Promoting the Autonomous Learning Ability of Graduate Students through Course Teaching

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Abstract: *The enhancement of autonomous learning ability is one of the most important goals of graduate education. The teaching team of the "Modern Civil Engineering Project Management" course takes enhancing graduate students' autonomous learning ability as an important goal of the course teaching reform. The level of students' autonomous learning ability has been effectively enhanced through various reform practices, such as redifining the course objectives, setting open and advanced teaching content, case-based thematic inquiry learning and practical learning in real construction projects. The teaching reform in this Course can provide a reference for other similar courses.*

Keywords*: Autonomous Learning Abilitiy; Graduate Students; Course; Teaching; Project Management*

Introduction

In the context of increasing interdisciplinary collaboration and rapid changes in knowledge and technology, the importance of enhancing students' autonomous learning abilities has become more evident.

Henry Holec was the first to propose the concept of autonomous learning, defining it as "the ability to take charge of one's own learning" [1]. In today's complex and ever-changing social context, autonomous learning ability is not only the capacity to learn knowledge and skills independently but also the ability to actively apply a range of knowledge and skills to solve real-world problems [2]. In addition to individual factors of students, institutional mechanisms, teaching models of teachers [3], learning resources, and learning environments all play crucial roles in the formation of students' autonomous learning abilities [4].

For graduate students, cultivating autonomous learning ability is not only essential for conducting academic research and completing thesis projects but also crucial for adapting to the rapidly changing industries and society in the future. It is a necessary condition for standing firm in the competitive job market. In the graduate education process, course learning, guidance from mentors, academic research, and professional practice all play vital roles. A graduate student typically spends about one-sixth to one-fifth of their total learning time on coursework. Therefore, course teaching must not only impart essential professional knowledge required for academic research and industry practice but also foster a spirit of inquiry and critical thinking, promoting the enhancement of graduate students' autonomous learning abilities.

1. Problems and Causes in Current Graduate Course Teaching

In recent years, the large-scale expansion of graduate education has facilitated the further popularization of graduate education in China. However, it has also inevitably led to a general decline in the average quality of graduate students. A significant portion of graduate students are still in a passive learning state, with weak autonomous learning abilities and a lack of initiative in their studies. Specifically, this manifests in the following ways: (1) Insufficient pre-class preparation and post-class review by students, which severely affects the effectiveness of classroom learning. (2) Low student engagement during classes, with few students actively listening, keeping pace with the instructor, thinking critically, and asking questions.[5]

There are several reasons for this phenomenon, with the following three being the most prominent: (1) The passive learning habits instilled throughout the entire education process, from elementary school to the graduate entrance exam, driven by an exam-oriented education system, is the most significant

reason. (2) The unreasonable design of some graduate-level courses, where the course content is weakly related to students' thesis research topics, leading to a lack of motivation to learn. (3) Some teachers use ineffective teaching methods, which also affects students' learning enthusiasm. Some teachers are accustomed to a "spoon-feeding" approach, providing information without allowing students sufficient time for independent thought. Some teachers do not prioritize graduate-level course teaching, instead relying on rote lectures, which naturally diminishes students' motivation for autonomous learning.

University teachers are not only knowledge transmitters but also guides in life. In the course teaching process, it is the responsibility of educators to explore appropriate teaching methods that foster students' autonomous learning and independent thinking. In the long-term practice of graduate-level course teaching, the teaching team for "Modern Civil Engineering Project Management" has made a series of teaching reforms in several aspects, achieving certain successes in improving graduate students' initiative and enhancing their autonomous learning abilities.

2. Curriculum Teaching Reform Aimed at Promoting Students' Autonomous Learning Ability

2.1 Re-defining Course Objectives

The course objectives determine the direction of a course. The first step in teaching reform is to integrate the goal of fostering graduate students' autonomous learning abilities into the course objectives based on the characteristics of the students.

This course is designed for master's students in Civil Engineering and Civil Water Engineering, most of whom will engage in project management work related to construction engineering after graduation. Although students have already studied "Engineering Project Management" in their undergraduate studies, the content and depth vary among different institutions. Most students do not have a solid, in-depth, and systematic understanding of project management knowledge, and many lack work experience in the field of engineering construction, leaving them unfamiliar with the practical aspects and cutting-edge developments of project management, as well as lacking the ability to think independently and solve real-world problems.

Unlike most other graduate courses in this field, this course has distinct practical characteristics. The goal of the course is not to lay the foundation for academic research during students' time in school, but rather to prepare them for their professional work after graduation.

Based on the above analysis of student backgrounds and course positioning, we have established course objectives that align with the principle of "review and innovate, ability-oriented, and apply what is learned." These objectives can be further broken down into the following sub-goals:

a. Deepen the systematic understanding of the project management fundamentals learned in the undergraduate phase.

b. Broaden students' awareness of the current practice in the field of engineering project management.

c. Cultivate students' ability to apply project management theories and methods to solve complex real-world engineering problems.

d. Foster students' autonomous learning abilities and research exploration spirit.

e. Develop students' qualities and competencies essential for project managers.

