowledge based on prior experiences and social interactions, is increasingly included in educational design to address these issues. This theory supports 21st-century learning needs by promoting authentic learning tasks, inquiry, problem solving, and collaborative knowledge construction, rather than examinations. It also promotes learning models such as research-based learning, problem-based learning, and cooperative learning to strengthen critical thinking, deepen understanding, and increase student participation (Nurhuda et al., 2023). However, in many Chinese universities, instruction still relies heavily on lectures and summative assessments, with limited opportunities for collaborative or technology-enhanced learning. First-year undergraduate students were selected as the target group because this stage is crucial for forming foundational academic skills, including analytical thinking and problem-solving, yet evidence shows they have limited exposure to interactive and student-centered learning environments. Furthermore, Hebei Academy of Fine Arts and Hebei University of Communications were chosen because both institutions have recently shifted toward blended learning reforms but

still face challenges in implementing learner-centered pedagogies, making them suitable research settings for model development.

Additionally, it is critical to incorporate technology into lessons that support active learning, particularly through blended learning. Blended learning increases students' engagement and flexibility. According to Lai et al. (2023), blended learning raises academic achievement and motivation. Pozzi et al. (2023) further found that the integration of digital resources enhances comprehension and knowledge retention. Therefore, to improve Chinese students' problem-solving abilities, this study aims to develop an instructional model integrating constructivism and blended learning. The model emphasizes technology integration, collaborative learning, and learner engagement, ensuring alignment with 21st-century competencies and contemporary educational practices.

Research Objectives

1. To study the current situation and problems of problem-solving ability of first-year undergraduate students in China.
2. To develop an instructional model using constructivism and blended learning approach to enhance the problem-solving ability of undergraduate students in China.

Literature Review

Constructivism

Constructivism assumes that students actively generate knowledge and understanding of the world by thinking and experiencing things. The main concept of this approach is that students should not only learn the facts that teachers have taught them, but also ensure that they construct new knowledge from existing conceptual framework conditions. This approach highlights how important the environment, culture and learner background are when creating the learning process. Research findings show that constructivist strategies promote the delivery of tasks in the real world and motivate students to participate in the learning process (Brown & Campione, 1994; Vygotsky, 1978) These principles have a major impact on the educational approach, particularly in the way teachers teach and interact with students.

Blended Learning Approach

Blended learning approach combines traditional personal educational interactions with digital teaching and learning techniques. This approach promotes flexibility and access to greater

choice of educational resources by using the benefits of both virtual and physical learning environments. Over time, blended learning has been shown to improve learning outcomes due to higher training locations and speeds. According to Bonk and Graham (2006) this approach increases student motivation and commitment, while simultaneously supporting many educational strategies that meet a variety of learning needs and styles. It also promotes many independent interactions for teacher students to improve academic achievement.

Constructivism and Blended Learning Approach

Constructivism and blended learning share core principles in promoting active and learner-centered instruction. Constructivism highlights knowledge construction through experience, interaction, and reflection, while blended learning integrates digital and face-to-face environments to enhance flexibility and engagement. Both approaches support collaboration, inquiry, and authentic tasks, enabling students to connect theoretical concepts with real-world applications. Prior studies (Brown & Campione, 1994; Vygotsky, 1978; Bonk & Graham, 2006) show that integrating these approaches increases motivation, deepens understanding, and strengthens higher-order problem-solving skills in university learners. These combined principles form the foundation of the six-step instructional process developed in this study, consisting of: Step 1: Self-directed learning with scaffolding and Step 2: Collaborative task preparation (Pre-class); Step 3: Interactive group discussions, Step 4: Presentation of collaborative results, and Step 5: Evaluation and feedback (In-class); and Step 6: Homework and reflection (Post-class).

