DEVELOPMENT OF PROBLEM-BASED AND TASK-BASED LEARNING INSTRUCTIONAL MODEL TO IMPROVE PROBLEM-SOLVING ABILITY OF COLLEGE STUDENTS

[1]He Xingan, [2]Areewan Iamsa-ard, [3]Tanaput Chancharoen and [4]Wapee Kong - In

Bansomdejchaophaya Rajabhat University, Bangkok, Thailand

[1] hexingan.bsru@hotmail.com

Received: January 26, 2023; **Revised**: March 27, 2024; **Accepted**: April 30, 2024

Abstract

The objectives of this research were 1) To examine the factors affecting problem-solving ability of college students, 2) To develop problem-based and task-based learning instructional model to improve problem-solving ability of college students at Beijing Vocational College of Science and Technology, and 3) To study the results of problem-based and task-based learning instructional model to improve problem-solving ability of college students at Beijing Vocational College of Science and Technology. The sample are 42 students who enrolled in Fundamentals and Practice of Management Course from class section C are obtained by simple random sampling in semester 1 of academic year 2024. Data analyzed by percentage, mean and standard deviation.

The results revealed the following the study examined internal and external factors influencing students' problem-solving ability. Internal factors, with a mean score of 4.26, highlighted intrinsic motivation as crucial for deep engagement in problem-solving, followed by existing knowledge. Conversely, experiences with learning styles had the lowest impact. External factors, with a mean score of 4.24, emphasized the significance of teaching style and the role of social media in fostering collaboration and diverse perspectives. However, factors like appropriate class size and a supportive learning environment scored lower. Understanding these influences can aid in enhancing students' problem-solving abilities, and Lecturers from diverse institutions emphasized internal factors like motivation, prior knowledge, learning styles, and personality traits in enhancing students' problem-solving abilities. They employ personalized approaches, integrate real-world experiences, and cater to diverse learning styles. Externally, they focus on classroom setup, technology integration, economic trends, and environmental considerations to create dynamic learning environments. By aligning course content with student interests, offering personalized feedback, and staying updated with industry trends, lecturers aim to foster practical problem-solving skills. Overall, they prioritize a supportive, inclusive atmosphere, aiming for relevance, engagement, and adaptability in management education.

Keywords: Instructional Model, Problem-Based Learning, Task-Based Learning

[1]Student in Curriculum and Instruction Program, Bansomdejchaophaya Rajabhat University, Bangkok, Thailand

[2]Associate Professor, Dr., in Curriculum and Instruction Program, Bansomdejchaophaya Rajabhat University, Bangkok, Thailand

[3]Assistance Professor, Dr., in Curriculum and Instruction Program, Bansomdejchaophaya Rajabhat University, Bangkok, Thailand

[4]Assistance Professor, Dr., in Curriculum and Instruction Program, Bansomdejchaophaya Rajabhat University, Bangkok, Thailand

Introduction

The Fundamentals and Practice of Management Course is designed to give students specializing in management at vocational colleges a solid grasp of essential management principles and practical skills. It's a core subject in China's vocational management curriculum and serves as the introductory course in this field, setting the stage for advanced management studies. At the Beijing Vocational College of Science and Technology, this course is not only mandatory for five management majors but also a key part of their undergraduate education, highlighting its significance. The aim of the course is to spark students' enthusiasm for management studies. It centers on developing their understanding of management concepts and their sense of responsibility in this field. The course emphasizes guiding students in their approach to learning and in applying what they've learned to real-world management issues, thereby bolstering their problem-solving skills. The course offers a wealth of resources, including short online courses, open-access courses, and a database of management cases. These tools enable students to learn in a flexible, self-directed, and collaborative manner, integrating theory with real-life practice to master key management knowledge and improve their problem-solving abilities in the field of management. (Beijing Vocational College of Science and Technology, 2023).

However, vocational students often face challenges when it comes to problem-solving, a crucial ability in both their academic and future professional lives. These challenges can be broadly categorized into 4 dimensions: "identifying problems," "analyzing problems," "solving problems," and "evaluating and improving the problem-solving process" (Huang & Chen, 2004). According to Huang & Chen (2004), vocational students often struggle with problem-solving, starting with identifying problems, where they confuse symptoms with root causes. Analyzing problems is another challenge due to lacking critical thinking skills to deconstruct complex issues. In solving problems, student's limited practical experience hinders their ability to create and assess effective solutions. Lastly, they typically overlook the importance of evaluating and learning from their problem-solving processes to enhance future endeavors.