2.2 Setting Open and Cutting-edge Teaching Content

To promote the enhancement of students' autonomous learning abilities, the course content must provide enough freedom, allowing students to explore within a given framework, which in turn enhances their motivation and autonomy in learning.

Building upon the undergraduate course "Engineering Project Management," this course introduces the latest ideas, theories, knowledge, methods, and tools in various areas of project management, categorized according to the Project Management Body of Knowledge (PMBOK), allowing students to gain an in-depth understanding of the theoretical and practical frontiers of the discipline.

The teaching team structures the course around the ten knowledge areas of project management, integrating both general project management theories and civil engineering practices in the field of construction project management. From the perspective of "what is most useful to students," we have

identified eight major themes: organizational strategy and project portfolio management, engineering project planning, project financing, project procurement models and procurement management, project contract management, project schedule and cost management, project quality and safety management, and project communication management and stakeholder governance.

To provide enough space for students' autonomous learning, we set open teaching content for each topic. For each theme, the student group in charge of the presentation will select no fewer than two cases from a case library provided by the teacher, along with one case they find themselves, combining them into a "case package." After mastering the topic's content, students design their own teaching plans, flexibly using cases to illustrate the content and incorporating discussion questions to guide other students in discovering knowledge during the discussion. During this preparation phase, the teacher provides guidance through both online and offline methods to ensure the accuracy of the content and quality of the presentation. The student group is given full autonomy in selecting cases, setting up teaching content, and designing lessons, while their performance also forms a major part of the course assessment. This arrangement provides a stage for students to showcase their talents and abilities, while also creating the pressure and motivation for autonomous learning.

2.3 Case-based Inquiry-driven Classroom Teaching

To ensure that students fully understand the practical project management aspects of the construction industry, and to highlight the differences between theoretical knowledge from textbooks and real-world practices, we designed a teaching model based on constructivist educational principles. This model encourages students to engage in self-directed learning, mutual teaching, and collective exploration under teacher guidance.

2.3.1 Teacher Overview

At the beginning of the course, the teacher provides a comprehensive introduction to the PMBOK's sixth edition project management knowledge areas and the course's knowledge map, giving students a full grasp of the course content, its structure, function, and interrelations. The teacher also provides learning resources to facilitate students' self-directed learning later on.

2.3.2 Student Self-directed Learning and Teaching Design

Students voluntarily form groups, choosing topics of interest within each theme and engaging in self-directed learning under teacher guidance. The teacher has compiled a case library containing nearly a hundred second-hand cases from various sources, including research cases, non-full-time graduate theses, and in-depth media reports. One month before each session, the student group in charge selects no fewer than two cases from the teacher's case library and one case they find themselves, creating a "case package."

The student group then conducts in-depth learning of the related topics, carefully studying the cases, and after digesting the material, they collaborate with the teacher on course design. They determine the content to be taught, choose relevant case applications, and prepare discussion questions and other supplementary learning materials (including but not limited to theoretical documents, research papers, and supplemental case-related materials). The discussion questions include both factual questions, designed to help students recall previous knowledge, and mostly exploratory and thought-provoking questions aimed at stimulating students' thinking and deepening their understanding.

To ensure that all students have completed the required pre-class preparation, the student group in charge uploads the course cases, learning materials, and pre-class questions to the course platform a week before class. The non-presenting groups are required to review the materials and prepare answers to the discussion questions, submitting them through the platform. Their participation in the classroom discussion is an important component of their course grade.

2.3.3 Classroom Discussion and Teacher Supplementary Lectures

Classroom teaching proceeds with presentations from the student groups, followed by class discussions and teacher supplements. Initially, the presenting student group lectures on the topic and organizes a discussion with the rest of the class. As long as the discussion is progressing smoothly, the teacher refrains from intervening, allowing students to inspire each other and find answers collectively. The quality of the presentation, the design of the discussion questions, and the guidance provided by the presenting group all contribute significantly to their grade.

However, not all student groups perform at a satisfactory level in terms of autonomous learning and

teaching design. Despite the teacher's prior guidance, some groups may fail to grasp the key points or effectively lead the classroom discussion. In such cases, the teacher steps in to reframe the issues and steer the discussion back on track. Similarly, if students are unable to answer questions or independently discover the right solutions, the teacher uses guided questions to prompt students' thinking, helping them construct their own knowledge systems. After the discussion, the teacher summarizes the key points and supplements any missing knowledge.

2.3.4 Post-Class Reflection

After the course, non-presenting student groups are required to write a reflection on the course content, recording the key knowledge points and their thoughts during the class discussion to reinforce their memory and understanding. The presenting group must also summarize the discussion content and share it with the class for further study.