Problem-Solving Ability of Undergraduate Students in China

Chinese problem-solving skills have been a central focus of educational research because they indicate how well-prepared students are for the demands of the global economy. However, many Chinese students still struggle to apply theoretical understanding to real-world issues due to the predominant use of lecture-based teaching methods in higher education. According to Zhao et al. (2021), such traditional practices often limit opportunities for higher order learning and intellectual engagement, which are essential for developing effective problem-solving skills. Their study found that effective teaching practices and constructive feedback play critical roles in fostering student engagement and enhancing creative problem-solving ability. Consequently, recent educational reforms in China have promoted more interactive, student-centered learning strategies to better cultivate these competencies.

Conceptual Framework

The conceptual framework was synthesized from key principles of constructivism and the blended learning approach, drawing on foundational theories and prior research (Brown & Campione, 1994; Vygotsky, 1978; Bonk & Graham, 2006). These sources informed the six core principles, which emphasize active knowledge construction, real-world application, learner diversity, flexible digital-physical learning environments, logical reasoning, and collaborative participation. Based on these principles and the empirical findings from interviews and student questionnaires, the teaching process was refined into six steps. The steps were organized into pre-class, in-class, and post-class phases to align constructivist learning processes with blended learning environments and to support the development of problem-solving skills in undergraduate students, as shown in Figure 1.

