

## Original Paper

# Exploration and Research on the Mixed Mode Curriculum of “Competition, Training and Teaching”

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### Abstract

*In response to the many problems encountered in the teaching of the “SSM Framework” course, a project-driven hybrid teaching model is proposed. The reform integrates “Competition, Training and Teaching” into one, utilizes online teaching platforms to arrange pre-class activities, carry out interactive teaching in class, and improve post-class practice. In teaching, the roles of teachers and students should be exchanged to fully mobilize students’ learning initiative and cultivate their ability to solve and analyze problems. In the assessment, a process evaluation mechanism is introduced to incorporate project construction into the assessment scope and improve practical application capabilities. The practical results indicate that the application of the new model in curriculum significantly enhances students’ learning interest and practical abilities, which is feasible for promotion.*

### Keywords

*online and offline, Hybrid mode, SSM framework, PBL*

## 1. Introduction

“SSM Framework” is a professional elective course for software engineering majors, focusing on enabling students to quickly develop enterprise level applications based on the SSM framework while

mastering it. Deeply understand the concept of IOC, master and apply it to enterprise level software development, and improve the scalability and maintainability of the system. Deeply understand the concept of AOP aspect-oriented programming, in order to achieve the separation of core business logic and general aspect business, pluggable components, and facilitate decoupling and implementation characteristics. Proficient in programmatic and declarative transaction management for enterprise level applications. Master the working principle of SpringMVC, type conversion and formatting, data binding, data validation, interceptors, internationalization and other related knowledge. The course belongs to the Java framework system and emphasizes the cultivation of practical abilities. However, there are some common problems in teaching, such as the difficulty of theoretical knowledge and the lack of practical experience, which makes it difficult for students to fully understand. The teaching method is single, making it difficult to interact and resonate with students. The experimental content lacks coherence, cannot form continuous knowledge point links, and lacks a sense of project-based experience. The experimental content is relatively traditional, with no updates or innovations; The experimental form is not novel, and the communication between teachers and students is poor <sup>[1]</sup>. Therefore, project-based application scenarios are urgently needed by students.

## **2. Exploration of Blended Teaching Mode**

The blended teaching mode is to move the content that should have been completed in the classroom and spread it to other teaching methods, allowing students to integrate into a new and efficient learning atmosphere to achieve teaching objectives. These efficient learning modes include, but are not limited to, online learning, as well as post class discussion groups, competition as a substitute for practice, etc.

### *2.1 PBL Teaching Method*

Project-Based Learning is a teaching method that focuses on student learning. The project is proposed by teachers or students, and students propose solutions to problems and implementation methods within a certain period of time. During this process, students attempt to think independently, communicate and collaborate, innovate ideas, and successfully transform theoretical knowledge into hands-on skills through contact with actual projects, in order to improve practical skills.

In PBL, it is necessary to pay attention to several points: problem proposal, solution establishment, solution, and evaluation feedback. According to the setting of the teaching syllabus, the projects are divided and distributed into each class. Students complete the course with specific learning tasks and complete the above four points through group cooperation. Teachers play an auxiliary role in it, constantly guiding students in various stages according to the project objectives, and adjusting the teaching plan to adapt to the progress of the project. Compared with the teacher teaching mode, the role of the teacher is interchangeable with that of the students, and the students are more proactive in the learning process, greatly improving their self-learning ability.

## 2.2 Flipped Classroom

Flipped classrooms have become popular worldwide in recent years. This teaching mode is a teaching form where teachers first create teaching videos, students watch video explanations at home or outside of class, and then return to the classroom for face-to-face sharing, exchange of learning achievements and insights between teachers and students, with the aim of achieving teaching objectives. This teaching form has made a readjustment to the allocation of time inside and outside the classroom, emphasizing students' pre class learning and teacher-student classroom communication, which greatly aligns with the teaching philosophy of "teacher led, student centered" in the new curriculum standard. In the concept of flipped classroom, teachers should establish a certain degree of resource sharing, such as uploading videos and courseware on the campus learning platform, or providing shared resources already available on the network to make up for the shortage of theoretical teaching time<sup>[6]</sup>. Provide appropriate guidance in the classroom, such as displaying results, conducting classroom discussions, and analyzing key knowledge. After class, students can further internalize and absorb the content based on self-directed learning and in class learning, and expand their knowledge.

