

Research Article

# The Practice of Project-Based Learning in a Management Information Systems Course for Graduate Students

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## Abstract

The Project-Based Learning (PBL) is a contextualized learning method based on constructivist theory, enabling students to learn knowledge by applying knowledge and conducting experiments. Most researcher in PBL focused on the K-12 and undergraduate students, less focused on graduate students. This article integrates PBL into the teaching practice activities of a management information systems (MIS) course for graduate students and constructs a PBL process consisting of four stages: startup period, middle period, presentation period, and closing period. It aims to address the practical application of relevant theories of MIS and the application of emerging information technologies in solving practical problems, so as to improve students' active construction ability of course knowledge and effectively enhance their team collaboration ability.

## Keywords

Project-based Learning, Management Information Systems Course, Knowledge Construction, Team Collaboration

## 1. Introduction

At present, emerging information technologies represented by big data, cloud computing, the Internet of Things, Blockchain, 5G, and Artificial Intelligence are showing strong development momentum and have penetrated deeply into all aspects of social and economic life. The Outline of the 14th Five-Year Plan for National Economic and Social Development and Long-Range Objectives for 2035 in China clearly states that we welcome the digital era, activate the potential of data elements, promote the construction of a powerful cyber nation, and accelerate the construction of a digital economy, digital society, and digital government. Use digital transformation to comprehensively drive changes in production methods, lifestyles, and governance methods. A digital enterprise is an enterprise with four key characteristics: connectivity, online presence, sharing, and intelligence. The dig-

ital transformation of enterprises is a gradual and spiral upward process that requires continuous iteration and ascent step by step.

In response to the needs of building a digital China and enterprise digital transformation, the MIS course for graduate students needs to reform its teaching methods. The PBL is a contextualized learning method grounded in constructivist theory, that allows students to acquire knowledge through application and experimentation.

PBL is widely recognized as a highly effective educational approach that fosters engaged students who are critical thinkers and problem solvers. PBL is a constructivist approach, whereby learning takes place in the service of problem-solving. In particular, PBL has garnered a significant amount of attention in the shift to student-centered pedagogies

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[1]. Much research shows that PBL can develop career-related skills, such as problem-solving skills through PBL for youths [2]. The teachers can use PBL in different courses, such as software engineering course, robotics courses, computer science courses, etc [3-5]. At the same time, teachers can learn and obtain professional growth during the implementation of PBL through lesson study [6, 7]. Most researchers in PBL focused on the K-12 and undergraduate students [8, 9], so the focus of this paper is on graduate students.

The article integrates PBL into the teaching practice activities of the Management Information Systems course. This teaching model takes students as the main body, teachers as the leading role, and course projects as the main line to carry out inquiry-based teaching activities. It allows students to explore problems, put forward hypotheses, make explanations, discuss ideas, question each other, and test new ideas, so as to better understand the practical application of relevant theories of management information systems and improve students' active construction ability of course knowledge.

## 2. The Basic Ideas of PBL

PBL refers to an inquiry-based instructional method that engages learners in knowledge construction by having them accomplish meaningful projects and develop real-world products [10]. PBL provides a way for students with the opportunity to participate in real problem-solving and knowledge construction in authentic professional contexts.

PBL theory is based on four viewpoints of learning science: situated learning, active construction, social interaction, and cognitive tools.

Situation and context, as they are characterized in situated learning theory, can be traced to the notion of position as physical location [11]. Situated learning theory emphasizes that learning should take place in a real-world contexts related to the learning content [12, 13]. This learning method holds that knowledge is generated in a specific social and cultural background, so learning should reflect these backgrounds. In PBL, students learn in projects that simulate real-world situations. This helps them understand how knowledge is applied in the real world and increases their learning motivation and participation.

Active construction originates from constructivist learning theory. It holds that knowledge is not passively received, but is actively constructed by learners through interaction with the environment and their own experience. In PBL, students construct and integrate new knowledge by actively participating in project activities such as experiments, research, and discussions. This learning method encourages students to actively explore and understand concepts rather than just memorize facts.

Social interaction plays a crucial role in PBL. Learning is regarded as a social process. Through communication and cooperation with peers, teachers, and other social members, students can develop and deepen their understanding. In a

teamwork environment, students can share ideas, discuss problems, and collaborate to solve problems. This social interaction helps promote the development of critical thinking, communication skills, and teamwork abilities. Cognitive tools refer to those tools and technologies that can expand and enhance learners' cognitive abilities, such as charts, models, computer simulations, and other forms of representation.

In PBL, students use these tools to organize and express their thoughts and promote learning and understanding. These tools can help students better understand and process complex concepts, support their inquiry process, and help them construct and display their learning outcomes.