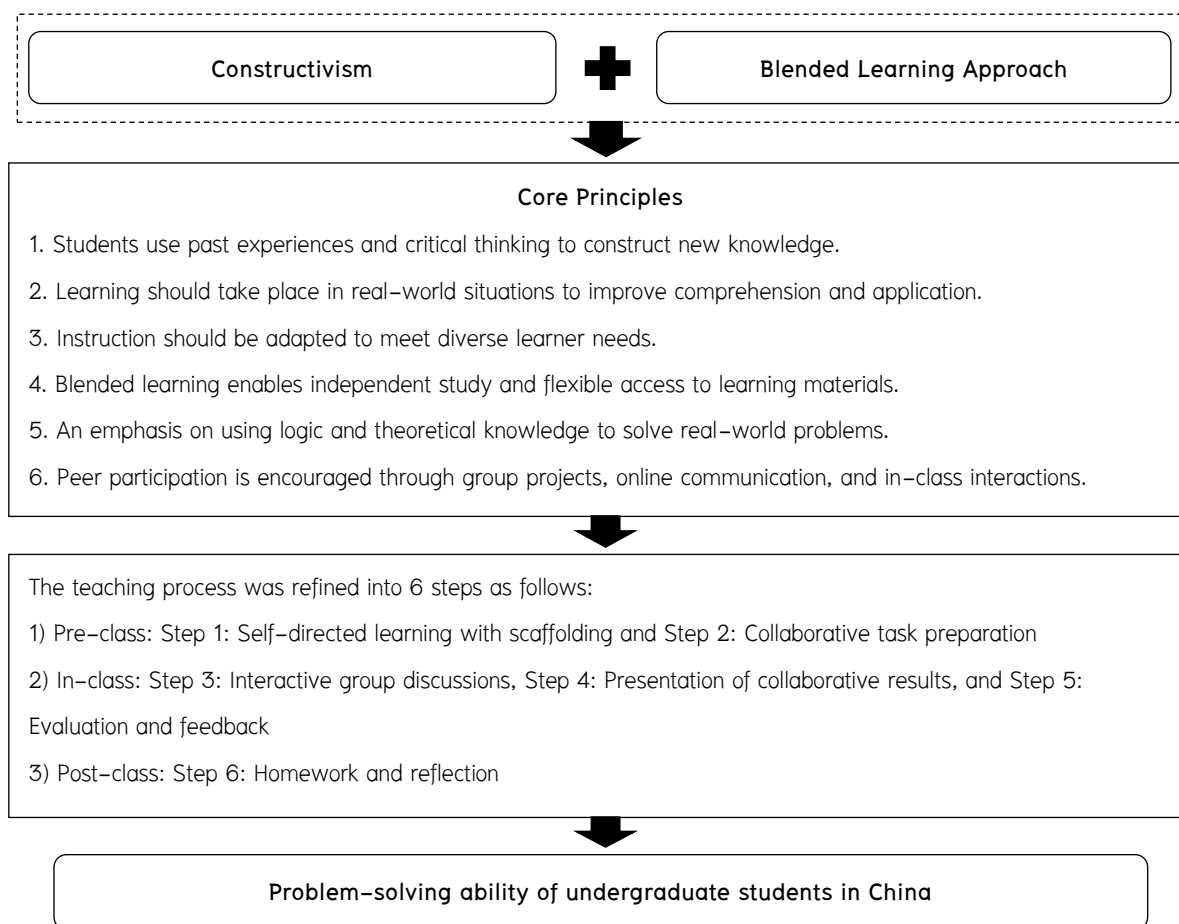


Figure 1 Conceptual framework

Research Methodology

This study is a Mixed Methods Research, with the details as follows:

Participants

Purposive sampling was used to select 320 students and 5 teachers with five to ten years of experience instructing the “Situation and Policy Course.” The student participants consisted of 160 first-year undergraduate students from Hebei Academy of Fine Arts and 160 first-year undergraduate students from Hebei University of Communications, selected because both institutions are implementing blended learning reforms and represent contexts where problem-solving skills remain limited, making them appropriate settings for model development. The five experts who evaluated the model were required to have at least five years of experience in instructional design, blended learning, or constructivist pedagogy.

Instruments

The research instruments consisted of a semi-structured interview form for the five teachers who had previously taught the “Situation and Policy Course,” which included three main sections: (1) teachers’ perceptions of students’ current problem-solving abilities, (2) instructional problems and learning needs, and (3) recommendations for developing an instructional model.

A questionnaire was also administered to all 320 students to gather their opinions on the current state and needs for the instructional model. The questionnaire was divided into four parts: Part 1: general information; Part 2: current learning situation (10 items); Part 3: needs for instructional model development (10 items); and Part 4: open-ended suggestions. All items in the Solomon Learning Style Scale-based questionnaire had an Index of Item-Objective Congruence (IOC) between 0.80 and 1.00.

Additionally, a form for evaluating appropriateness was used to assess the instructional model using constructivism and blended learning approach to enhance the problem-solving ability of undergraduate students in China. The evaluation form consisted of six components aligned with the model structure (introduction, theoretical foundation, principles, objectives, procedures, and assessment). Five experts assessed this form, and each item received an IOC score between 0.80 and 1.00.

Data Collection

The data collection process was conducted in four steps as follows:

Step 1: Teacher Interviews (November 1–10, 2024): Semi-structured interviews were conducted with five teachers to collect data on the current situation and problems related to students' problem-solving abilities.

Step 2: Student Questionnaires (November 1–10, 2024): Questionnaires were administered to 320 first-year undergraduate students during the same period to gather information on their learning conditions and needs for instructional model development.

Step 3: Model Development (November 11–23, 2024): Based on the interview and questionnaire findings, the researchers developed the instructional model integrating constructivism and the blended learning approach.

Step 4: Expert Validation (November 24–30, 2024; December 1–10, 2024): The draft instructional model was submitted to five experts for IOC validation. The researchers then revised the model according to expert recommendations to produce the final version.

Data Analysis

To collect data for the development of the instructional model, this study used questionnaire and interview content analysis to examine the current state and problems regarding the problem-solving ability of Chinese students. Interview data were analyzed using thematic analysis to identify recurring issues and learning needs. Quantitative data from the student questionnaires were analyzed using descriptive statistics, including mean and standard deviation, to determine the overall level of current learning conditions and needs.

Data from the five experts were then analyzed to assess the instrument's content validity, including the calculation of the IOC. The appropriateness of the instrument was also evaluated, with mean and standard deviation used to summarize expert agreement. The synthesized qualitative and quantitative findings were subsequently used to develop the instructional model.

Research Results

Objective 1: To study the current situation and problems of problem-solving ability of first-year undergraduate students in China.