So, the researcher studied about the model and found that problem-based and task-based learning instructional model to improve problem-solving ability of college students according to Zhu (2016). Zhu (2016) noted that problem-based learning (PBL) and task-based learning (TBL) instructional model are different from the traditional instructional model, because it can arouse students' active participation and is more conducive to the cultivation of students' problem-solving ability. This instructional model takes the problem as the core of the task, so that students can complete the task by solving the problem and improve their problem-solving ability in the process of completing the actual task. Zhu (2016) highlights the model's benefits: it enhances course practicality by deepening knowledge through real-life application, boosts autonomous learning and interest, fosters teamwork and communication, nurtures critical thinking by integrating PBL and TBL, and builds self-management and confidence.

There was other research about problem-based and task-based learning instructional model to improve problem-solving ability of college students. For example, Takahashi (2008) studied about "Problem-based learning and task-based learning: a practical synthesis". The result had found that students in PBL tutorials were worried about not getting enough guidance from their tutors; In addition, PBL case writers are worried that their case results are poor, because non expert tutors may mislead students in the first step of the tutorial discussion. Therefore, he proposed that the combination of standard PBL method and TBL method primitives can effectively solve these two problems and better improve students' ability to solve problems. Musal (2013) studied about "Problem-based learning & task-based learning curriculum revision experience of a Turkish Medical Faculty". He combined PBL and TBL to develop an educational program and revise curriculum for the Medicine Faculty of Dokuz Eylul University, thus improving the students' ability to solve problems. Ummah (2020) studied about "The Effect of Jumping Task Based on Creative Problem Solving on Students' Problem-solving Ability". He conducted a study aimed to study the effectiveness of jumping

task application based on creative problem solving (CPS) in improving students' problem-solving abilities. The study shows that the students' problem-solving abilities in mathematics learning with jumping task based on CPS is better than students' problem-solving abilities in mathematics learning with sharing task based on CPS, and students' problem-solving abilities in mathematics learning with sharing task based on CPS is better than students' problem-solving abilities in conventional model. Xu (2022) studied about "Research on the Impact of Task-based Teaching Model on High School Students' Ability to Solve Biological Problems". He used the task-based instructional model to cultivate students' biological problem-solving ability. After a semester of teaching practice, the analysis of relevant data before and after the experiment showed that the task-based instructional model can help improve students' biological problem-solving ability, but it has different influences on all dimensions of biological problem-solving ability, among which the way to deal with problems is the most influential. This instructional model is conducive to strengthening students' mastery and application of knowledge and plays a positive role in teachers' professional development and growth.

As the rationale shown above, the author realizes the importance of studying "Development of Problem-based and Task-based Learning Instructional Model to Improve Problem-solving Ability of College Students".

Objectives

1. To examine the factors affecting problem-solving ability of college students.
2. To develop problem-based and task-based learning instructional model to improve problem-solving ability of college students at Beijing Vocational College of Science and Technology.
3. To study the results of problem-based and task-based learning instructional model to improve problem-solving ability of college students at Beijing Vocational College of Science and Technology.

Material and Method

Literature review

Development of Problem-based Learning Model (PBL)

The emergence and development of PBL

1) The emergence of PBL

Problem-based Learning was first introduced in medical schools and had a significant impact on thinking and practice in medical education for the past 60-70 years. In 1960s, teachers from some medical schools in North America questioned the effectiveness of the traditional two-stage curriculum (the first stage was focused on basic subjects; the second stage was comprehensive clinical internships). They believe that although students trained by this model have learned a lot of professional knowledge during their school years, the application of this knowledge in practical work is very limited. The excellent performance of students in theoretical learning during their school years may not be well translated and applied in future medical practice. The most effective learning period for students in school is the "clinical internship period", which is when students face patients and solve practical problems. So, in 1966, a new hospital and medical school began PBL planning in Ontario, Canada. The medical school's name was McMaster University Medical school (Haslett, 2001). This school provided an opportunity for developing a new method for medical education. In 1969, American neurology professor Barrows established the PBL teaching model at McMarster University, attempting to implement a group teaching method that combines student self-study with mentor guidance. He was the first man who used the word "PBL" (Loyens et al, 2011; Savin-Baden & Howell, 2004). His experience and teaching theory were

gradually adopted and accepted by other colleges. Subsequently, many medical schools in North American universities joined the experiment of this teaching reform. The medical schools of New Mexico State University, Harvard University, and Michigan State University have successively adopted problem-based learning for teaching.

2) PBL theory of Barrows & Tamblyn

After repeated practice and refinement, PBL has gradually formed a relatively stable activity structure and operating procedures. At the same time, theories surrounding this type of teaching have also been continuously constructed. In 1980, Barrows & Tamblyn published the book "Problem based Learning: An Approach to Medical Education", which for the first time systematically expounded the activity structure and educational ideas of the problem-based learning teaching model.

