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Research on the Teaching Mode and Method of Artificial Intelligence Foundation Based on Project-Based Learning

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Abstract: ***To address the deficiencies of computer science undergraduates in learning courses that focus on application and algorithm practices, such as the foundation of artificial intelligence, project-based learning (PBL) helps students understand the theoretical knowledge learned in class more deeply and helps to improve their fixed learning habits and thinking modes. The teaching mode and method based on project-based learning have important theoretical and application reference values for evaluating the effectiveness of engineering education programs, promoting the acquisition of engineering knowledge, and improving the teaching effect of artificial intelligence algorithms in engineering practice.***

Keywords: Project-based learning; Artificial intelligence; Teaching mode; Teaching method.

1. INTRODUCTION

In recent years, teaching methods based on project-based learning (PBL) have gradually become important for engineering majors. This method plays important roles in cultivating students' problem-solving ability, critical thinking ability, teamwork ability and technical communication ability. However, there is still a lack of relevant discussion on how engineering students majoring in computer science view PBL and how these concepts affect students' existing fixed learning thinking and learning habits. Therefore, in this paper, the artificial intelligence foundation course offered by the author's institution is taken as an example from the perspective of students, and the teaching mode and teaching method based on project-based learning are explored in depth, with the goal of deepening the understanding of the current teaching mode and method based on project-based learning and providing important teaching theories and applications for future research work in this field.

Research on "how students view their own learning" is usually an area and topic of interest to teaching and research personnel. In the past few decades, many studies have investigated students' learning concepts and their learning methods in different educational fields [1-4].

2. RELATED RESEARCH

2.1 Project-based Learning

As a teaching strategy, PBL has extensive research and application value in engineering education. There have been some previous works on students' learning using the PBL concept, for example, works involving face-to-face seminars and online discussion groups [5], and some studies on the evaluation process in the PBL environment [6]. However, in the context of engineering education, existing research has not delved deeply into how to enable students to generalize the PBL concept from their existing learning habits and experiences to fill the gaps in course knowledge and improve their learning outcomes and how to better adapt them to the teaching mode and learning methods in the PBL environment.

2.2 The Comprehensiveness of the Course

The characteristics of engineering courses indicate that the cultivation and training process of engineering courses for students should be an integrated and comprehensive thinking training process [7]. This comprehensiveness is reflected in the fact that the course itself can provide the course's contextual relevance for the students who are participating in the course learning rather than allowing them to establish a connection between the course content and the applications in the real world by themselves [8]. Comprehensive learning can be the integration of individual courses, requiring that these courses are "interdependent and constructed by common knowledge and clues" [9]. Therefore, comprehensive courses should provide "real backgrounds to connect this knowledge, thereby promoting students' learning" [10].

2.3 Integrated Learning and Project-based Learning

The comprehensive project-based learning approach is similar to the system-level approach in the project-based learning taxonomy. Such approaches have a high degree of coordination among courses and allow for more "student-centered" elements to be incorporated [11].

3. COURSE TEACHING MODE

The course teaching mode studied in this paper takes the Artificial Intelligence Basics course of the School of Computer Engineering of the author's institution as an example and takes two teaching classes of the Internet of Things Engineering major at the ×× level as the object and data sample of the course research. It is a new type of heuristic teaching mode based on project-based learning. The framework of the teaching mode of the artificial intelligence basic course based on project-based learning.

The entire process through which the teacher taught the artificial intelligence basic course, which is divided into 4 steps, is shown in Figure 1: releasing the requirements for forming project teams, releasing the project topic selection guide, releasing the project implementation plan, and releasing the project assessment plan.

Corresponding to these 4 steps, students need to complete 4 links.

1) Project team formation. After the teacher releases the project team formation requirements, students need to form teams according to the various restrictive conditions of the team formation requirements;

2) Project topic selection. After the teacher releases the project topic selection guide, students need to determine the project assessment topic within the key assessment directions of this semester's course, which is limited by the teacher;

3) Project implementation. After the teacher releases the specific project plan and implementation rules, students need to complete the various requirements of the project assessment in order and with quality according to the specific requirements restricted by the terms and rules;

4) Project evaluation. After the teacher releases the project assessment plan and scoring criteria, students need to complete the entire course assessment process according to the various requirements specified in the evaluation indicators to achieve the course assessment objectives.

