# Exploration-based Teaching Mode for Introduction to AI Course

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**Abstract.** In response to the characteristics of the Introduction to Artificial Intelligence (IAI) course and the shortcomings of traditional teaching methods, a new exploration-based teaching model is proposed to enhance students' capability in learning and application of AI techniques. Taking Machine Learning module in the healthcare field as the background, the design, research, and implementation process of specific cases is introduced. Finally, the teaching effect is explained through a student survey questionnaire, which shows the effectiveness of the teaching mode.

**Keywords:** Exploration based teaching mode, Case Introduction to Artificial Intelligence, Teaching practice.

## 1 Introduction

Artificial intelligence has risen to become a national development strategy, and its related applications have penetrated all aspects of human life. [1] The Introduction to Artificial Intelligence (IAI) course systematically elaborates on the basic principles, methods, and application technologies of artificial intelligence, comprehensively introduces the latest research progress and dynamics at home and abroad, and lays a foundation for students to further learn [2].

Traditional teaching model and methods cannot adapt to the development of disciplinary fields: The teaching content is not updated timely. Classroom teaching is disconnected from practical teaching, lacking practical development cases, which is not conducive to improving students' practical abilities [3]. The teaching method is single and lacks interactive teaching, which cannot enhance students' interest in learning. Most students rarely engage in independent learning outside of class, making it difficult to achieve learning outcomes. Therefore, an exploration-based teaching model be introduced to enhance students' ability to analyze and solve engineering problems, and cultivate their innovative potential [4].


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## 2 Teaching Modes and Processes

### 2.1 Case Driven Exploration-based Teaching Mode

Unlike traditional indoctrination and reception teaching models, exploration-based teaching can effectively stimulate students' subjective enthusiasm, innovative spirit, and practical skills in learning [5]. Exploration based teaching also emphasizes students' knowledge cognition and emotional experience in learning, and emphasizes teacher-student communication and group teamwork [6].

Exploration based teaching starts from the perspective of students' "learning". Exploration based teaching requires students to preview before class and review after class, collect and read literature, conduct case studies on research topics, and explore scientific problems from a practical perspective, to improve knowledge structure, enhance practical skills, cultivate innovative abilities, and learn to write academic research reports [7].

### 2.2 Practice Oriented Project Case Design

Traditional case teaching often selects classic cases as materials, such as Eight queen problem, seven bridges problem, travelling salesman problem, etc. Although these classic cases help students deeply understand the theory content, they lack training in their ability to independently analyze practical problems [8]. Cases derived from actual scientific research projects have obvious effectiveness and pertinence.

For example, for the students of Biomedical engineering major, in Machine Learning (ML) module, we emphasize that ML has made significant progress in medical image processing. Convolutional neural networks do not require manual feature extraction and adopt deep learning methods. As the number of convolutional layers deepens, they can extract more abstract and semantically rich features. This case discusses how to obtain, interpret, and make judgement from CT images with machine learning methods.

### 2.3 Process of Exploration-based Teaching Mode

After establishing the cases, specific practice be carried out according to the exploration style teaching approach shown in Fig. 1. Firstly, the teacher provides specialized guidance on evolutionary computing, swarm intelligence optimization, and medical emergency site selection in the form of scientific research lectures in the classroom. Then, the students group choose topics independently. After selecting topics, students independently carry out research and development tasks such as data collection, model construction, algorithm implementation, and result analysis. Finally, they conduct defense and write a research report on the research and development content. The entire teaching process is student-centered, and teachers only play auxiliary roles such as guidance [9]. Through theoretical lectures, questioning and inspiration, case teaching, and comparative analysis, students can learn new knowledge, compare different methods, and truly understand the principles and application scenarios [10].

