



# The Exploration of SPOC Development and Application in Higher Mathematics Under the Environment of “Internet + Education”

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**Abstract.** In this paper, combined with the current teaching situation of advanced mathematics, guided by the idea of Web application design, under the Java language development environment, using MyEclipse integrated development tool, and according to MVC design pattern, we will build an online teaching system of advanced mathematics SPOC. The server side of the system will be integrated by Spring, SpringMVC and MyBatis framework, which is convenient for the compilation of dao interface, mapper file, service business processing class and controller control class. It can fully realize the networking and digital transformation of higher mathematics teaching process, focusing on teaching resources, teaching forms, assessment and interaction, so as to make positive attempts to improve teaching efficiency, improve the construction of education system and promote the information reform of education mode.

**Keywords:** Internet + · Advanced mathematics SPOC · Java · Web application

## 1 Introduction

The education and teaching mode in colleges and universities includes teaching ideas or teaching theories, teaching objectives, operating procedures, teacher-student combination, conditions and evaluation. [1] Among them, the teaching goal is the core of the teaching mode, which marks the presupposition of teaching results, and is more related to the implementation of operating procedures and the formulation of evaluation standards. The teaching objectives are obviously different among different disciplines and majors. As a basic discipline, the teaching goal of higher mathematics is not only to improve students' knowledge level and master their applied skills, but also to focus on the cultivation of logical thinking ability, the establishment of innovative consciousness and the formation of correct world outlook. So, the practical significance and far-reaching influence of the reform of higher mathematics teaching mode are self-evident, and it has become an important topic in front of colleges and universities at all levels.

According to the survey results, the current situation of higher mathematics education and teaching still faces many difficulties. In the traditional teaching mode system,

```

public void service(ServletRequest req, ServletResponse res)
    throws ServletException, IOException;
protected void doPost(HttpServletRequest request, HttpServletResponse response) throws
ServletException, IOException {
    String reqUri = request.getRequestURI();
    String header = request.getHeader("Content-Type");
    BufferedReader reader = request.getReader();
    String str = null;
    while((str=reader.readLine()) !=null ){
        System.out.println(str);
    }
    public static void errorResponse(ServletResponse servletResponse, BusinessException e)
    throws IOException {
        HttpServletResponse res = (HttpServletResponse) servletResponse;
        res.setHeader("Access-Control-Allow-Origin", "http://localhost:8081");
        res.setHeader("Access-Control-Allow-Headers", "accessToken");
        res.setHeader("Access-Control-Allow-Headers", "refreshToken");
        res.setHeader("Content-Type", "application/json;charset=UTF-8");
        res.setStatus(HttpServletResponse.SC_OK);
        res.setCharacterEncoding("UTF-8");
        PrintWriter writer = res.getWriter();
        AjaxResult result = AjaxResult.builder().withSimpleInject(e).build();
        writer.write(JSON.toJSONString(result));
        writer.close();
    }
}

```

**Fig. 1.** The key code for the Servlet to implement the request/response pattern (Original)

problems such as unclear teaching objectives, single teaching methods and forms, outdated teaching resources, and imperfect evaluation standards aggravate the contradiction between teaching supply and talent training needs of higher mathematics education. Therefore, this paper holds that under the environment of “Internet + education”, based on Java language development environment, SSM framework is adopted to construct SPOC online teaching system of higher mathematics, so as to realize the network and digital transformation of higher mathematics education and teaching. It is conducive to the reform of traditional teaching mode to “online-offline” hybrid teaching mode, and promotes the deep integration of the new generation of information technology and classroom teaching.

## 2 Overview of Key Technologies

### 2.1 JavaWeb Technology

As one of the representative technologies to realize Web application development, Java technology is the general name of dynamic Web resource development technology with Java language as its core. The JavaWeb technology can be divided into three parts: front-end development, back-end development and database development. The core technology of the back-end development is Servlet, which runs on Web server-side programs. The Servlet forms a one-to-one correspondence with the requests sent by the client, and the business logic is constructed by receiving the request information contained in ServletRequest. Then, the response information is encapsulated as ServletResponse and returned to the Web server, and then converted into a standard HTTP response and returned to the client to complete the processing of the client’s request. The overall process implementation code is shown in Fig. 1. [2].

## 2.2 SSM Architecture

The SSM (Spring + SpringMVC + MyBatis) framework set is the integration of Spring and MyBatis. As a standard MVC development framework model, SSM framework is a Web application development framework with simple data sources in Java language development environment. [3] SSM architecture obeys the J2EE development specification. In practical application, SSM architecture can use the classic three-tier structure of “view-model-controller” to realize the agile development of Web applications. It greatly reduces the development time and cost, and at the same time, it relies on the support of strong user community to improve the functional expansibility of the framework, so as to achieve the functional requirements of the system with more reasonable resource allocation and smaller resource proportion.