To ensure the effective implementation of the teaching mode based on project-based learning in the "Artificial Intelligence Basics" course and effectively improve the engineering practice ability of students, a full-process teaching implementation framework is constructed. By simulating the operation mechanism of real engineering projects and combining the class hours and content constraints of the teaching syllabus, clear specifications and standards are established for the teaching process. The specific implementation process includes four main core links: releasing the requirements for forming project teams, releasing the project topic selection guide, releasing the project implementation plan, and releasing the project assessment plan.

1) Releasing the requirements for forming project teams. The project team is the basic element for the implementation of actual computer engineering projects. In the artificial intelligence basic course, simulate the implementation process of actual engineering projects and combine the actual teaching situation to create the following restrictive conditions and requirements for the simulation process:

① Number limit requirement: Assume that the number of students in the teaching class is X; then, the limited number of people for team formation is $Y (Y_{\min} \leq Y \leq Y_{\max})$.

② Requirements for the limit of assessment class hours: If the number of assessment class hours is too large, it will affect the normal teaching arrangement and progress; if the number of assessment class hours is too small, it will be impossible to design a comprehensive assessment plan to evaluate the learning effect and ability target requirements of students for this course. Therefore, only when the number of class hours for the assessment link is appropriate can the assessment objectives for the learning effect and quality of students in the Artificial

Intelligence Foundation course be achieved.

③ Requirements for team division of labor: In the process of forming teams, the requirements for students to complete project assessment should be considered. The recommended number of team members (usually 4–5) can be determined in the division of labor links. The specific division of labor can be referred to in the following arrangements:

1 team leader (acting as the role of “project manager"): responsible for the overall work planning and design of the assessment project, controlling time nodes and promoting progress; 1 member for algorithm analysis and design (acting as the role of “algorithm design engineer”): responsible for the design and implementation of the core artificial intelligence algorithms involved in the assessment project; 1 - 2 coders (acting as the role of “programer"): responsible for coding and implementation throughout the project; 1 documentation staff: responsible for tasks such as literature review, collection, collation and reading during project implementation, writing assessment papers, and making roadshow PPTs.

From the above division of labor arrangements, if the number of team members is too small, it affects the implementation progress of project assessment; if the number of team members is too large, the phenomenon of “loafing” among team members occurs. Moreover, a clear division of labor also helps to separately evaluate the workload and contributions of each project team member in the project assessment link.

For example, if the class size is 60, consider the limited duration of each class hour (usually 45 min) and the limited duration of the assessment in the roadshow stage (usually 10 minutes for student roadshow and 5 minutes for teacher–student Q&A interaction). Thus, the number of project assessment teams per class hour can be divided into 3 groups. Moreover, combined with the recommended number of team members, the number of teams can be determined as 15 groups (4 people/group) or 12 groups (5 people/group), totaling 4–4.5 class hours.

2) Release the project topic selection guide. A project topic selection library is constructed by collecting and organizing popular research directions in the field of artificial intelligence from the past 3 years, and moderately difficult candidate topics from the project topic selection library are selected as project assessment topics for students to choose.

① Topic difficulty: How to select moderately difficult topics for students to choose is an important aspect to consider in the assessment link based on project-based learning. If the difficulty is too high, students will be afraid of difficulties in the topic selection process; if the difficulty is too low, the ability assessment objectives and requirements of this course cannot be achieved throughout the assessment process.

② Topic direction: The direction not only determines the core content of project-based learning assessment but also determines which key and difficult points should be focused on in the teaching of this course. For example, if the key theme and topic direction examined this semester are established as “The Application of Artificial Intelligence Technology in Computer Vision”, then the teaching content in the teaching link needs to be adjusted accordingly to enable students to receive more teaching knowledge points related to the theme and technology.