These theoretical concepts together form the framework of PBL, making it a teaching method that can promote students' in-depth understanding, critical thinking, and creative problem-solving abilities. Through the application of active construction, situated learning, social interaction, and cognitive tools, PBL can provide a rich, dynamic, and highly participatory learning environment.

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PBL covers multidisciplinary knowledge and emphasizes student-center, publicly displaying the learning results of projects, attaching importance to evaluation and revision, and aiming at the reconstruction of core knowledge [14]. Ultimately, PBL is to enable students to reconstruct knowledge. On the basis of mastering core knowledge, students can acquire new knowledge by means of transfer, application, and conversion in new situations and put it into practice, using various knowledge and resources around to solve practical problems.

## 3. The Application of PBL in a MIS Course

Students often come away from the typical introductory MIS course with a basic understanding of the concepts of IT strategy and a broad knowledge of a number of IT terminologies and acronyms [15]. MIS deals with behavioral issues as well as technical issues surrounding the development, use, and impact of information systems used by managers and employees in the firm. Due to the cost and complexity of modern corporate MIS, most students in information systems never really get their hands on actual corporate MIS within a classroom setting. So we introduce PBL into the MIS course to solve these problems.

PBL is an instructional approach in which students learn new content by working in collaborative groups over time to develop products or performances for authentic audiences

[16]. The PBL requires students to take the initiative to learn and cultivate various abilities when completing a real project and solving a real problem. In PBL, students are at the center of learning. They can use powerful tools at any time, improve their initiative in learning, ignite curiosity about the world, and receive support and encouragement from teachers who continuously review their own teaching practices.

Based on the basic idea of PBL, in the MIS course, we have constructed a project-based teaching process as shown in Figure 1. The entire teaching process is divided into four stages: startup period, middle period, presentation period, and closing period. Special emphasis is placed on the role of the process in the course project.

**Course Project Timeline**

Period	Project Startup Period	Project Middle Period	Project Presentation Period	Project Closing Period
Teacher	Planning	Collaborative Mediation	Demonstrate Feedback	Artifact Evaluation
	Driving Question	Bracket support	Timely Teaching	Teaching Reflection
	Import Explain			
Students	Group Building	Investigation	Project Presentation	Artifact Submission
	Question Exploration	Construct solution	Evaluation Revision	Learn Reflection
	Project Planning	Report Writing	Presentation Improvement	

*Figure 1. Project-based teaching process.*

### 3.1. Project Startup Period

In the project startup period, the main task of teachers is to do a good job in course project design, plan projects in advance, especially prepare driving questions, and explain the project introduction to students.

Driving questions are a hallmark feature of PBL. They are used to organize and drive project activities and take real-world situations as anchors. Good questions can trigger students' desire to learn and make students realize that there are many real problems waiting to be solved. For teachers, choosing a valuable, meaningful, contextual, and feasible problem is a course project.

Setting a good question is the first step in successfully implementing PBL. A good question can provide learners with a broad and multi-dimensional exploration space. It can not only stimulate learners' intrinsic motivation for learning but also outline the direction for learners to continuously think and explore on their own. For graduate students, the problem needs to have a certain degree of higher-order nature, that is, what needs to be solved are complex problems. A complex problem is often intrinsically related to society, culture, concepts, etc. It is difficult to explain with a single logical framework and requires thinking from different perspectives. A problem often contains multiple other problems. There is no standard answer or even an end-point answer. Students will come up with different answers due to different foundations, different exploration angles, different tools and methods used, and different information mastered. Therefore, the driving question of the project needs to have no unified standard answer, so as to facilitate the develop-

ment of PBL activities.

In course teaching, we take the construction of Digital China and the digital transformation of enterprises as the application context of problems. We require students to combine relevant theories and practical achievements of management information systems, consult literature, investigate relevant enterprises and users, analyze the main problems currently existing in fields such as intelligent transportation, smart energy, intelligent manufacturing, smart agriculture and water conservancy, smart education, smart healthcare, smart culture and tourism, smart communities, smart homes, and smart government affairs (or user pain points), analyze the possible applications of artificial intelligence, the Internet of Things, cloud computing, big data, Internet platforms, and enterprise social media, propose directions or ideas for product/service innovation implemented by applying these technologies, analyze the potential for business model innovation or the preliminary design (conceptual) of an Internet platform, propose the key success factors for the sustainable development of this innovative product or model, and put forward a preliminary implementation plan.

In the startup period, the main task of students is to form project teams based on the teacher's explanation of driving questions, conduct preliminary exploration of the problems and select projects suitable for the teams. On this basis, formulate an implementation plan for the course project.

### 3.2. Project Middle Period

The midterm stage is a critical period for student teams to advance their projects. They need to complete the investigation and research, scheme construction, and writing of the

preliminary report of the selected project. In this process, student teams need to divide labor and cooperate, and make full use of various digital tools to learn, digest, and apply corresponding knowledge. At this stage, the main role of teachers is to coordinate and mediate and provide scaffolding support. In the course project process, teachers provide a platform for communication with teachers for each student project team and some necessary learning resources on the course teaching platform. According to the theory of learning science, scaffolding is customized specifically for learners to help them achieve their learning goals.