## 2.3 Development Process

The overall development of higher mathematics SPOC online teaching system is based on Windows10.0 operating system, with Java as the basic development environment, JDK version 1.8 and above, MyEclipse 2018 as the Java development environment, Tomcat 8.0 as the Web server and MySQL 5.8 as the database server. And the project object model (Maven) is used to manage the project structure. Maven chooses Apache-Maven-3.2.1 version. After the above software is installed and set up, the basic framework of the project is built through Maven Project function under MyEclipse 2018. Then, under the generated pom.xml file, various Jar packages required by SSM framework are introduced through code editing. After the introduction, the controller package, entity object package, mapper package and service package are newly created in src/main/java directory to further improve the operation control and management of SSM framework. [4] After adjustment and testing, it is proved that the overall development environment is built. Through the introduction of the above key technical theories, the overall environment of the system development, the configuration of related software and tools are determined, and the technical feasibility of the overall project of SPOC online teaching system for higher mathematics is also clarified.

# 3 Function Realization

## 3.1 Student Side

The system supports hashing algorithm to encrypt user password, which is used as authentication method to complete user login authentication. The key code of implementing RSA encryption algorithm in Java language is shown in Fig. 2. After successful login, students can enter the course selection interface and choose and join according to their own preferences.

### a. Online Learning

IN the online learning module, the system uses SPOC teaching mode to plan and set the course content and learning progress in detail. Students are required to complete their studies according to the established “learning path” and are not allowed to quit or change

```

protected byte[] encrypt(RSAPublicKey publicKey,byte[] obj)throws Exception {
    Cipher cipher =Cipher.getInstance("RSA");
    cipher.init(Cipher.ENCRYPT_MODE,publicKey);
    return cipher.doFinal(obj);
}
protected byte[] decrypt(RSAPrivateKey privateKey,byte[] obj)throws Exception{
    Cipher cipher =Cipher.getInstance("RSA");
    cipher.init(Cipher.DECRYPT_MODE,privateKey);
    return cipher.doFinal(obj);
}

```

**Fig. 2.** RSA algorithm implementation key code (Original)

halfway. Meanwhile, the system will introduce the learning points system. Students will get points after completing the learning tasks, and the points will be accumulated to the corresponding standards to unlock the learning of follow-up resources. The learning resources covered by the system are mainly divided into two categories. The first category of resources is synchronized with offline classroom teaching, mainly teaching materials, PPT courseware and after-class review materials. The other is the unique online video teaching courses. The rich network teaching resources can not only make up for the deficiency of the traditional teaching mode, but also conform to the current habit of college students' network learning and life, stimulate students' learning enthusiasm and improve their learning effect.

### **b. Operation and Testing**

In this module, the system supports students to finish the homework assigned by teachers online, and upload and submit it to get teachers' corrections in time. Moreover, students can complete the staged assessment tests organized by teachers online. The content of the tests involves not only the course content, but also the corresponding assessment of students' learning objectives, learning self-control ability and learning autonomy. With this data as the same, set the restrictive constraints for students to complete or withdraw from the course. [5].

### **c. Exchange Feedback**

The communication between students and between teachers and students is supported by systematic forum posting and interest topic groups. It not only facilitates the exchange and sharing of learning experiences among students, but also forms a strong learning atmosphere. And it can also narrow the distance between students and teachers, facilitate teachers' professional answering and counseling, and get students' real thoughts and real needs in time.

## **3.2 Teacher Side**

When the teacher users log in to the system, the main work lies in the collection, collation, production, uploading and maintenance of various teaching resources. According to SPOC mode, the online learning path of the course is set, and the points of the corresponding learning tasks are set to ensure the normal operation of the online teaching system. And students' communication and questioning can also actively participate in it.

With the application advantages of the platform, targeted counseling and help to students can be completed more conveniently and directly, which will help improve the teaching effect.

## 4 Conclusion

In this paper, taking the present situation of higher mathematics teaching as the research object, aiming at the new standard of high-quality discipline system construction and the new demand of teaching mode reform, and with the help of the application advantages of network information technology, the SPOC online teaching system of higher mathematics is completed. It can not only effectively improve the effectiveness of teaching activities, but also give consideration to students' autonomous learning and individualized growth, promote the reform of teaching mode, improve the teaching system, and further make a beneficial attempt for the informatization construction of higher education.

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