③ Topic selection incentive item: This incentive item is used to motivate students’ learning enthusiasm during the implementation of the project-based learning assessment plan. For example, when students choose a topic with high difficulty, a certain degree of score addition is given; for students who actively participate in the classroom discussion process of the project related to the selected topic, a certain degree of score addition is given.

3) Release the project implementation plan. By formulating various project implementation plans and rules under the project-based learning mode, students’ multiple abilities, such as independent innovative thinking, the design of solutions, collaborative project implementation, roadshow, and thesis writing, can be comprehensively examined.

① Similar case analysis: By presenting cases similar to the students’ topic selection directions for classroom discussion, assess questions related to such cases should be assigned to students in class, and students should use the knowledge they have learned to analyze such cases. For example, let students use the knowledge they have learned about system architecture, functional modules, and program flow design in the previous software engineering course to analyze and solve similar topics and the selected topic from the perspectives of system architecture, functional modules, and program flow, respectively, to train students in independent innovative thinking and solution design.

② Heuristic question guidance: Guide students to solve key problems in the project implementation process through heuristic questions for specific topics. An example of heuristic question guidance based on project-based learning is shown in Table 1.

③ Requirements for the project implementation process: By formulating process-limiting conditions in the project implementation, further standardize students to complete the selected project topic within the specified range according to the target requirements so that it is as close as possible to and meets the various scoring indicators in the project assessment link. For example, take "Design and Implementation of a Web-based News Recommendation System" as an example. This system can meet the following limited requirements for the project implementation process to clarify the workload and scoring criteria for students during the implementation and completion of this project. The specific requirements are shown in Table 2.

Table 1: Example of Heuristic Question Guidance Based on Project-based Learning

Project-based topic selection for students based on research directions	Heuristic question setting
Design and implementation of an early prevention system for agricultural product pests and diseases	① For which agricultural products should early prevention of pests and diseases be carried out? ② For which pathological characteristics of specific agricultural products should pest and disease prevention be carried out? ③ How to identify the characteristics of agricultural products damaged by pests and diseases? ④ How to implement early prevention measures for agricultural product pests and diseases? Please list the technical implementation ideas and implementation steps. ......
Design and implementation of an insurance recommendation system based on collaborative filtering	① What are the common recommendation methods and technologies? ② What are the target audiences for applying the recommendation system to insurance recommendations? ③ What are the different characteristics for different target audiences? ④ How to recommend different insurance types for different target audiences? ⑤ How to verify the effectiveness of the insurance recommendation algorithm, that is, the effectiveness verification of the insurance recommendation algorithm. ......
... ...	... ...

Table 2: Examples of Requirements for the Project Implementation Process

Project Topic Example: Design and Implementation of a Web-based News Recommendation System	
Requirements for the Project Implementation Process	Optional Items, Evaluation Objectives, and Assessment Requirements during Students' Implementation Process
① Before students implement the design of the news recommendation system, they are required to	a. If students choose to use a publicly available news dataset as the data source for the news recommendation system, the data collection link will not be judged (not required as an additional scoring item).
They must first collect the news materials required before implementing the news recommendation system	b. If students choose to use data collection software or tools to collect data from target websites on the internet, a small amount of additional points will be given when evaluating the data collection link (usually set within 2 points of additional points).
As the data source for data mining and analysis	c. If students choose to write their own web crawlers to crawl data, the data collection link will be included in the additional scoring item requirements for evaluation, and this process will be used as a key additional scoring target item.
② During the implementation of the news recommendation system design, students are required to select a recommendation algorithm with updated algorithms and better effects as the core algorithm for news recommendation.	a. If students directly obtain relevant information about the recommendation algorithm through search engines such as Baidu without consulting relevant research literature on the recommendation algorithm during the process of selecting the algorithm, only a very small amount of design workload score will be considered in the scoring item for the recommendation algorithm design (usually set at scores of 1 - 2 points). b. If students only consult a small amount of relevant research literature on the recommendation algorithm during the process of selecting the algorithm, and the quality of the selected recommendation algorithm is not high, a small amount of design workload score will be considered in the scoring item for the recommendation algorithm design (usually set at scores of 3 - 4 points). c. If students consult a relatively large amount of relevant research literature on the recommendation algorithm during the process of selecting the algorithm, but the quality of the selected recommendation algorithm is not high, a certain amount of design workload score will be considered in the scoring item for the recommendation algorithm design (usually set at scores of 5 - 6 points). d. If students consult a relatively large amount of relevant research literature on the recommendation algorithm during the process of selecting the algorithm, and the quality of the selected recommendation algorithm is relatively high, a relatively high design workload score will be considered in the scoring item for the recommendation algorithm design (usually set at scores of 7 - 8 points). e. If students consult a large amount of relevant research literature on the recommendation algorithm during the process of selecting the algorithm, and the quality of the selected recommendation algorithm is high, a more design workload score will be considered in the scoring item for the recommendation algorithm design (usually set at scores of 9 - 10 points).
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4) Project assessment plan: This plan is used to formulate the assessment objectives and evaluation criteria for