The PBL theory of Barrows and Tamlyn emphasizes a student-centered teaching approach, where learning revolves around the process of students exploring and solving open-ended problems. The following are several key points of their PBL theory: Student center: PBL encourages students to actively learn and take responsibility for their own learning. The role of a teacher is more of a facilitator and guide, rather than a one-way transmitter of knowledge.

Problem oriented: Learning begins with the context of practical problems that simulate the complexity of the real world, requiring students to use interdisciplinary knowledge and critical thinking to solve them.

Autonomous learning: PBL encourages students to independently seek resources and information to solve problems. This helps them develop their ability to self-guide learning, which is an important component of lifelong learning.

Group cooperation: Students usually work in groups, which promotes the development of cooperative and communication skills. Group members discuss problems together, share knowledge, and develop solutions together.

Reflection: Reflection is a key component of the PBL process. Students need to reflect on their learning process, including how they solve problems and what knowledge they have learned. Integration and application: PBL requires students not only to memorize facts, but also to integrate and apply knowledge to the problem-solving process.

Furthermore, in Barrow's book, “PBL applied to medical education” (1994) stated that PBL was about teaching students to be independent. It was an essential method for medical students to explain the actual medical problems and to learn the reason for their patient problems (Barrows, 1994).

3) The development of PBL

In the 1990s, over 70% of American medical schools used PBL teaching methods, and at the same time, some medical schools in Europe also began to attempt PBL teaching experiments. Maastricht University in the Netherlands introduced problem-based learning at its inception, first implemented in medical schools and later expanded to other departments, making it an important feature of the university. After years of practical research, the University of Aalborg in Denmark had proposed a problem-based and project-based teaching method, known as the Aalborg PBL teaching method. At this point, the PBL method had achieved results in improving student learning initiative and classroom teaching efficiency in the field of medicine education and had subsequently been widely promoted and applied in other countries and other education fields. From 1990s, an increasing number of European and American universities introduced PBL in other professional education fields such as management, business, engineering, architecture, public policy, social work, special education, psychology, etc. While being adopted and promoted by numerous educational institutions, the theory and operational methods of this teaching model have also been continuously supplemented, developed, and improved. At present, the problem-based learning teaching model has been recognized by many international organizations and educational institutions, and is widely used in various teaching contexts, from graduate level teaching to primary and secondary school and even kindergarten education; Small aspects can be applied to the

teaching of a specific course unit, while large aspects can be expanded to the teaching of the entire degree course.

4) The application of PBL in Asia

In 1990s, the PBL method had introduced in the Asia Pacific region (Khoo, 2003). Achike & Nain (2005) stated that "the delay is attributable to such factors like the lack of leading regional PBL experts, conservative attitude with attendant resistance to change, and the long-standing myth that Asians students are not suited to PBL". In case, Asian students tended to have less respect for their teachers, they did not like to ask some questions during the teaching-learning process in-class time, and their teachers taught as authoritarian presenters who ask their students to be quiet and well-behaved students in the class. Those findings proved that Asian students tending to be passive in their class, and they might prohibit them from becoming active students and independent students in the class (Sari, 2022).

2. The main research contents of PBL

1) Goal of PBL

Unlike traditional teaching methods that focus on knowledge mastery, PBL places more emphasis on the cultivation of various skills and abilities. Barrows (1994) believes that the main goals of PBL are: 1. to develop students' thinking or reasoning skills; 2. Help students become independent and autonomous learners. Uden & Dix (2004) pointed out that the goal of PBL is to cultivate students who: 1. participate in challenges with creativity and enthusiasm; 2. start from an integrated, available, and flexible knowledge base, accurately, effectively, and creatively reason; 3. be able to cope with one's own shortcomings in knowledge and skills; 4. as a member of the team, effectively carry out cooperation; 5. supervise and evaluate their own learning in order to achieve ideal results. Hmelo Silver (2004) also pointed out that PBL should strive to enable students to build a broad and flexible knowledge foundation, develop effective problem-solving skills, develop self-guidance and lifelong learning skills, become effective collaborators, and form intrinsic motivation for learning.

2) Basic elements of PBL

Lian (2013) pointed out that PBL includes four main elements: (1) Problem. PBL starts with real-life problems that lack a clear, structured answer, requiring students' active inquiry and critical thinking to solve. These problems should be authentic, reflecting situations students may face professionally, and open-ended, allowing for multiple solutions and approaches. This challenges students to engage in advanced thinking, as they must collect and organize information and design solutions without ready-made answers. (2) Group cooperative learning. In PBL, students learn collaboratively in small groups, ideally comprising 6-8 members to balance teaching costs with effective interaction. (3) Teachers as facilitators. Teachers act as facilitators, not direct information providers, guiding students in metacognitive skills and critical judgment. They take on roles such as challengers and supporters to foster cognitive growth. (4) Reflection during the learning process. Reflection is integral to PBL; students must reflect on their problem-solving and learning process, connecting new knowledge with past experiences. This reflection helps students understand and apply learning strategies, enhancing their understanding and ability to apply knowledge flexibly.

