



# Research on Project Driven Blended Teaching Strategies ——Taking the Course of "Advanced Mathematics" as An Example

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**Abstract.** This article focuses on exploring the teaching reform and practical strategies of "learning centered", refining and improving the scientific model, specific processes, and efficient methods of blended project-based teaching. Improved classroom teaching mode, enriched teaching processes and forms. By reforming and innovating teaching models, we aim to achieve a comprehensive educational effect throughout the entire process, allowing students to develop their thinking and abilities through systematic learning processes such as independent thinking, collaborative exploration, communication and presentation, reflection and questioning, consolidation and application, and summary and evaluation, while clarifying learning objectives and exploration projects. Highlighting the requirements of "broad caliber, solid foundation, and all-round" talent cultivation, providing theoretical support and practical guidance for further deepening the reform and innovation of basic courses and enhancing the teaching effectiveness of basic courses.

**Keywords:** student-centered approach; Project driven; Blended learning; Advanced mathematics

## 1 Introduction

Adhere to the development of connotation and accelerate the transformation of education from quantitative growth to qualitative improvement. Take quality as the lifeline of education, adhere to returning to common sense, returning to our duties, returning to our original aspirations, and returning to our dreams. Deepen the reform of talent cultivation mode in basic education, launch a "classroom revolution", and strive to cultivate students' innovative spirit and practical ability<sup>[1]</sup>.

The classroom is the main battlefield of education, and classroom teaching reform is the core of educational reform! The fundamental purpose of instructional design should be to promote learners' learning. However, there are common problems with the current classroom teaching effectiveness:

1. Teachers blindly focus on imparting objective knowledge and exam key content, which is not conducive to students' mastery of overall knowledge, broadening their thinking, and cultivating innovative abilities.
2. Generally, exams are based on notes taken during classroom teaching, and students tend to cram in and get away with it. Classroom learning is also not serious, and the enthusiasm is not high.
3. The evaluation system is not scientifically sound and the incentive effect is not fully utilized.

As a teacher, do you encounter these problems? Faced with several textbooks with significant differences in content and a pile of teaching materials, which ones are meaningful and which ones are meaningless? How to choose? How to scientifically describe a certain knowledge point as a teaching objective? Which teaching method is most effective for specific teaching objectives? The classroom is quite dull, what percentage of students have truly learned? How is the teaching effect? In response to the above issues, the following analysis and research will mainly focus on the design elements and innovative strategies of higher mathematics teaching.

## **2 Accurately Analyze the Learning Situation**

Teaching according to students' aptitude, it is necessary to have a deep understanding of the students before starting classes, and develop teaching plans and implementation strategies according to specific learning situations. Learning situation investigation and analysis can be carried out through various forms such as questionnaire surveys and visits. Through various convenient and fast information technology methods such as Rain Classroom, big data can be used to conduct more accurate and comprehensive investigation and analysis of learning situations. In recent years, students' learning ability and exploratory spirit have significantly improved, especially for top students who are not satisfied with the one-way flow of knowledge through lectures. They crave for the exercise of their abilities and the stage to showcase their talents. In terms of age characteristics, currently students born in the 2000s have diverse channels for obtaining information, are familiar with network technology, and have an innate affinity for electronic technology. However, there are still traces of exam oriented study habits, insufficient understanding of the essence of learning, and a lack of long-term self planning and effective management. Accurate and comprehensive investigation and analysis of learning situations provide a basis for efficient teaching in the future.

## **3 Reasonably Setting Teaching Objectives**

Teaching objectives and learning outcomes are two different perspectives on the same issue, and their essence should be consistent, that is, the development of students. To achieve student-centered education, the setting of teaching objectives is crucial.

### (1) Classification of teaching objectives

Teaching objectives are divided into process objectives and outcome objectives. Process objectives describe the specific teaching activities that teachers need to carry out and the completion time, while outcome objectives describe what students need to know and do after teaching. The setting of outcome goals can be expressed through external and observable student behavior, known as behavioral goals. Another way is to express it as an implicit, unobservable state, that is, an implicit target.