project-based learning. Project-based learning aims to comprehensively examine and stimulate students' learning potential and promote the improvement of their all-round abilities through course learning.

① Project design and practical ability: This ability is used to assess the students' overall R&D ability in the process of project-based learning, including independent thinking and team discussion, the comprehensive design of the architecture of the software and hardware system, the full 梳理 of the logical ideas and the program flow of the software and hardware system module implementation, and, finally, coding to implement the entire system.

② Roadshow ability: This ability is used to assess the students' project presentation ability, on-the-spot response ability and oral expression ability during the process of project-based learning. For example, in the final project-based assessment, students conduct a project roadshow in teams. Referring to the model of an undergraduate graduation project to make a defense PPT, through the division of labor and cooperation, the framework and content of the defense PPT are conceived, the display effect is beautified, the speech process and defense of the project are participated, and the executable situation and the implementation process defense of the project are displayed.

③ Literature review and writing ability: This ability is used to assess the students' ability to discover problems, extract problems, define problems, solve problems by consulting scientific research literature, and finally write the entire project R&D process into a thesis-style project R&D document according to the writing ideas of the scientific research literature. For example, after students select the project topic for the final assessment, the instructor, acting as the supervisor of the graduation thesis, can heuristically guide students to construct relevant basic knowledge in the field according to the keyword information in the topic; students, taking the project team as a unit, consult professional computer literature retrieval systems (such as the English retrieval database DBLP and the Chinese retrieval database CNKI) with the topic keywords to further understand the latest research work involved in the project topic, extract problems and solve problems by dividing the work to read the reference literature, and then complete the gradual in-depth learning of the project topic in the form of regular project team meetings held after class until the software and hardware systems related to the project topic are realized. Moreover, in the final assessment link, students are required to submit a complete course assessment paper that describes the whole process and all the elements of the project implementation in the form of a graduation thesis. On the one hand, students can train them in the ability to consult scientific and technological literature in the project-based learning mode and gradually complete the entire process of discovering problems and problem-solving through literature retrieval and transform from a "research novice" to a "research expert" in a way that involves following the clues; on the other hand, students can train them in the ability to write scientific research literature in the project-based learning mode, clarify the implementation logic and ideas of the project implementation through continuous thinking and discussion, and clearly express the details of the project implementation in the form of scientific research literature.

④ Team collaboration ability: This ability is used to evaluate the tacit understanding among team members in aspects such as problem discussion, collaborative division of labor, project management and cooperation throughout the entire process of project research and development during project-based learning. For example, students, as a team, need to comprehensively plan the process of implementing the entire project during project-based learning, including controlling the time nodes of project implementation; dividing project tasks; identifying responsible persons for implementation; designing and docking software and hardware interfaces; and coding and debugging software and hardware systems. All the above processes require detailed planning and close cooperation among members of the team.