Teaching scaffolding, also known as teaching support or learning support, is a teaching strategy or method designed to provide students with necessary support and guidance to help them gradually establish and consolidate new knowledge and skills. This strategy particularly focuses on students' learning process, especially when they face learning challenges or need to master new concepts and skills. The role of teaching scaffolding can be analogized to scaffolding in construction. It provides workers with a stable platform so that they can gradually build high-rise buildings. Similarly, teaching scaffolding also provides students with a stable learning platform so that they can gradually master new knowledge and skills under the guidance of teachers.

In teaching practice, scaffolds can take various forms, such as information foreshadowing, question guidance, demonstration and explanation, prompts and feedback, etc. The purpose of these scaffolds is to help students fill knowledge gaps, guide them to think deeply, show correct operation methods, and provide timely feedback to ensure that students always move forward along the correct path. In an effective learning process, teachers need to gradually add, modify or remove scaffolds according to students' needs, and even completely remove scaffolds.

### 3.3. Project Presentation Period

During the project presentation period, the main activities of student teams include project presentation, evaluation and modification, and refinement of the presentation. Course project teams use multimedia means such as slides to complete project presentations in class, and introduce in detail the origin of the project, the research process, the problems solved, the use of emerging information technologies, team division of labor and collaboration process, etc. The presentation of student projects can be divided into multiple times according to the size of the project workload and the number of class teams, or it can be carried out at one time after completion.

During the student team's presentation process, teachers continuously provide necessary feedback to help the team improve the solution of the corresponding project. Simultaneously, based on the presentation of students' projects, teachers can conduct timely teaching and supplement corresponding management information system theories and project-related knowledge to promote continuous improvement

of project quality by student project teams. Based on teacher feedback and appropriate teaching, students supplement, revise, and perfect the project.

### 3.4. Project Closing Period

In the project closing period, the main tasks of student project teams are submitting products and reflecting on learning. Research in learning science shows that students have the best learning effect when creating products. Products are the external manifestation of knowledge construction and should reflect the driving questions and show students' gradually deepening understanding ability. In this course, each project team needs to submit a management information system solution and a presentation PPT in the corresponding field. By submitting products, students construct and reconstruct their understanding of management information system-related knowledge. At the same time, through product creations, the products created by students can be understood by themselves and others and can be commented on by teachers and classmates. Continuously revise and improve products based on comments. These revised comments can prompt students to continuously revise and enhance their understanding of knowledge. Throughout the entire project process, students continuously reflect on learning and make continuous progress. At this stage, teachers mainly complete the evaluation of the products submitted by students and continuously reflect on the entire project's teaching process to continuously improve and enhance teaching quality.

Through the implementation of PBL in nearly three years, student teams had completed more than 30 products in the management information system course, such as smart tourism solutions, smart community management platforms, digital transformation plans for securities firms, 5G network management systems for parks, smart personnel management systems, county-level smart environmental sanitation systems, smart homes, smart government affairs, smart medical emergency information systems, and smart education solutions. Combining course theories and emerging information technologies, they have provided corresponding solutions to problems in actual work, life, and study, effectively achieving the course teaching objectives.

## 4. Conclusion

The PBL involves helping students learn by working together on substantive issues. In many cases, the tasks have no single correct or absolute solution. Student learning comes about through group negotiation, group government, and arrival at a group consensus to the problem.

In the field of education in the 21st century, critical thinking, communication skills, collaboration spirit and creativity are regarded as the core skills that students must master. The goal of education is to cultivate students' adaptability so that they can quickly learn new knowledge in

a constantly changing environment and maintain psychological balance and stability. Good education does not lie in telling us a definite answer at this moment, but in helping every individual freely explore and find their own answers when facing the unknown world.

In the process of PBL of MIS course, there are still some issues worthy of further consideration, including how to group to ensure that the grouping method is really effective, and how to help students experience, learn, refine and reflect on their own collaboration ability. The real purpose of PBL is not to make students remember how much, or even understand how much, but to cultivate their ability to distinguish between the known and the unknown to deal with future uncertainties. Future research is needed to explore the pedagogical implications of PBL to better support students in developing career-related skills as a critical competency for sustainable future education.

## Abbreviations

PBL	Project-Based Learning
MIS	Management Information Systems

## Author Contributions

Bo Shen is the sole author. The author read and approved the final manuscript.

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## Conflicts of Interest

The authors declare no conflicts of interest.

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## Biography



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## Research Field

**Bo Shen:** Knowledge Management, Management Information Systems, Human-Computer Interaction