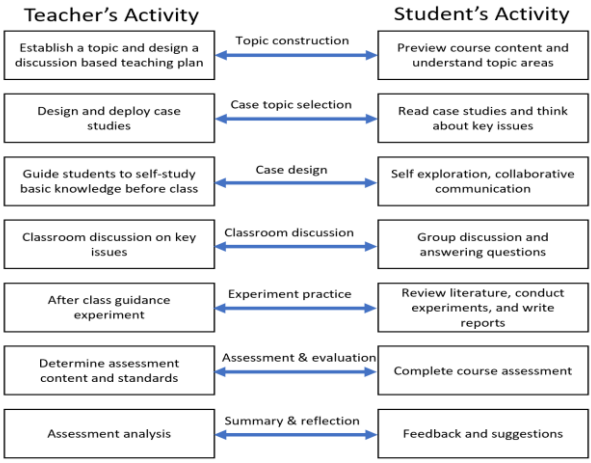


**Fig. 1.** Process of exploration-based teaching mode.

## 3 Teaching Effectiveness

During the course and after the exam, tracking surveys on the teaching effectiveness are conducted including six aspects: Problem analysis ability, Literature retrieval ability, Solution design capability, Innovation and creativity ability, Teamwork ability and Course satisfaction. The data are extracted from daily performance, written test scores, experimental scores, student self-evaluation, and teacher evaluation, and generated by weighting formula. A total of 146 students randomly dispatched into two classes participated in the survey, relatively one half without/ one half with the new exploration-based teaching mode and the comparison results are shown in Fig. 2. The satisfaction rate with teaching reform is 91.3% for those who are "relatively satisfied" or above, while only 70.2% without the reform. Through case driven learning, the exploration teaching mode has greatly helped to cultivate practice ability, team collaboration ability, and innovative thinking.

To better improve teaching effectiveness, the teaching team held several symposiums among the semester to identify the problems that exist among students who were selected as "average" or below in the survey questionnaire. We propose the following strategies: Pay attention to tutoring basic knowledge; Choose questions with lower difficulty; Give full play to the assistance and leadership role of the team leader, and implement the principle of "helping the weak with strength and improving together".

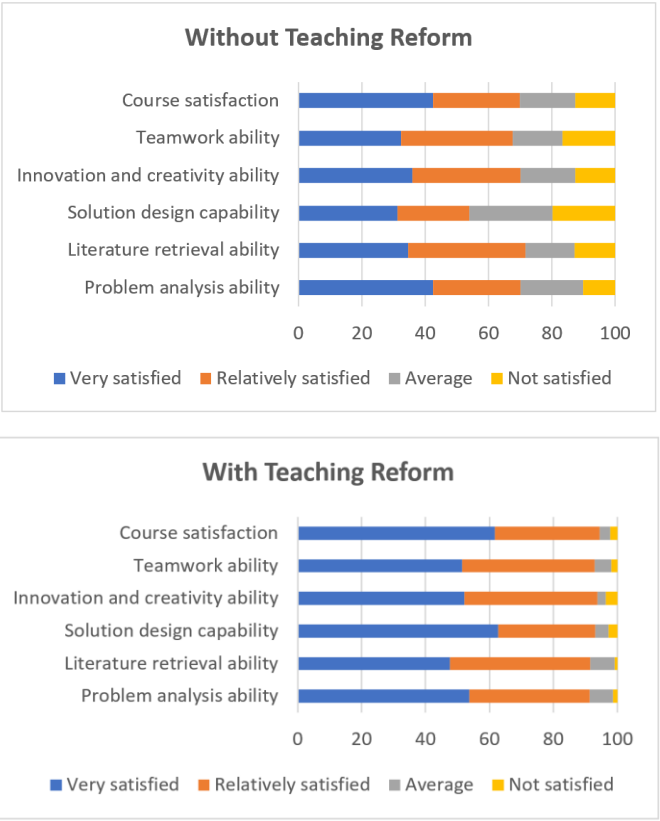


**Fig. 2.** Comparison of teaching reform effects.

## 4 Conclusion

Exploration-based teaching mode and project development not only allows students to quickly access the latest technology and complete projects, but also combines scientific research projects, school enterprise cooperation projects, and curriculum ideological and political education to assist students in starting innovative and entrepreneurial thinking as soon as possible. From the perspective of teaching pilot effects, the implementation of the exploration-based teaching model has been highly recognized by students, improving the quality of course teaching, and is of great significance for cultivating high-quality innovative talents in the field of artificial intelligence.

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