4. EXPERIMENT

In this section, the basic artificial intelligence course is taken as an example to elaborate on the implementation process of the "teaching mode and method based on project-based learning". First, the data objects of the experimental research are given. Table 3 shows the basic situation of the students in the two teaching classes of the Internet of Things Engineering major in the college who participated in the teaching work of the basic artificial intelligence course.

4.1 Assessment of Students' Basic Abilities

In this paper, the changes in students' programming ability, literature reading ability, and mathematical modeling ability before and after training based on project-based learning are evaluated mainly to prove that these changes significantly improve the cultivation of students' basic abilities. The decomposition of the evaluation indicators for students' basic abilities is shown in Table 4.

Table 3: Basic Information of IoT Major Students Participating in Course Teaching (Taking the Basics of Artificial Intelligence as an Example)

Class	Number of students		Professional foundation survey (percentage of students, %)							
Internet of Things Class A	43	Programming ability	★★★★★	6.11%	Literature reading ability	★★★★★	7.32%	Mathematical modeling ability	★★★★★	5.29%
	32 (male) 11 (female)		★★★☆☆	12.19 %		★★★★☆	10.91%		★★★☆☆	12.34 %
Internet of Things Class B	37		★★★☆☆ ☆	30.81 %		★★☆☆☆	29.27%		★★★☆☆ ☆	31.62 %
	28 (male) 9 (female)		★★☆☆☆	46.29 %		★★☆☆☆	48.91%		★★☆☆☆	46.59 %
			★☆☆☆☆	4.60%		★☆☆☆☆	3.59%		★☆☆☆☆	4.16%

Table 4: Decomposition of Assessment Indicators for Students' Basic Abilities

Programming ability	Literature reading ability	Mathematical modeling ability
1. Analogical transfer ability	1. Foreign language foundation	1. Breadth of mathematical knowledge
2. System architecture ability	2. Literature reading habit	2. Depth of mathematical knowledge
3. Coding proficiency	3. Literature reading skills	3. Modeling proficiency
4. Proficiency in programming languages	4. Proficiency in using auxiliary reading tools	4. Mathematical modeling experience
5. Cognitive analysis ability	5. Literature analysis ability	5. Proficiency in using modeling tools
6. Adaptability to independence and collaboration	6. Inductive and evolutionary ability	6. Problem-solving awareness
... ...	... ...	... ...

4.2 Star Rating Calculation Method

If the basic abilities of the students in Table 3 are rated with five stars, the corresponding stars can be calculated using the following formulas. Among them, formulas (1) ~ (3) are used to calculate the evaluation index scores of students' basic abilities in three subitems: programming $S(P)$, literature reading $S(R)$, and mathematical modeling $S(M)$. Formula (4) is used to calculate the comprehensive evaluation index score of students' basic abilities, and formula (5) is used to calculate the star levels corresponding to the evaluation index scores of formulas (1)–(4).

$$S(P) = s_p = \sum_{i=1}^{n}(\alpha_i s_i) \tag{1}$$

$$S(R) = s_r = \sum_{j=1}^{m}(\beta_j s_j) \tag{2}$$

$$S(M) = s_m = \sum_{k=1}^{l}(\chi_k s_k) \tag{3}$$

In the formula, α_i, β_i, and χ_k in formula (1) ~ (3) represent the weights of index i in programming ability, index j in literature reading ability, and index k in mathematical modeling ability, respectively, among the 3 types of students' basic ability evaluation indices listed in Table 4. s_i、s_j and s_k represent the evaluation index scores of students in index i for programming ability, index j for literature reading ability, and index k for mathematical modeling ability, respectively. All the above indices are scored on a 100-point scale. For example, if the index scores of student θ in programming, literature reading, and mathematical modeling calculated by formula (1) ~ (3) are 83, 94, and 75, respectively, then the comprehensive evaluation index score of the student's basic ability can be calculated by formula (4), and the star level corresponding to the student's abilities in the above three aspects can be calculated by formula (5).