Gould (2015) pointed out five key elements of PBL: (1) the role of teachers is to promote learning; (2) the implementation steps of teaching must be clear; (3) the problem originates from real life; (4) emphasize collaborative learning among students; (5) problem goal driven.

Xia (2022) pointed out that the implementation of PBL must include the following five elements: (1) problems; (2) The skills and knowledge necessary to solve problems; (3) Study groups; (4) Procedure for problem-solving; (5) The spirit of self-directed learning among students.

3. Theoretical and practical research of PBL in China Similar to related research abroad, PBL research in China began in the field of medical education. The earliest scholar in

China to conduct PBL research was Li Jinsuo from Xi'an Jiaotong University. In 1990, he visited and studied at a medical school in New Mexico, USA. In 1990, he applied PBL to experimental teaching classrooms in medical majors and conducted follow-up and investigation on this study. It was found that this model was in line with China's national conditions, had high feasibility, and cultivates medical students with high professional quality and strong abilities. The experimental results proved the feasibility of the PBL teaching model and provided valuable template reference for the expansion of the application scope of this model in the future. So far, PBL in China mainly presents appropriate questions to medical students, and then students need to analyze and answer the questions raised by the teacher, collect the reasons for the problem, the consequences, and feasible solutions and methods. Then, each group member exchanges and summarizes the discussion results, and finally, the teacher evaluates based on the performance of the group members. With the promotion and application of PBL in the field of medical education, teaching practice research on this mode has also been carried out in other educational fields.

Starting from introducing the research and development of PBL teaching abroad, Chinese scholars have conducted extensive research on the introduction of PBL into teaching practice. Liu (2002) applied PBL to primary and secondary schools and provided reasonable suggestions for implementing PBL under the Chinese education system and traditional teaching habits. Jiang (2003) started from the connotation and general process of PBL, compared the differences between traditional teaching and PBL, proposed the constraints of PBL, and provided valuable suggestions for the application practice of PBL in China. Xu & Yang (2006) discussed what constitutes effective implementation of PBL: (1) balancing problem posing with disciplinary knowledge; (2) the transformation and adaptation of the roles of teachers and students; (3) teachers should monitor the entire process and provide diverse evaluations; (4) teachers and students should actively engage in PBL; (5) the implementation process of teaching requires divergent thinking; (6) the constructed knowledge should be flexible.

4. Research Review

PBL (Problem-based learning) originated in the 1960s at McMaster University Medical School in Canada, revolutionizing medical education. It was a response to the observation that traditional education wasn't effectively preparing students for practical problem-solving in medical practice. PBL emphasizes student-centered learning through the investigation and resolution of complex, real-world problems, promoting self-study and mentorship. Barrows & Tamblyn solidified PBL theory, highlighting its main components: student-centered learning, problem orientation, autonomous learning, group collaboration, reflection, and integration of knowledge. Their work in the 1980s made PBL a structured approach to education, stressing the importance of students becoming independent, critical thinkers.

Throughout the 1990s, PBL's popularity surged, with over 70% of American medical schools and many European institutions adopting the methodology, later expanding beyond medical fields into areas such as engineering and psychology. It prompted a shift towards more interactive and student-driven education worldwide. Despite initial resistance due to cultural and pedagogical differences, PBL gained traction in Asia during the same period. Studies indicated positive outcomes in student engagement and skill development, countering earlier concerns that Asian students might not adapt well to PBL due to traditional learning environments.

In China, PBL research started with Li Jinsuo in the 1990s and has since expanded into various educational fields, with scholars adapting PBL to the Chinese education system and emphasizing the transformation of knowledge into skills, particularly in vocational education. The PBL model in China typically involves problem posing by teachers, group discussion, and analysis by students, and evaluation based on group performance.

In summary, PBL represents a significant shift from traditional teaching methods to a dynamic, student-centered approach that emphasizes practical problem-solving, self-directed

learning, and collaborative work, with successful global adoption and continuous refinement in various educational contexts, including in Asia.

Development of Task-based Learning Model (TBL)

1. The emergence and development of TBL

1) The emergence of TBL

The task-based learning model was first proposed and implemented by British education expert Prabhu in the Bangalore region of India in the 1980s. At there, he conducted an experiment in which he implied knowledge points in multiple communicative tasks and proposed teaching methods that students could learn through task activities. He advocated for the infiltration of task-based teaching in specific teaching practices, setting different learning tasks according to different types of tasks, and requiring the integration of learning content into the tasks. Students achieve the goal of mastering knowledge by completing specific tasks. Prabhu (1987) believed that students may learn more effectively when their minds are focused on the task, rather than on the language they are using. He believes that language mastery requires application and exposure in different environments, that is, learning through practice. He was the earliest person to introduce "task-based" into instructional design and the founder of TBL. However, there are still some shortcomings in Prabhu's theory: emphasizing language while neglecting all language centered activities during task completion.

