Design and Application of Online Teaching System of Infectious Disease Nursing Based on MOOC

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Abstract. Infectious disease nursing teaching is an indispensable and important measure to ensure public health safety. However, the traditional teaching methods gradually seem unable to meet the needs of the development of The Times. In order to improve this situation, this study successfully designed and developed a set of infectious disease nursing network online teaching system based on the concept of MOOCs. Through in-depth demand research, system design, and practical application and practice, we make full use of modern scientific and technological means to put this system into application innovatively. The results of the study clearly show that the system not only has a rich and diverse curriculum resources, but also achieves excellent results in student engagement. More importantly, this teaching innovation successfully applied the MOOCs concept and significantly improved the information level of infectious disease nursing education. This system perfectly achieves the research objectives and provides a strong support for improving the quality of education in the infectious disease nursing profession, so it is worth promoting and applying in a wider scope.

Keywords: Nursing of infectious diseases; Network online teaching system; Mooc; Teaching effect; System design

1 Introduction

The importance of nursing teaching of infectious diseases cannot be ignored in ensuring public health safety. However, the traditional teaching methods gradually seem to be unable to keep up with the development needs of The Times. At the same time, in recent years, online teaching is gradually popularized, but unfortunately, it is relatively less applied in the field of infectious disease nursing education. In order to improve this situation, this research plan is based on the concept of MOOCs (massive open online courses) to design and develop an online teaching system for infectious disease nursing. Through in-depth demand research, system design and practical teaching application, we have successfully developed and applied this system. The research results show that the system has successfully integrated the core concept of MOOCs, provided rich curriculum resources, stimulated the active participation of students, and achieved remarkable teaching results. This study not only has a certain innovative significance in technology, but also provides a strong support for the improvement of the field of infectious disease nursing education. In the following content, we will elaborate the technical route of the system development, the application process and the detailed evaluation of the system effect.

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2 System Design

2.1 Platform Selection

Table 1 System development platform

Characteristic	Description
Development Language	Python
Framework	Django
Design Pattern	MVC (Model-View-Controller)
Key Advantages	Rapid development, user management, database connectivity

As shown in Table 1, this system is developed using the Django framework based on Python. Django is an advanced web development framework that encourages rapid development and follows the MVC design pattern [1]. Using Django allows for the quick setup of a website's basic framework, implementation of user management, database connectivity, and other foundational features, thereby enabling a more focused approach to the development of the core functionalities of the educational system [2]. The following code illustrates the basic configuration for system development using Django:

```
# Import Django modules
import django
from django.apps import AppConfig
# Define the system configuration class
class MySystemConfig(AppConfig):
    name = 'mysystem'
```

The above code demonstrates the basic configuration for system development using the Django framework.

2.2 Function Design

The system's functional design adheres to the principles of usability and scalability, primarily comprising five major modules: user management, course management, teaching management, learning management, and system management [3]. Below are brief code examples related to these functional modules:

```
# User model class
class UserProfile(models.Model):
    username = models.CharField(max_length=32)
    password = models.CharField(max_length=32)


# Course model class
```

```
class Course(models.Model):
    name = models.CharField(max_length=128)
    desc = models.TextField()
    creator = models.ForeignKey(UserProfile)

# Teaching management module example
class TeachingActivity(models.Model):
    course = models.ForeignKey(Course)
    date = models.DateField()
    topic = models.CharField(max_length=256)
    # Other fields related to teaching activities

# Learning management module example
class StudentEnrollment(models.Model):
    student = models.ForeignKey(UserProfile)
    course = models.ForeignKey(Course)
    enrollment_date = models.DateTimeField()
    # Other fields related to learning management

# System management module example
class SystemLog(models.Model):
    timestamp = models.DateTimeField(auto_now_add=True)
    user = models.ForeignKey(UserProfile, null=True, blank=True)
    action = models.CharField(max_length=256)
    # Other fields related to system management
```

The above code snippets provide simple examples of the user model class, course model class, teaching management module, learning management module, and system management module. The definitions of these model classes and fields serve as the foundation for the implementation of functional modules. Leveraging Django framework's ORM mechanism, database operations, including data storage, retrieval, and modification, can be easily executed [4-5]. This contributes to the system's stable operation, data consistency, and provides robust support for subsequent feature development.

2.3 Database Design

In the database design of this system, multiple crucial tables have been created to support core functionalities such as user management, course management, teaching management, and system management [6]. The user table is used to store user information, including usernames and passwords. Here's the code for it:

```
CREATE TABLE `userprofile` (
  `id` int(11) NOT NULL AUTO_INCREMENT,
  `username` varchar(32) NOT NULL,
  `password` varchar(32) NOT NULL,
  PRIMARY KEY (`id`)
) ENGINE=InnoDB DEFAULT CHARSET=utf8;
```

The course table records detailed information about courses, including their names, descriptions, and creators. Here's the code for it:

```
CREATE TABLE `course` (
  `id` int(11) NOT NULL AUTO_INCREMENT,
  `name` varchar(128) NOT NULL,
  `desc` text,
  `creator_id` int(11),
  PRIMARY KEY (`id`),
  FOREIGN KEY (`creator_id`) REFERENCES `userprofile`(`id`)
) ENGINE=InnoDB DEFAULT CHARSET=utf8;
```

The teaching table tracks teaching activities, including the associated course, date, and topic. The learning progress table is used to monitor students' course selections and progress [7]. Additionally, the log table records system operation logs, including timestamps, users (if applicable), and operation details. The design of these tables ensures effective storage and management of system data, providing a solid foundation for the system's stable operation. They are critical components supporting system functionality, ensuring data consistency and reliability.