$$S(P,R,M) = s_{p,r,m} = \sum_{\theta=1}^{\Theta}(\omega_\theta s_p + \xi_\theta s_r + \psi_\theta s_m) \tag{4}$$

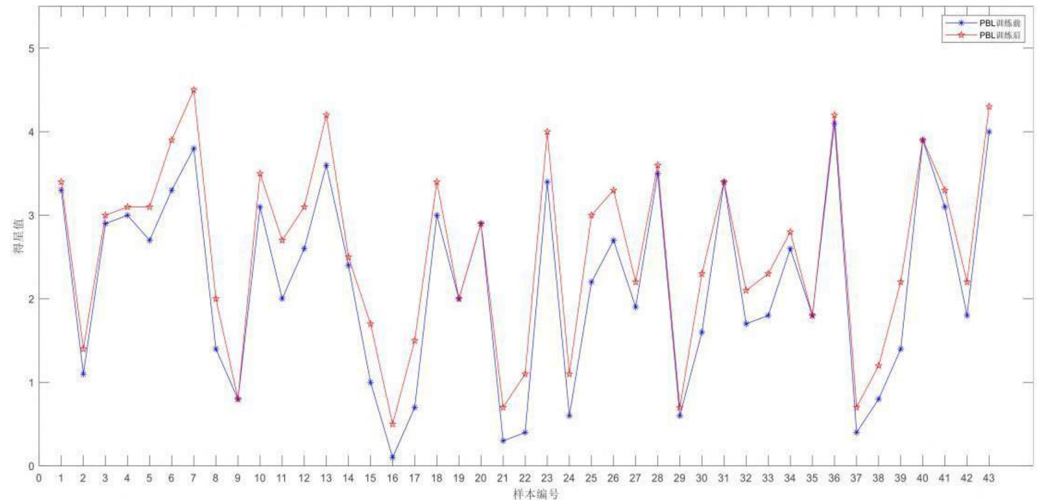

Figure 3: Changes in the Programming Ability before and after Model Training Based on Project-based Learning

In the formula, $S(P,R,M)$ is used to calculate the comprehensive evaluation index score of students' basic abilities. P、R、M represent the decomposition sets of evaluation indices for the abilities in three aspects: programming, literature reading, and mathematical modeling. ω_θ、ξ_θ、ψ_θ is the weight, indicating the respective importance of the above three abilities when the evaluation index score of students' basic abilities is calculated; s_n、s_r、s_m is calculated by formula (1) $\sim(3)$, and its value ranges from 1 to 100. For example, when the set weights ω_θ, ξ_θ, and ψ_θ are 0.3, 0.3, and 0.4, respectively, and the scores of s_p, s_r, and s_m of student θ are 83、94、75, respectively, then the evaluation index score of student θ's basic ability can be calculated as $0.3\times 83+0.3\times 94+0.4\times 75=83.1$. Then, for the evaluation index score obtained from formula (1), formula (2) is used for further sorting and normalization processing to calculate the star level corresponding to its basic ability.

$$\mathrm{Star}(V,\theta)=\frac{S_\theta-S_{\min}}{S_{\max}-S_{\min}}\times V \tag{5}$$

In the formula, $\mathrm{Star}(V,\theta)$ represents the score after normalization. V takes a value of 5 in this article, which can cause the scores of each student to fall between $(0,5]$. θ represents the sample number of the student. $S_{\max}$, $S_{\min}$, and S_θ represent the maximum value and minimum value, respectively, of the full set of scores of students' basic abilities calculated by formula (1), and the score of the student sample θ. For example, when S_θ is calculated by formula (4) to be 83.1 and $S_{\max}$, $S_{\min}$ is calculated by formula (4) to be 92.7 and 71.1, respectively; after being calculated by formula (5), the comprehensive score of the student's basic ability can be obtained as 2.7, falling between $2.5\sim 3.0$, and its corresponding comprehensive star level is 3 stars. Suppose the maximum and minimum values of the full set of scores of the student's basic abilities in the above three aspects are as follows: programming ability (92, 69), literature reading ability (95, 78), and mathematical modeling ability (97, 52). Then, the scores of the students' basic abilities in the above three aspects can be calculated as 3.01, 4.72, and 2.55, respectively. Therefore, by rounding, the star levels obtained for the students' abilities in the three aspects are 3.0 stars, 4.7 stars, and 2.6 stars, respectively.