2) The development of TBL

After Prabhu's research, much scholars researched TBL mainly on language teaching in the 1980s and 1990s, made this model became a further development of communicative language teaching, transforming the basic concepts of language application into practical classroom teaching methods, fully reflecting the educational philosophy of student-centered and student-centered development.

Candlin & Breen (1987) made improvements because of Prabhu's research. They improved Prabhu's research by stating that tasks are a series of differentiated and hierarchical activities that contain problems (especially communication problems). They enable students and teachers to find various solutions to problems through various cognitive and communicative processes and apply new and old knowledge to explore and achieve the goals of the activities in the scenarios created by the activities. Candlin & Breen also consider tasks as units of course design and refer to such course outlines as "process outlines.". Unlike Prabhu, Breen assigns a new mission to curriculum design, providing optional activities and tasks for teaching, which requires teachers to have strong teaching abilities and students to be more active in learning. Candlin goes further than Prabhu in grading tasks, proposing a series of criteria for selecting tasks and measuring difficulty.

Nunan (1989) designed a task-based learning framework that includes task objectives, various activities, the roles played by teachers and learners in the task, situational questions for executing the task, and input materials for the task. The drawback is that in the process of completing tasks, he places more emphasis on meaningful language expression rather than language structure.

Crookes & Long (1992) believe that when determining teaching tasks, it is necessary to consider the problems that students may encounter and closely link them with their lives. The drawback is that in the process of completing tasks, teachers only pay attention to students when they make multiple mistakes. If students adopt an evasive attitude towards complex problems, it is difficult for their language system to achieve balance.

Willis (1996) divided TBL into three stages: pre-task activity stage - introducing the topic and upcoming tasks; Task cycle - the report plan required to complete the task; Language Focus - Practice again after analyzing. The TBL she believes is that students first complete learning tasks independently, and then provide guidance on their language form. This has a high requirement for students' proficiency, which is not conducive to the development of students with poor foundation, resulting in poor task completion results, which is also its drawback.

Skehan (1998) described the characteristics of tasks based on affirming Willis' three stage model of task teaching: tasks that learners can complete; Integrating theory with practice, that is, tasks need to be closely related to life; Emphasize the significance of language learning; Able to handle communication issues; Evaluate the completion of tasks. They believe that tasks have five main characteristics: the expression of meaning is the most important, learners need to do things that are closely related to life, problems that need to be solved are practical communication problems, completing tasks is the primary, when and how completed are secondary, and evaluation is based on the results.

3) The Enrichment of TBL

From 2000s, since its inception, TBL has been enriched by research on task definition, selection, and implementation. Scholarly work has also led to the accumulation of extensive practical experience. TBL has evolved into a distinct educational theory, maturing and refining over time. Its application has extended beyond language instruction to other disciplines, showcasing its effectiveness in enhancing students' practical abilities and professional skills, which are increasingly valued in today's skill-oriented world.

TBL theory now acknowledges a more nuanced understanding of the interplay between task completion and language form accuracy. Recent developments emphasize the importance of feedback and reflection, acknowledging that language development can occur both during and after tasks. Moreover, TBL's scope has broadened to include digital literacy, with tasks that incorporate technology and digital media, reflecting the changing landscape of communication.

Furthermore, contemporary TBL practice considers the importance of adaptive learning, whereby tasks are tailored to the individual needs and skill levels of learners, allowing for differentiated instruction that accommodates a wide range of abilities within the classroom.

2. The development of TBL in China

The research on TBL in China began in the 1990s and started relatively late compared to foreign countries. Since 2002, the research of TBL has received widespread attention in China, with most researchers being frontline teachers and researchers who combine their actual teaching experience to conduct research in this area and put forward their own views on TBL. Its main application areas are foreign language teaching and information technology teaching.

The research on the application of TBL in information technology courses is reflected in the advantages, practical research, and teaching modes of applying TBL to information technology courses. In terms of teaching advantages, Wang (2008) compared TBL with traditional teaching method and found the advantages of applying TBL in information technology teaching. In terms of practical research, Chen (2011) elaborated that when designing TBL, it is not only necessary to enhance students' interest in learning and cultivate their abilities to ask, analyze, and solve problems, but also to promote their autonomy ability to explore and collaborate cannot be ignored. In terms of teaching mode, Zhang (2022) divides the implementation of TBL in information technology courses into five stages: "designing tasks - independent and autonomous learning - collaborating to complete tasks - guiding students to build knowledge - evaluating the effectiveness of task completion."