## 2.3 Online To Offline

The characteristic of framework courses is a focus on practice, emphasizing coding ability, and belonging to applied courses. The traditional blackboard writing mode is not suitable. After introducing PPT teaching, the classroom atmosphere has slightly improved. At this time, the classroom teacher takes the lead, and students can only passively receive knowledge, and the teaching effect is still poor. The mixed teaching mode adopts a combination of online and offline methods, fully utilizing the superstar teaching platform to make students the main body of the classroom, exchanging roles with teachers, and teachers play a guiding role. Students complete most of the course content through online materials before class, and teachers use the teaching platform to conduct teaching statistics and analysis, real-time grasp students' learning situation, dynamically adjust teaching plans, and improve teaching quality.

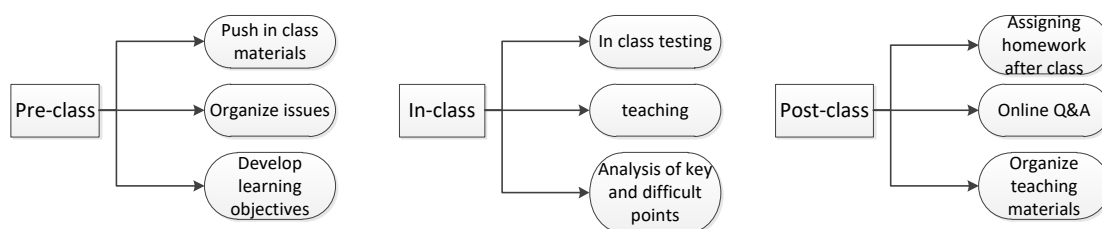
## 2.4 Competition Combined with Training

The practical ability of students directly affects employment, and there are many ways to improve this ability. Our school actively carries out various skill training programs, such as encouraging participation in various A-class skill competitions, organizing various colleges to carry out innovation and entrepreneurship projects, and open laboratory projects. Through these practical training projects, students can apply a large amount of theory to practice and greatly improve their hands-on abilities.

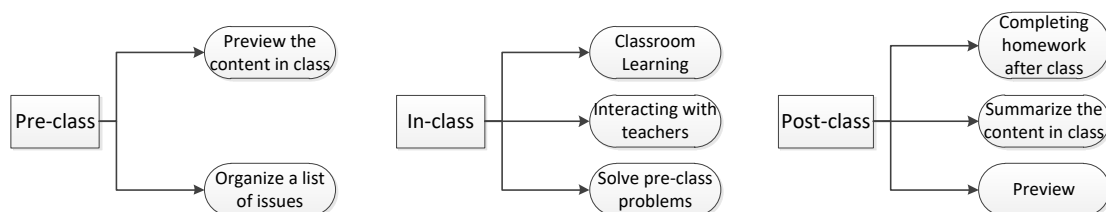
# 3. Implementation of Curriculum Reform

## 3.1 Design Ideas for Architecture

The design of this course system is based on the superstar teaching platform, adopting a combination of online and offline modes. The course process is divided into three stages: pre-class, during class, and after class. The tasks of each link are shown in Figures 1 and 2.



**Figure 1. Work on the Teacher Side**



**Figure 2. Work on the Student Side**

### (1) Pre-class

Teachers should prepare a large amount of learning materials and be familiar with the usage methods of online teaching platforms. For example, check-in, quizzes, materials, assignments, etc. Then set the learning objectives for this lesson, organize relevant courseware materials, and push them to the platform.

The specific implementation process requires the allocation of two roles: teacher and student. Among them, the teacher's tasks include uploading materials, organizing questions, and setting learning goals.

#### 1) Data Upload

Familiarize yourself with the prerequisite and follow-up courses of the SSM framework course, combine the knowledge points used in this course with these courses, construct a course system, and obtain relevant materials through the internet, including learning videos, blogs, literature, and code. In the compilation of materials, guidance should be reflected and integrated with the real world. The guide book should be as attractive as possible and provide relevant examples. For example, when completing the SSM framework learning, the myBatis persistence layer framework needs to be used. Students should supplement the relevant knowledge points of the myBatis course on their own, and master how to create Maven projects, methods for importing dependencies into pom.xml, create entity classes and operation interfaces, and establish mappers. Further complete the establishment of the myBatis main configuration file and ultimately complete the test. Students need to self-study based on video materials and preview Maven related knowledge, such as the introduction of dependencies, as shown in Figure 3.

```

<dependencies>
  <dependency>
    <groupId>mysql</groupId>
    <artifactId>mysql-connector-java</artifactId>
    <version>5.1.34</version>
    <scope>test</scope>
  </dependency>
  <dependency>
    <groupId>io.druid.extensions</groupId>
    <artifactId>druid-caffeine-cache</artifactId>
    <version>0.9.2</version>
  </dependency>
</dependencies>

```

**Figure 3. Dependency Introduction**

## 2) Organize issues

Establish a pre-communication session, push the content outline of this class in the WeChat group, mobilize students to brainstorm, and allow them to independently ask questions. At the same time, based on past teaching experience, organize the relevant questions of this lesson and divergent thinking based on these questions. For example, use dynamic SQL if tags to complete the operation of concatenating SQL id=# {id} if the id is not empty.

```

<select id="findUserById" resultType="user">
  select * from user where
  <if test="id != null">
    id=#{id}
  </if>
  and deleteFlag=0;
</select>

```

**Figure 4. SQL Splicing**

If the ID passed in is null, the SQL statement becomes select \* from user where and deleteFlag=0, which is a problem! Transformed through where tags.