Next, the above calculation method and process will be repeatedly applied to calculate the changes in the star ratings of students with different basic abilities before and after they learn the basic artificial intelligence course using the project-based learning teaching mode and method, and Figures 3 to 5 will be used for display.

Changes in the star ratings of students' programming abilities before and after training with the project-based learning teaching mode are shown in Figure 3. As shown in the figure, in the experiment, 43 representative student samples were randomly selected from two teaching classes (a total of 80 student samples). It was found that the programming ability of students in the student samples was almost zero before taking the basic course of artificial intelligence, but after being trained with the project-based learning teaching mode, the programming ability of these students significantly improved to the level of 1 star and above; among the students who were at the 1-star level before training, owing to different levels of effort, although the degree of ability improvement differed, the ability improvement evaluations all increased by 0.5–1.0 stars. The figure shows that the programming abilities of the representative samples as a whole significantly improve to varying degrees.

Changes in the star ratings of students' literature reading ability before and after training with the project-based learning teaching mode are shown in Figure 4. As shown in the figure, whose literature reading abilities did not improve significantly after training because of relatively weak language foundations, the literature reading abilities of the vast majority of students significantly improved after they were trained using this mode.

Changes in the star ratings of students' mathematical modeling abilities before and after training with the project-based learning teaching mode are shown in Figure 5. It can be seen from the figure that except for students with relatively weak mathematical foundations, the mathematical foundations of the vast majority of students are in good condition. The mathematical modeling ability evaluations of the above student samples generally remained at the level of 2 stars and above, and after being trained with the project-based learning teaching practice mode, these student samples also improved significantly before and after this mode of training. These experimental results prove the effectiveness of project-based learning in the implementation of courses such as the basic artificial intelligence course.

4.3 Experimental Results and Discussion

The results in Figures 3 to 5 show that the mathematical foundation of these student samples is slightly stronger than their English foundation. Moreover, there is a certain degree of correlation between the weak programming ability of a very small number of students and their weak mathematical foundation.

The teaching mode and method based on project-based learning significantly improve the abilities of the abovementioned representative student samples in three aspects: programming, literature reading, and mathematical modeling. This effect is not only significant among students with better foundations but also applicable to students with weaker foundations.

Although the teaching mode and method based on project-based learning have a certain degree of in teaching thoughts and concepts, it can also be seen from the experimental results in Figures 3 to 5 that no matter how advanced the thoughts and concepts are, they are not universally applicable. For example, the teaching mode based on project-based learning does not have a very significant effect on improving the abilities of students with weak foundations and insufficient effort.