3. Practical study of TBL in vocational education of China

With the deepening of research, the application of TBL in other professional fields is also becoming increasingly widespread in China. In recent years, one of the research hotspots in the field of education, especially vocational education in China, is TBL. Because the reform of instructional model emphasizes the combination of learning process and practical work tasks, aiming to improve students' practical ability and comprehensive quality. In this context, more and more vocational education scholars are paying attention to TBL and striving to integrate it with various professional fields to create better instructional models. For example, in majors such as engineering, medicine, management and economics, scholars attempt to combine TBL with subject knowledge to improve students' practical abilities and

comprehensive qualities. These attempts not only help improve teaching effectiveness, but also help cultivate more high-quality talents that meet social needs.

Wang (2023) analyzed the basic principles of applying TBL in vocational mathematics teaching, determined the basic points for reforming and innovating mathematics teaching, and then analyzed and studied the strategies of using target task teaching method in vocational mathematics teaching according to the process of collecting task resources, setting task plans, organizing task exercises, implementing task plans, and conducting task summaries.

Ma (2021) applied TBL in the course teaching of Auto CAD software for mechanical majors. Starting from the characteristics of the Auto CAD course and TBL, he explained the application ideas of TBL and conducted practical design, evaluating the necessity of the application of task-based teaching method.

In conclusion, TBL has significantly evolved from its initial concept as a method of embedding language learning in practical tasks to a comprehensive educational framework. It now encompasses a broad spectrum of instructional strategies, integrates technology, and focuses on developing a range of skills and competencies that align with the demands of the globalized world. The ongoing research and practice continue to enrich TBL theory, making it a dynamic and adaptable approach to education.

Material and Method

This research used Mixed Method of Research. This research is divided into 3 phases.

Phase 1 was conducted to answer research objective 1: To examine the factors affecting problem-solving ability of college students.

Table 1 Conduct research from Phase 1

Topics	Details
Research process	Analyzed both internal and external factors
Research objective 1	To examine the factors affecting problem-solving ability of college students.
Target group/Key informants	1) 150 former students of Fundamentals and Practice of Management Course in semester 1 of academic year 2024 from 3 vocational colleges in Beijing City. 2) 3 lecturers who are teaching the Fundamentals and Practice of Management Course from 3 colleges in Beijing City.
Instrument	1) Questionnaires 16 items 2) Interview by 10 questions
Data analysis	1) Descriptive Statistics i.e., Frequency, mean (μ) standard deviation (σ)for questionnaires 2) Content analysis for interview
Research process	Analyzed both internal and external factors
Output	The result of the factors affecting problem-solving ability of college students. The internal factors such as learning interest, educational practices, etc., external factors such as teaching information, Integration of theory and practice, etc.

Phase 2 was conducted to answer research objective 2: To develop problem-based and task-based learning instructional model to improve problem-solving ability of college students at Beijing Vocational College of Science and Technology.

Table 2 Conduct research from Phase 2

Topics	Details
Research process	Development of problem-based and task-based learning instructional model in terms of accuracy standard, propriety standard, feasibility standard, and utility standard.
Research objective 2	To develop problem-based and task-based learning instructional model to improve practical ability undergraduate students.
Research method	Study the component for development of problem-based and task-based learning instructional model
Target group/Key informants	By3 experts through Item-Objective Congruence (IOC) according to the criteria
Instrument	The questionnaire

Data analysis	Frequency and percentage
Output	The appropriateness of the problem-based and task-based learning instructional model are confirmed by experts for further implementation.

Phase 3 was conducted to answer research objective 3: To study the results of problem-based and task-based learning instructional model to improve problem-solving ability of college students at Beijing Vocational College of Science and Technology.

Table 3 Conduct research from Phase 3

Topics	Details
Research process	1) Deign lesson plan 2) Design scoring rubric form
Research objective 3	To study the results of problem-based and task-based learning instructional model to improve problem-solving ability of college students.
Conduct research	Designing instrument 1 (Lesson plan) Designing instrument 2 (Rubric evaluation form)
Target group/Key informants	The 42 students who enroll in Fundamentals and Practice of Management Course in Beijing Vocational College of Science and Technology in the 1st semester, the academic year 2024 from class C are obtained by cluster sampling.
Instrument	1.Lesson plan 2.Rubric evaluation form
Data analysis	Categorize students' performance according to rubric scoring criteria into their levels descriptor.
Output	Students' problem-solving ability are at a good level ≥ 80%.