## 3) Develop learning objectives

Clarify the expected goals of the course, focusing on key points and difficulties, including knowledge achievement goals, ability development goals, etc. Before class, take a small test and integrate the relevant knowledge of this lesson into the test questions. The week before class, post it on WeChat group to evaluate the preview effect of students.

### (2) Middle of course teaching

During class, it is necessary to conduct statistics on students' online check-in and strictly enforce discipline during class. Sort out the course content and specify the pre class preview content. In teaching, projects can be broken down into different knowledge points, and each knowledge point can be dispersed into each course content. Students' pre-class previews are integrated with these knowledge points to achieve teaching objectives.

### 1) Quiz

In teaching, actively utilize the small test function of the teaching platform, prepare quick question and

answer questions, assign them for a 10 minute test, and provide on-site explanations. For example, the `sum()` return value in SQL is returned as `BigDecimal` in `myBatis`, and what is used to receive it. This question can guide students to receive return values in different ways, compare the results, and obtain the correct results. At the same time, use the statistical function of the platform to judge the students' answers, and then summarize the errors and misunderstandings, and provide detailed explanations.

## 2) Interactive teaching

The teaching method of divided classes is adopted in the class. Firstly, starting from stimulating students' interest in learning, practical cases are listed to support the viewpoint of the importance of the course. For example, large shopping websites often use the `SSM` framework, and some backend code can be selected for analysis. This makes the scope of application of the course clear at a glance, enhancing the motivation for learning. Furthermore, the teaching method should be more flexible, allowing students to use mobile phones, combining online and offline, and conducting group discussions centered around students. Teachers can use the teaching platform to call and answer questions online, distribute questions online, answer questions online, and publish online survey questionnaires. Adopting this method can greatly stimulate students' enthusiasm for learning, activate the classroom atmosphere, and enable them to learn happily in a relaxed atmosphere.

## 3) Analysis of key and difficult points

Before class, the teacher will categorize the key and difficult problems and publish them online. The common problems have been summarized, and in classroom teaching, the form of divided classes can be used to analyze the problems sorted out before class. The entire class can be divided into two parts: the first half of the class is taught by the teacher, and the second half is discussed in groups. Discussion groups are usually voluntary, but for groups with uneven abilities, teachers need to assist in grouping. For each class, for key and difficult issues, the discussion group needs to send a classmate to the stage to explain. This student should be rotatable, and other groups of students can ask questions during the explanation. Students from the stage and off stage can interact, and teachers need to participate. The form of explanation includes but is not limited to specific forms, such as case analysis, experimental analysis of key and difficult points, or special topic Q&A.

## (3) Post-class

Learning after class is the consolidation of the content in class, and strengthening practice, especially improving hands-on skills, is the most effective method.

### 1) Assigning homework post-class

Organize the content in class into individual knowledge points, assign homework after class, and include an appropriate amount of thinking questions. The submission of homework is done online. At the same time, pay attention to the student feedback on the teaching platform, and pay attention to whether there are any student messages on WeChat, sort out common problems, actively organize online Q&A work, and digest difficult problems. In order to enable students to better understand theoretical knowledge, it is required that they must be able to draw mind maps and corresponding mind

maps of each class content to help students understand and understand.

## 2) Expansion training

In addition to emphasizing the explanation of theoretical questions, practical questions are also indispensable. Students are arranged to undergo a large amount of training, and after-school quizzes are arranged, which can be completed online. The quizzes are divided into confirmatory and design questions. Students gain knowledge application methods from confirmatory questions, and explore problem-solving ideas in design questions, which helps to improve their independent thinking ability. The practical content should be diverse, and the PBL teaching method should be used to break down a project into small problems and allocate them to various chapters, and finally combine them into the original project.