The research results found that:

1.1 Results from the interviews with five to ten years of experience instructing the “Situation and Policy Course. Nine structured questions were used in the in-depth interviews, and the following results were gathered:

1.1.1 Teachers in the “Situation and Policy Course” serve as both facilitators and assessors, directing problem-based learning and offering helpful criticism. Active, collaborative learners who interact with the material and collaborate well with others are expected of the students.

1.1.2 To boost motivation and engagement in learning, teachers recommended using real-world problems, pre-class preparation, group projects, constructive criticism, and reflective exercises.

1.1.3 Teachers had a positive view of blended learning, highlighting its adaptability and capacity to incorporate a variety of resources. They thought it improved student engagement and combined the best features of offline and online learning.

1.1.4 Group work is crucial for encouraging collaboration and problem-solving, according to all teachers. Assigning tasks like case studies, discussions, and collaborative analysis to small, diverse groups was what they recommended.

1.1.5 Teachers recommended evaluating learning processes and outcomes using diverse assessment methods like project-based evaluation, participation, presentations, and reflective writing.

1.1.6 They placed a strong emphasis on applying interactive exercises, real-world scenarios, and critical thinking assignments. The curriculum should incorporate case analysis and problem-based learning.

1.1.7 Lack of student involvement, restricted technology use, and a lack of opportunities for critical thinking and active participation were among the problems noted.

1.1.8 One teacher gave an example of how to successfully use a real policy issue to get students talking in groups and working together, which enhanced their ability to think critically and solve problems.

1.1.9 Teachers recommended that to make the course more effective, teachers should keep improving their skills and use new teaching methods.

1.2 Results from the questionnaires with 320 students. The survey divided students in first year into two groups, one group consisted of 160 students from Hebei Academy of Fine Arts, and the other group was 160 students from Hebei Media College, totaling 320 students in the

survey. Most of the students were between 18 and 20 years old. About 65.3% were female, and 34.7% were male.

The results showed that most students with an average score above 4.00 felt that the blended learning approach increased their interest in the subject, made them more involved in their studies, and gave them more say in how they handle their time. Case studies, group discussions, and teamwork are activities help increase the ability to think critically and solve problems. However, students wanted to work on solving problems more than they wanted to focus on the lessons.

Students generated ideas to enhance the blended learning method. They recommended adding more learning materials such as videos, articles, and interactive activities. They further wanted better communication channels between teachers and students, such as live chats. Students emphasized the importance of more group work chances, both in person and online, to improve teamwork and discussion. They also asked for more flexible class schedules to make it easier to attend classes. Additionally, they recommended changing the assessment approach, focusing more on projects and in-class assignments instead of just final exams.

Objective 2: To draft the instructional model using constructivism and blended learning approach to enhance problem-solving ability of undergraduate students in China

The research results found that using data from questionnaires and interviews, the researcher created an instructional model utilizing constructivism and a blended learning approach to improve undergraduate students' problem-solving ability. The instructional model is composed of six parts: 1) the model's introduction; 2) the theoretical underpinnings; 3) the principles; 4) the objectives; 5) the procedures; and 6) the measurement and assessment. Pre-class (self-directed learning and group task preparation), in-class (group presentations, interactive discussions, and peer/teacher feedback), and post-class (homework and reflective activities) are the three stages of the instructional process, which consists of six steps. Using the Index of Item-Objective Congruence (IOC), the five experts evaluated the model; it received scores ranging from 0.8 to 1.0 and a mean appropriateness score of 4.35. Clearer phase structure, live discussions, virtual simulations, defined group roles, and personalized support are just a few of the improvements brought about by expert feedback. The final model fosters real-world problem-solving skills by emphasizing student-centered, interactive, and reflective learning.