Results

This chapter presents findings derived from the fieldwork procedures outlined previously, focusing on data collection crucial to this study. The objectives, outlined in Chapter 1, serve three primary purposes:

Objective 1: To examine the factors affecting problem-solving ability of college students.

This section presents analysis results serving objective 1 using table and description in terms of MEAN, standard deviation, interpretation (Level of Attitude), and ranking of all factors in overview. After that, items of all factors are presented likewise.

The amount of student's university

From class 1: 50 students, Chain Operation Management Program from Beijing Institute of Economics and Management.

From class 2: 50 students, Chain Operation Management Program from Beijing College of Finance and Commerce.

From class 3: 50 students, Chain Operation Management Program from Beijing Vocational College of Science and Technology.

Common data of the respondent in overall (N- 150)

The common data of the respondent in overall shows that the difference between males and females is not significant, with 52.00% of males and 48.00% of females. The age distribution of students is highest in the 18-20 years old age group at 83.33%, consistent with enrollment patterns, basically the freshmen age group is in the 18-20 years old.

The result of questionnaire from students in overview (N- 150)

It can be seen that among the internal factors (μ=4.26) affecting students' problem-solving ability, considering each item individually, it was found that No.1: Students believe that intrinsic motivation, which stems from a personal interest in the subject matter, is critical for engaging deeply with the content and persisting through complex problem-solving tasks (μ=4.45) , have the highest, followed by No.3: Students believe that existing knowledge in problem-solving refers to a person's understanding of specific concepts, situations, and challenges associated with the problems encountered (μ=4.38), the lowest mean is No.6:

Students believe that their experiences with different learning styles impact their approach to problem-solving (μ=4.11).

Among the external factors (μ=4.24) affecting students' problem-solving ability, considering each item individually, it was found that No.1: Students believe that a teacher's teaching style, which encompasses clear communication, engaging delivery, and the ability to connect with students, plays a critical role in fostering a learning environment that enhances problem-solving abilities (μ=4.43), have the highest, followed by No.4: Students believe that social media and online communities offer unique platforms for collaboration and discussion, allow learners to share educational content, engage in problem-solving activities, and gain diverse perspectives which are invaluable for expanding their problem-solving abilities (μ=4.36), and the lowest mean is No.7: Students believe that having an appropriate class size, a clean, orderly, and distracted-free problem-solving environment, along with a supportive learning culture, positive atmosphere, and constructive teacher-student interactions, are positive for enhancing their problem-solving ability (μ=4.11).

The Lecturers Interview analysis results

The amount of lecturers University.

From 1 lecturer, work on College of Management, Beijing Institute of Economics and Management.

From 1 lecturer, work on College of Commerce, Beijing College of Finance and Commerce.

From 1 lecturer, work on College of Economics and Management, Beijing Vocational College of Science and Technology.

The common data of the lecturers shows that the most common gender is female, representing 66.67% of the respondents, while male lecturers make up 33.33% of the sample; In terms of teaching experience, 1 is 7-9 years, accounted for 33.33%, and 2 are over 9 years, accounted for 66.67% of the total; In terms of the age of lecturers, the 36-50 age group accounted for 66.67%, and the 25-35 age group accounted for 33.33%. This shows that the interviewees have some teaching experience and are young and strong, their views on the factors affecting problem-solving ability of college students are more representative.

After interviews with three lecturers, the factors to affecting problem-solving ability of college students summarized as follows:

Internal factors

Motivation: All lecturers acknowledged the critical role of motivation in enhancing students' problem-solving abilities in the Fundamentals and Practice of Management course. They agreed that aligning course content with students' personal interests and goals is vital for boosting intrinsic motivation. Lecturer A emphasized the use of interactive class activities that relate to real-world business scenarios to spark students' interests and make the subject matter more relevant to their future careers. Lecturer B focused on the use of a structured reward system where students are recognized for their achievements through class points, badges, or certificates, which can be redeemed for various privileges or small gifts. Lecturer C highlighted the importance of personalized feedback as a reward that not only motivates but also guides students towards effective problem-solving strategies.

Prior Knowledge: The lecturers concurred that their own knowledge and experience are instrumental in guiding students and nurturing their problem-solving skills. Lecturer A uses a diagnostic assessment at the beginning of the course to gauge students' prior knowledge and tailor the coursework accordingly. Lecturer B integrates case studies from their own professional experience to provide context and depth to theoretical concepts. Lecturer C believes in continuously updating the course material to include the latest management trends and practices, thereby keeping the content fresh and relevant.

Learning Styles: All lecturers recognized the diversity of learning styles and the need for varied instructional methods to cater to visual, auditory, and kinesthetic learners. Lecturer A incorporates multimedia presentations and visual aids to cater to visual learners and uses storytelling techniques for auditory learners. Lecturer B relies on group discussions and

debates to engage auditory learners and direct projects for kinesthetic learners. Lecturer C designs interactive simulations and role-playing exercises that require active participation from students, thereby engaging various learning styles simultaneously.