### 3.2 Other Teaching Methods

#### (1) Experimental session

The experimental phase adopts the method of students voluntarily forming teams, dividing students into several groups. Each group selects a group leader internally, and refers to the actual division of labor of the enterprise. The group leader supervises the execution of tasks, and the experimental guidance teacher guides and monitors the progress throughout the process. In this way, the group is both a collaborative “colleague” and a mutual learning community. Each group can choose different design methods, but the complexity of the project is roughly the same. The guidance teacher provides goals, and the specific analysis and design work are completed within the group to improve students’ independent analysis and design abilities, as well as to promote students’ self-management ability. Hierarchical experimental teaching is carried out. Students are required to make sufficient preparations before the experiment, guide them to analyze the problems encountered in the experiment, guide them to discuss with team members, encourage them to actively think, and complete the experimental tasks as required. Pay attention to the development of students’ personalities, teach them according to their aptitude, and guide the group leader in assigning tasks based on the characteristics of each student, so that they can meet the basic requirements of the experiment and improve on their shortcomings.

#### (2) Competition and training session

In order to enhance students’ practical skills, a project team is established. The teacher distributes project materials, and students apply the knowledge learned before and during class to the project. Through practical exercises, the teacher coordinates, guides, and assists students in learning and expanding. Based on the characteristics of each group, the teacher extends the experiment to subsequent practical training courses, and encourages each group to actively participate in computer competitions and related competitions organized at all levels, Apply the knowledge learned from experiments and practical training to competitions, using competition to test learning and training to promote learning. In competitions, students can summarize their experiences and repeatedly verify them through experiments and practical training.

#### 4. Analysis of the Effectiveness of Curriculum Reform

##### 4.1 Overall Idea

###### (1) Overall idea

Design a classic case - medical information system, which utilizes framework knowledge to implement. The goal of the project is to provide the medical department with the ability to collect, store, process, extract and exchange data of patient diagnosis and treatment information and administrative management information, and to meet the Functional requirement of all authorized users. The system includes user management, department management, doctor management, registration management, drug management, etc. This case is closely related to daily life and is relatively close to students, making it easier to understand. Students can complete the preliminary design through on-site research, online reference materials, and the assistance of third-party personnel.

###### (2) Implementation Rules

The system development of this project is divided into 8 parts, corresponding to relevant knowledge points. The detailed rules are shown in the Table below:

**Table 1. Allocation of Project Development Proportion**

Step	Content	Proportion (%)
Project Background and Structure	Collect sales business information and analyze system and data requirements	10
Environmental construction	Configuration Engineering Files	10
Module Design	Module functional structure design	40
code	Code implementation	30
Testing and Maintenance	Use testing tools or front-end development platforms to complete testing and maintain continuous monitoring of data	10

In the software development lifecycle, the design phase is the most core, including conceptual model design, logical model design, and physical model design. Therefore, when teaching, it should be taken as the main line, with key content interspersed, while also taking into account code writing, testing, and maintenance, which is easily overlooked by most students.

##### 4.2 Implementation Rules and Assessment Standards

The course includes two parts: online and offline. The method reform integrates the cultivation of practical abilities, using theoretical guidance to practice. The specific assessment standards are shown



in Tables 2 and 3.

**Table 2. Project Evaluation Standards**

Rating level	Standard Analysis
Excellent	Undertake multiple tasks, work diligently and responsibly, possess strong independent design ability, and strong team coordination ability; Having the ability to solve practical problems and innovative thinking; Strong ability to connect front and back platforms; Proficient in using various database objects
Good	Undertake a lot of tasks, have a serious work attitude, and have a certain degree of independent design ability; Able to assist in solving practical problems, with a bit of innovative thinking; Proficient in using various database objects
Medium	Undertake certain tasks and possess certain design skills; Proficient in using various database objects
Pass	Undertake some tasks, have a serious work attitude, and can complete basic database object operations
Fail	Not actively working and unable to complete basic database object operations

**Table 3. Comprehensive Evaluation Criteria**

Project	Proportion (%)	Rating Description
Sign in	10	Deduct 1 point for each delay and 3 points for absences
Quiz	10	Organize 2 tests with 10 objective questions each time
Online learning situation	10	Based on online duration
Class Performance	10	Q&A, interaction, discipline, etc
Experimental condition	30	Experimental report, hands-on ability, etc
Project Implementation Status	30	Reference Table 2 Standards

## 5. Conclusion

Through the curriculum reform, it has been found that the reformed blended teaching mode enriches teaching methods and better mobilizes students' learning enthusiasm compared to traditional teaching modes. It combines online and offline learning in a reasonable manner, while disassembling projects into experiments, gradually advancing knowledge points, and adopting a split classroom teaching method, making students the main body of the classroom, cultivating their independent problem-solving ability, and developing scientific and effective evaluation standards, after several semesters of application, the effect is significant.

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