The teaching team holds monthly meetings to review the teaching situation, analyze any problems, propose improvement strategies, and implement them in future lessons, continuously improving the teaching effect.

2.4 Curriculum Practical Teaching Aligning with Industry Needs

The development of China's engineering construction industry is progressing rapidly, and the industry's demands and practices continue to drive updates and advances in project management theories. In order to bridge the gap between classroom content and industry practice, expand students' understanding of practical engineering project management, and enhance their comprehension of the real-world application of project management knowledge, the course team fully leverages the knowledge structure and work experience of its members. A variety of practical teaching activities are incorporated into the course beyond traditional classroom instruction.

2.4.1 Field Visits and On-site Teaching

Field visits and on-site teaching are conducted by instructors who have hands-on experience in engineering project management. The instructor leads students to the project site, where they meet with project managers and team members to discuss project planning, management issues encountered during construction, and other relevant aspects. Students analyze these issues through the lens of theoretical knowledge, engage in discussions, propose solutions, and receive feedback from the instructor.

2.4.2 Off-campus Expert Lectures

Each semester, 1-2 off-campus experts who are actively engaged in project management work on the front lines are invited to give specialized lectures based on the course content. Additionally, relevant video clips from academic conferences and expert lectures are played during the course to further broaden students' perspectives. This ensures seamless integration of classroom teaching with industry practice and academic frontiers.

3. Outcomes and Reflection on the Curriculum Teaching Reform

This course has undergone teaching reform for over three years. After continuous improvement and refinement, the teaching model has matured. Throughout the teaching process, the course teaching team has actively engaged with students to assess the effectiveness of the teaching reform. This has been done through surveys, interviews, and other methods to identify problems and implement timely improvements.

Based on existing research by scholars, the teaching team developed an evaluation system consisting of four dimensions and 14 indicators: self-directed learning ability, autonomous decision-making ability, self-monitoring ability, and self-assessment ability. By interviewing experts and scoring, the weight of each indicator was determined. Before and after the 2023 semester, an evaluation of students' autonomous learning ability was conducted among the students who chose the course (Table 1).

The results of the evaluation show that the teaching reform implemented in this course has achieved significant outcomes. Students' autonomous learning ability has been effectively enhanced. All four dimensions of autonomous learning ability have shown improvement, with an overall increase of 14.22%. However, it should be noted that other factors, such as mentor guidance, academic research, and other courses, also contributed to the improvement of students' autonomous learning ability. Therefore, the increase in autonomous learning ability cannot be entirely attributed to this course alone.

Table 1 The Level of students' Autonomous Learning ability

	Pretest	Post-test	Percentage of improvement
Self-orientation Ability	2.54	2.84	11.81%
Autonomous Decision-making Ability	2.38	2.55	7.14%
Self-monitoring Ability	2.66	2.85	7.14%
Self-evaluation Ability	2.25	2.58	14.67%
Autonomous Learning Ability	9.35	10.68	14.22%

In the interviews conducted after the course, all the students interviewed expressed recognition and support for the teaching reforms implemented in this course. A majority of the interviewed students stated that their autonomous learning ability had improved most significantly through the special learning sessions and case study teaching design carried out by the main speaker group under teacher guidance. During this process, the students experienced a role transformation—from being passive recipients of knowledge to becoming knowledge providers. Students not only needed to deeply study the subject matter of the topics they were assigned to present but also had to think from the teacher's perspective in designing the course: considering how to deliver the content, how to design discussion questions, and how to guide classroom discussions in the most effective way to pass on the knowledge they had learned to their peers.

For most students, this process was unprecedented, challenging, and uncomfortable. However, once they completed this transition, students no longer felt apprehensive when entering a new area of knowledge. Instead, they could quickly adjust to the situation, create learning plans based on their individual needs, select appropriate learning methods, and actively monitor their learning progress. This transformation allowed them to reflect and summarize in real-time during their learning process. Not only did this boost students' learning ability, but it also enhanced their self-confidence and sense of efficacy.

However, on the other hand, several students reported that the learning process they experienced as part of the non-main speaker groups (including pre-class preparation, in-class discussions, and post-class summaries) did not differ significantly from traditional learning methods. As a result, the improvement in their autonomous learning ability was somewhat limited. In future teaching processes, it is necessary to further explore and research how to improve the learning processes for non-main speaker groups, in order to maximize their development of autonomous learning skills.

Fund Project

Graduate core course construction project of Yunnan University, "Cases in construction project management".

Eminent teacher training project of Yunnan University.

Undergraduate education and teaching reform research project of Yunnan province. The construction and promotion of first-class Blended Learning Course Construction Laws and Regulations based on the "Five Integrations".(JG2023176)

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