Personality Traits: The lecturers agreed that being aware of and supporting students' personality traits is essential for developing their problem-solving abilities. Lecturer A believes that fostering an environment of openness and encouraging conscientiousness through structured course design is key to student success. Lecturer B considers resilience the most important trait and often shares subjective experiences of overcoming obstacles to inspire students. Lecturer C focuses on recognizing individual student traits and providing tailored support, whether it is through one-on-one mentoring or adaptive feedback, to help students navigate the course.

In summary, while there is a shared understanding among the lecturers of the importance of motivation, prior knowledge, learning styles, and personality traits in developing problem-solving ability, they express individual preferences and strategies in addressing these factors. They employ a mix of personalized and structured approaches, use their own experiences as teaching tools, and design their courses to be dynamic and responsive to student needs. The most important traits identified for problem-solving abilities vary among openness, conscientiousness, and resilience, with each lecturer bringing their unique perspective to the course.

External factors

Teachers and instructors: All lecturers acknowledged the significance of the classroom setup from teachers and instructors in fostering problem-solving skills. They agreed that the organization of the class, including size, seating arrangements, and teaching equipment, must be conducive to interaction and engagement. Lecturer A focuses on small class sizes and round-table seating arrangements to facilitate discussion and teamwork, using various teaching aids to demonstrate real-life management scenarios. Lecturer B emphasizes the use of the PBL+TBL instructional model to stimulate critical thinking and real-world problem-solving, while also exploring alternative teaching methods such as flipped classrooms to enhance student engagement. Lecturer C seeks to motivate students by incorporating game-based learning and competitive elements into the classroom, aiming to make learning more dynamic and interactive.

Technological and Social Media: Lecturers concurred on the importance of incorporating technology and social media in the course to keep up with modern communication trends and engage students. Lecturer A uses social media platforms for class announcements and discussions, believing that this integration makes the course more accessible and relatable to students. Lecturer B prefers technology tools that facilitate collaborative online workspaces, enhancing group problem-solving and project management skills. Lecturer C integrates specialized management software into the curriculum to simulate business environments, allowing students to practice problem-solving in a virtual setting.

Economic Trends: There was a unanimous view that the curriculum should evolve in response to changing economic conditions and job market trends to maintain the relevance of problem-solving skills taught. Lecturer A revises the course material annually to include the latest economic trends and case studies, ensuring that students' skills are up-to-date and market relevant. Lecturer B focuses on teaching fundamental problem-solving skills that are transferable across various economic contexts, preparing students for a wide range of scenarios. Lecturer C actively invites industry experts to share insights on current economic trends and their implications for management practice, providing students with a direct connection to the industry.

Environment: All lecturers agreed that the classroom environment plays a significant role in student participation and success in the Fundamentals and Practice of Management Course. Lecturer A believes in creating a supportive and inclusive atmosphere where every student feels comfortable to contribute, through varying class activities and maintaining a dynamic teaching style. Lecturer B suggests that the physical environment should be flexible to accommodate different teaching methods and student activities, such as group work or

presentations. Lecturer C acknowledges the need for continuous improvement in teaching approaches, including the adoption of green practices and sustainability in the classroom to reflect environmental concerns in management education.

In conclusion, while the lecturers share a mutual understanding of the importance of external factors in influencing students' problem-solving abilities, they each have their unique approach to adapting their teaching methods and classroom environment to these factors. They all strive to create a classroom setting that is dynamic, relevant to current economic trends, and enhanced by technology, while also considering the need for a supportive and inclusive learning environment.

Through the above analysis, lecturers recognize the importance of internal and external factors in enhancing students' problem-solving skills in management. Internally, motivation is key, with strategies such as aligning interests with course content, using rewards, and offering personalized feedback. Lecturers assess prior knowledge to tailor coursework, integrate real-world experiences, and update content with current trends. Catering to diverse learning styles, they employ multimedia for visual learners, discussions for auditory learners, and interactive activities for kinesthetic learners. Personality traits like openness, conscientiousness, and resilience are nurtured through the course environment and personalized support. Externally, classroom setup, including size and seating, is structured to encourage interaction and engagement. Teaching models like PBL and TBL, alongside technology and social media, are used to make learning dynamic and accessible. Lecturers keep the curriculum relevant with the latest economic trends and invite industry experts to connect theory with practice. Emphasizing a supportive and inclusive environment, they adapt physical spaces for flexibility and adopt sustainable practices. Overall, lecturers aim to create a responsive, practical, and engaging educational experience that fosters problem-solving ability.

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