To enhance the problem-solving ability of undergraduate students, the researcher developed an instructional model using constructivism and blended learning approach, obtaining data from the interviews and questionnaires. The instructional model consists of six components: 1) introduction of the instructional model, 2) foundation of theory, 3) principles, 4) objectives, 5) procedures, and 6) measurement and assessment. The instructional process is divided into three phases with six steps: pre-class (self-directed learning and collaborative task preparation), in-class (interactive discussions, group presentations, and peer/teacher feedback), and post-class (homework and reflective activities). The model was assessed by the five experts using the Index of Item-Objective Congruence (IOC), receiving scores between 0.8 and 1.0 and a mean appropriateness score of 4.35. Expert feedback led to refinements including clearer phase structure, live discussions, virtual simulations, defined group roles, and individualized support. The final model emphasizes student-centered, interactive, and reflective learning, fostering real-world problem-solving competencies.

Discussions

The findings for Objective 1 indicated that the main obstacle to developing students' problem-solving ability was the misalignment between curriculum expectations and first-year students' readiness. Although teachers emphasized real-world issues as noted by Rusmin et al. (2024), many students lacked the prior experience and cognitive foundation needed to interpret and apply abstract concepts. This difficulty is consistent with constructivist theory, which highlights the need for scaffolding and contextual learning (Vygotsky, 1978).

Traditional exam-based assessment further limited students' higher-order thinking, supporting the argument of O'Neill and Padden (2021) that such assessments do not measure deeper cognitive skills. Students, however, viewed group projects positively because they increased interaction and supported critical thinking. Vermeulen and Volman (2024) similarly emphasize the need for learning environments that address diverse learner needs particularly relevant for first-year Chinese students transitioning from exam-oriented secondary education. These findings reinforce the study's conceptual framework, which advocates learner-centered and blended learning approaches.

The results for Objective 2 showed that the instructional model consists of six components introduction, theoretical foundation, principles, objectives, procedures, and measurement and assessment and follows three stages: pre-class, in-class, and post-class, consistent with Rosero-

Rojas et al. (2024). These stages align with the constructivist learning cycle, supporting the conceptual framework of the study. The model promotes self-observation, collaboration, and self-directed learning, while the post-class stage particularly supports higher-order thinking (Liu et al., 2024). Expert validation indicated high content validity (IOC = 0.80–1.00) and overall suitability (mean = 4.35; Best, 1977). Experts recommended adding virtual and integrated online-offline activities, which were incorporated into the revised model. Although the model demonstrates strong potential, further classroom implementation is needed to confirm its effectiveness.

New Knowledge from Research

The instructional model based on constructivism and blended learning approach was developed to correct the ability to resolve limited problem-solving, gaps between theoretical knowledge and practical applications, and over control of exam assessments. This model consists of three main phases before, while, and after class, highlighting group work, interaction and reflex learning. This model helps enhance student's engagement and learning flexibility. The appropriateness of this model was validated by the experts with the IOC ranging 0.8–1.0. Further explanation is provided in Figure 2.