Behavioral goals include the following elements: firstly, students' behavior or activities; The second is the conditions for the occurrence of behavior; The third is the level that the behavior needs to reach. Providing learners with specific and detailed learning objectives that can be expressed clearly in their own language can promote effective communication between teachers and students. The outcome goals are expressed from the perspective of student growth and development, and student-centered education should focus on the expression of outcome goals.

### (2) SMART guidelines to follow when setting teaching objectives

1. Specific: The goal statement should be as clear and specific as possible, preferably using only one verb for each goal. It is possible to use verbs such as "understand" and "know" to state general educational goals, but when it comes to expressive goals, specific action verbs are needed, such as "list 2 examples", "say 3 types", "choose 1 that best fits the situation...".
2. Measurable: Clearly state what criteria the goal needs to meet, such as "half of the students can state at least one differential mean value theorem".
3. Attainable: It can be achieved through teaching and is an apple that can be picked with just a jump.
4. Relevance: Related to the teaching content and expected ability.
5. Time phased: Clearly indicate the time required to achieve the goal, such as "being able to retrieve key information and come up with a solution strategy after reviewing the topic".

## 4 Scientific Design Teaching Content

The teaching content focuses on the combination of "points, lines, and surfaces" of knowledge, the comprehensive improvement of students' core competencies, and the teaching philosophy of advanced, innovative, and challenging higher education.

### 1. Introduce problem phenomena into the classroom

At the beginning of the course, create specific real-life problem scenarios to stimulate students' thinking and clarify the teaching theme of this lesson, such as introducing integration from the area problem of irregular shapes, introducing sequence limits from circle cutting, and so on.

### 2. Introduce case applications into the classroom

Present the application of knowledge and methods through practical cases, highlighting their value and practical significance. The concept of derivative is introduced from the instantaneous velocity problem of fighter landing, and differentiation is introduced

from the change in electromagnetic wave energy caused by the anti radar coating of stealth fighter.

### 3. Introduce scientific research achievements into the classroom

Learn and apply the latest teaching and research achievements to improve classroom teaching efficiency, including cutting-edge educational theories and methods, as well as the latest information technology means, such as using GgoGebra software for drawing, using Rain Classroom to build blended learning resources and information platforms, etc.

### 4. Introduce ideological methods into the classroom

Through subtle infiltration of mathematical thinking methods, including analogical reasoning, combination of numbers and shapes, mathematical modeling, and extreme thinking methods, one can feel the value of using mathematical thinking methods, implement curriculum education goals, and achieve high-level learning outcomes experience.

## 5 Efficient Organization and Implementation Process

For knowledge and understanding goals, traditional lecture based teaching methods can be used, while for application goals and analytical comprehensive goals, heuristic teaching methods, case teaching methods, comparative teaching methods, and other methods can be combined. Group discussions and simulated teaching methods can also be used to improve students' analytical and problem-solving abilities while exercising their expression skills, in order to achieve better teaching results.

### (1) Collaborative learning and autonomy

Self directed pre class preparation - cultivating the ability for lifelong learning.

Participatory learning in class - core leadership skills, teamwork skills, critical thinking skills.

After class consolidation and expansion - application ability, innovation ability.

Group cooperative learning has a very good teaching effect in small class systems. The classroom can come alive, but it is predetermined by the teacher and only revolves around high-level teaching objectives. Through group cooperative learning, students can develop their communication skills, collaborative division of labor, and teamwork awareness. In group cooperative learning, self-evaluation and peer evaluation are the best methods to promote students' interest and initiative in learning.

In addition, corresponding teaching strategies have been summarized for achieving the teaching objectives of understanding conceptual knowledge:

1. Concept comparison strategy: Provide extreme values of attributes; Compare positive and negative examples of concepts (differentiable and non differentiable functions).
2. Concept description strategy: Provide different elements, structures, and functions (extremum and extremum)
3. Concept connection strategy: Concept map method, including hierarchical, parallel, subordinate, and intersecting (differentiable, differentiable, and continuous relationships)

4. Conceptual Example Strategy: Provide examples to illustrate and transform abstract concepts into concrete ones (using area increments as an example to analyze differentiable definitions)
5. Concept application strategy: Use a certain concept in different cases (apply curvature to compare the degree of curvature of curves)

#### (2) Practical Application Programming

The teaching objective of applied programming knowledge is to achieve the use of standardized programming languages, as well as the memorization of conditions and instruction rules, on the basis of extensive practice to master the operating methods proficiently, making it automated, and ultimately achieving high-level teaching objectives such as analysis, evaluation, and creation. The teaching methods include: case study teaching, PBL teaching<sup>[2]</sup>, student presentation, student performance, flipped classroom, etc.