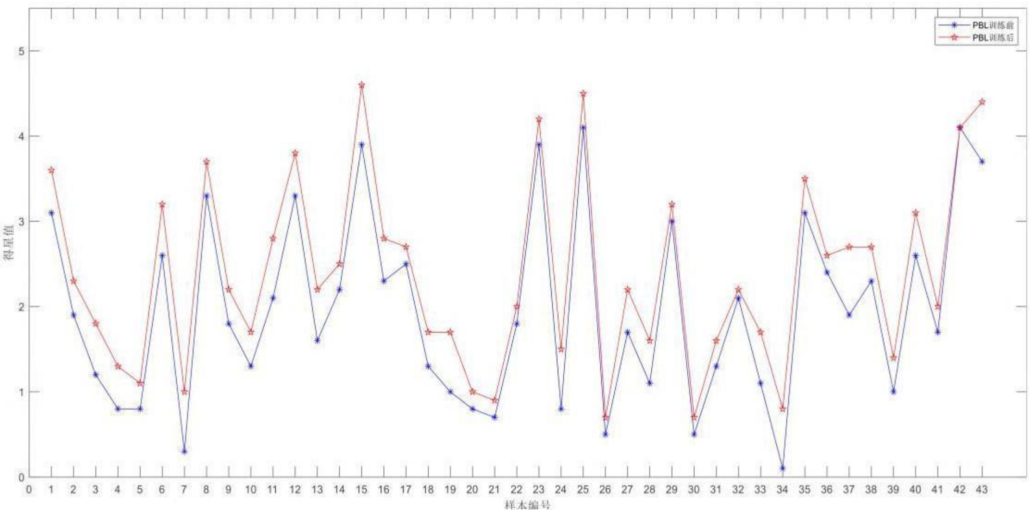

Figure 4: Changes in the number of stars for literature reading ability before and after training with the project-based learning mode

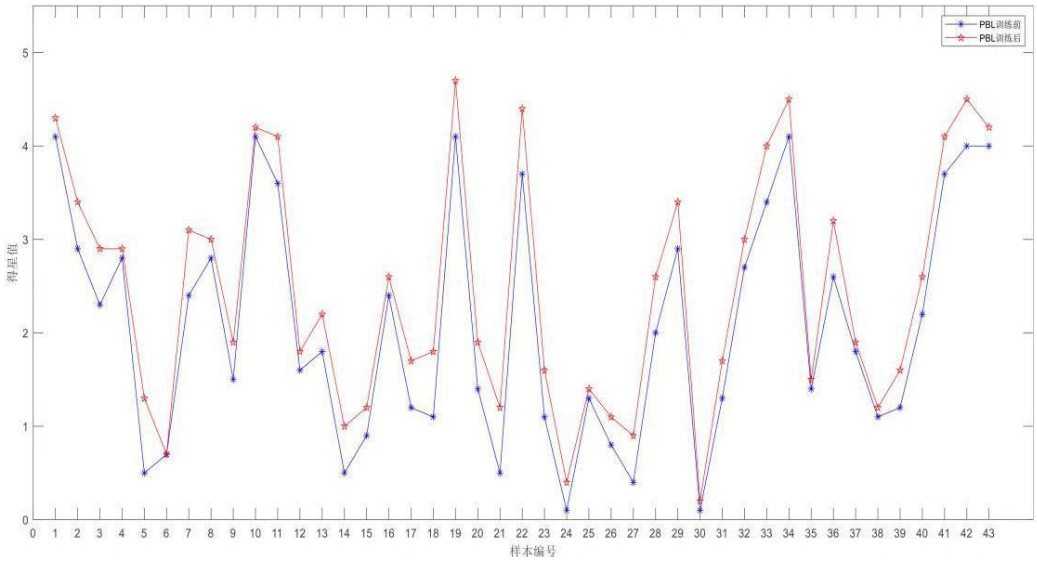

Figure 5: Changes in the number of stars for mathematical modeling ability before and after training with the project-based learning mode

Thus, although the teaching mode and method based on project-based learning improve students' abilities in courses related to the foundation of artificial intelligence, which are more engineering practice oriented, they still require students to have good learning attitudes, habits, and methods.

5. CONCLUSION

Taking the basic artificial intelligence course as an example, this paper introduces how the project-based learning teaching mode can improve the engineering application and practical ability of students in undergraduate engineering practice courses. Through the arrangement and design of the content of the basic course of artificial intelligence, this paper analyzes in depth how to specifically carry out the teaching mode and method of project-based learning in the teaching implementation process of engineering application-oriented courses and how to gradually achieve the ability and goal requirements of the course by designing ability index points and the degree of achievement of ability requirements for course assessment. Finally, taking the students majoring in Internet of Things engineering who have completed the whole teaching process of the basic course of artificial intelligence as an example, this paper studies in depth and discusses the ability assessment and improvement effect from three aspects: programming, literature reading and mathematical modeling. The experimental results show that the teaching of project-based learning.

The mode and method have significant effects on the process implementation of engineering practice-oriented courses, such as the foundation of artificial intelligence.

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