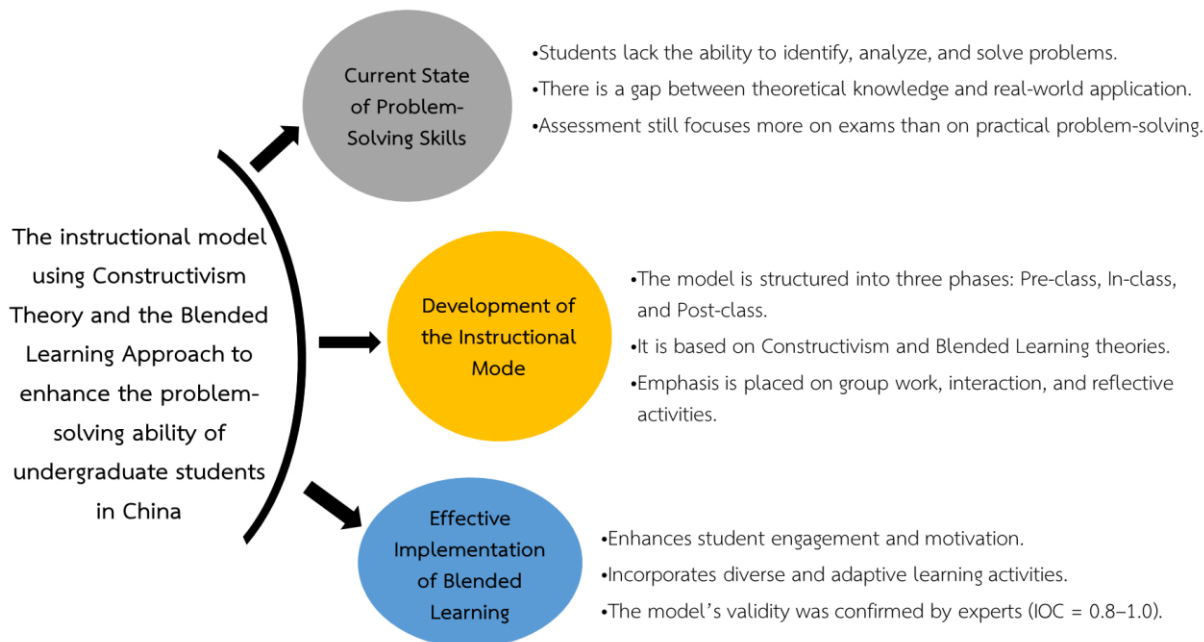


Figure 2 The concept of the development an instructional model

Conclusion

To study the current state and problems in problem-solving ability of first-year undergraduate students in China

This study showed that first-year Chinese students faced notable challenges in problem-solving ability. Teachers stated that students “lacked the ability to combine theoretical knowledge with practical applications” and “struggled to analyze problems and plan solutions effectively,” indicating insufficient analytical and strategic development. They also reported that “traditional reviews remain dominant,” which limited opportunities for higher-order thinking. However, student perspectives provided complementary insights. Some students remarked that blended learning “increases motivation and flexibility,” while others suggested that learning could be improved through “more real-time interaction,” “diverse learning resources,” and “group-based activities.” These quotations highlight both instructional limitations and student preferences for more active, collaborative, and technology-supported learning environments consistent with the need to redesign instructional models for first-year undergraduates.

To draft the instructional model using constructivism theory and blended learning approach to enhance students’ problem-solving ability in China

Based on the findings, researchers developed an instructional model integrating constructivism and the blended learning approach, consisting of three phases with six procedures: pre-class (self-directed learning and group task preparation), in-class (group presentation, interactive discussion, and peer/teacher feedback), and post-class (homework and reflective learning). The model includes six components introduction, theoretical foundation, principles, objectives, procedures, and measurement and assessment. Expert validation showed IOC values ranging from 0.80–1.00, indicating high content validity, and a mean appropriateness score of 4.35, which, according to Best (1977), reflects a high level of suitability. Each component received high ratings for clarity, relevance, and instructional usefulness. Following expert feedback, the model was refined to enhance clarity, interactivity, and personalized learning support, resulting in a more flexible and effective framework for developing students’ real-world problem-solving skills.

Suggestions

From the research results the researcher have the following suggestions:

Suggestions for application

1. The research findings for Objective 1 revealed that first-year undergraduate students in China struggle to link theory to practice. They lack analytical and strategic skills and are limited by traditional examinations. According to constructivist theory and the blended learning approach, teachers should integrate real-world problems, use varied and authentic assessments, encourage collaborative learning, and foster an inclusive environment for self-directed problem solving.

2. The research findings for Objective 2 revealed that the instructional model comprises six components and three stages pre-class, in-class, and post-class and is grounded in constructivist theory and blended learning. Teachers should use online and offline tools to enhance flexibility and engagement, adjust activities based on feedback, and extend the model's use to other subjects requiring analytical thinking and practical application to improve its transferability and effectiveness.

Suggestion for future research

This study developed an instructional model based on constructivist theory and a blended learning approach. The model addresses limitations in problem-solving skills, bridges the gap between theory and practice, and reduces reliance on traditional examinations. This model can be applied to courses that require analytical thinking, collaboration, and reflective learning. It emphasizes pre-, in-, and post-class activities to enhance engagement and flexibility. Future research should examine the model's effectiveness in other disciplines and with diverse learners to assess its transferability and sustainability.

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