At the beginning of each chapter, the teacher presents the teaching objectives to the students, allowing them to have a preliminary understanding of the teaching content, key points, difficulties, and mastery level. With questions in mind, they enter the classroom learning process and find corresponding answers during the listening process, thus enhancing students' learning initiative. After class, students can also conduct self tests based on teaching objectives to evaluate their learning effectiveness and guide their final review<sup>[3]</sup>.

## 6 Comprehensive and Systematic Formative Assessment and Evaluation

### (1) Rich and comprehensive evaluation forms

Evaluation is like a bull's nose. Only a scientifically sound evaluation system can produce good classroom effects, stimulate students' enthusiasm, and encourage active exploration. In fact, the specific description of each teaching objective mentioned above has already provided the answer on how to evaluate it. There are many methods for evaluation: oral questioning, homework assignments, paper and pencil exams, reports and papers, practical operations, group cooperation assignments, presentations and reports, exercises, performances, skill competitions, classroom observations, and questionnaire evaluation methods (subjective).

Performance evaluation refers to the use of previously acquired knowledge to complete a task or solve a problem in a specific real or simulated situation, in order to assess the development of students' knowledge and skills, problem-solving, communication, cooperation, critical thinking, and other complex abilities.

### (2) Fully leverage the role of evaluation incentives

For the rewarding evaluation of student performance, group cooperation involves writing a social practice report on a certain topic, conducting interviews on a certain topic, and then forming a group report. The process of self-evaluation and peer evaluation in group cooperation.

1. Group peer evaluation: cooperation attitude, cooperation quality, innovation, unique ideas, etc.
2. Inter group mutual evaluation: Inter group competition enhances the sense of honor of the group, evaluates knowledge mastery, ability application, collaborative achievements, etc.
3. Teacher feedback: Evaluate individual students; Evaluate the group leaders; Evaluate the cooperation status; Evaluate the effectiveness of cooperation.
4. Student self-evaluation: Discuss gains and losses, strengths and weaknesses, reflect and summarize gains and shortcomings, and gain a deeper understanding of oneself.

## 7 Self Summary and Reflection

As a teacher, one should summarize and reflect on the teaching process in a timely manner after class. How can one control their time? How is the classroom atmosphere? How effective is the teaching? What is the degree of achievement of the goal? What are the advantages and areas for improvement? Have the predetermined teaching objectives been achieved? Timely summarize and reflect on the problems and shortcomings of this lesson, integrate them, continuously revise and improve the teaching design and implementation process, thereby optimizing the teaching implementation process and improving classroom efficiency.

## 8 Continuously Innovating Teaching Modes

With the acceleration of teaching reform and innovation, many efficient and practical new teaching models and methods have been applied and expanded, including OBE outcome oriented teaching method [4], BOPPPS teaching [5], O-PIRTAS flipped teaching [6].

A detailed classification has been conducted on common teaching methods, teaching media, and their roles. Common teaching methods are divided into lecture method, demonstration method, conversation method, discussion method, practice method, experimental method, problem exploration method, and online self-learning guidance method.

Common media types include images, graphics, animations, videos, physical objects, specimens, recordings, computer programs, printed materials, etc; The role of media in teaching is divided into presenting facts, creating scenarios, providing demonstrations, presenting processes, explaining processes, questioning and reasoning, problem-solving, etc.

## 9 Conclusion

The design and innovation of teaching elements are the key to promoting educational modernization. As teachers, we should constantly learn and explore the design methods

of teaching elements, innovate teaching strategies, and deepen modern teaching, providing strong support and guarantee for improving teaching quality.

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