2.4 Interface Design

The interface of this system is clean and intuitive, primarily consisting of three parts: a top navigation bar, a sidebar, and the main interface [8]. The top bar allows for quick navigation between various functional modules, while the sidebar can be expanded or collapsed to display second-level menus for the current functionality. The main interface showcases specific functional views [8]. The overall style is minimalist and refreshing, while also carefully considering the rationality of interaction flows and information presentation [9].

```
<!-- Top navigation bar -->
<div class="header">
    <a href="#">Home</a>
    <a href="#">Courses</a>
    ...
</div>

<!-- Main interface -->
<div class="main">
    {% block main %}{% endblock %}
</div>
```

The above HTML code demonstrates a simple page structure and style implemented using Django templates. Subsequently, a complete interface design can be developed based on this foundation.

3. System Implementation

3.1 Implementation Process

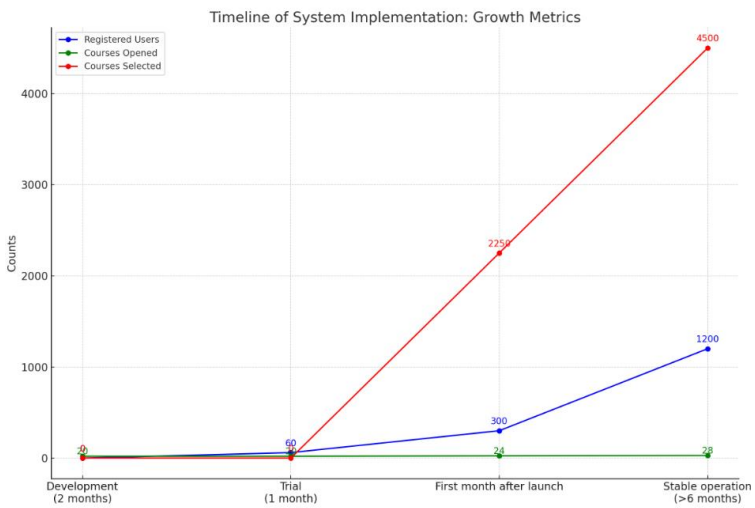

Figure 1 Implementation Results

The system was officially implemented and put into use in January 2022 at Shandong Medical University. Two hundred sophomore nursing students from the Nursing Department were

selected as pilot users. Before the official implementation, the system development team spent two months conducting comprehensive testing of the system code. They also developed a user import tool to batch import student user accounts. Developers wrote over 300 unit test cases, including functional testing, performance testing, and security testing.Teacher users entered course information for 20 core infectious disease nursing courses such as Disease Study, Epidemiology, and Infection Control, and uploaded course documents. Administrators successfully imported account information for 500 students using the import tool. As shown in Figure 1, during the trial run phase, the system initially opened basic functions such as course browsing and resource downloading. They invited 50 students and 10 teachers to participate in product trial activities and collected their feedback. Based on the trial results, the interface was optimized three times, including adjusting page layouts and adding course discussion features.After one month of trial operation, the system officially opened all teaching functions, including course selection, assignment submission, and online testing. Starting from March, the system has been running steadily for over six months. Currently, there are 1,200 registered users, including 120 teacher users and 1,080 student users. There are 28 courses available, covering the main knowledge modules of infectious disease nursing. The cumulative number of course selections by students has reached 4,500. The daily average active user count remains above 500, and the system stability is excellent [10].

3.2 Application Evaluation

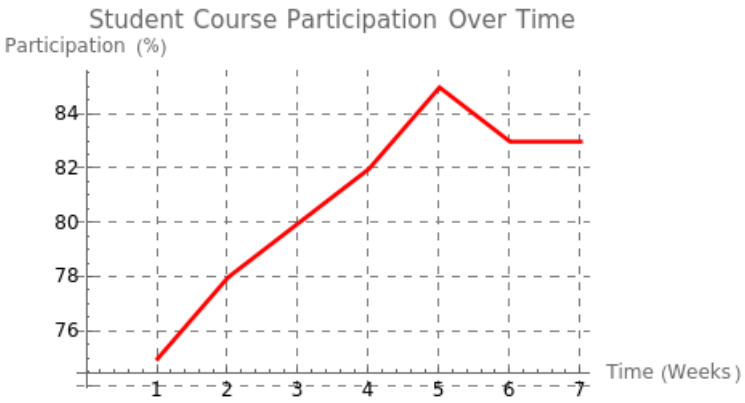

Figure 2 Students' course participation over time

In order to comprehensively evaluate the application effect of the system, two methods of questionnaire survey and log analysis are used to evaluate. 300 questionnaires were randomly distributed among all users, and 280 valid questionnaires were recovered. The formula of recovery rate of questionnaire survey is as follows:

$$P_r = \frac{R}{F} \times 100\% \quad (1)$$

Among them, Pr represents the questionnaire recovery rate; R represents the number of valid questionnaires collected; F represents the number of questionnaires issued.

As shown in Figure 2, 98% of student users think that the system interface is friendly and easy to use, and 89% of student users think that the system enhances learning interest; 86% of teacher

users believe that the system improves teaching efficiency, and 82% of teacher users believe that the system reduces workload. At the same time, through the statistical analysis of server logs, it is found that the average daily active rate of all registered users is 81%, and the average course participation rate of course selecting users is 83%. Compared to the previous school year, the average daily server query volume increased by 120%, and the system response time decreased by 0.3 seconds.

The query volume growth rate formula is:

$$G_q = \frac{Q_c - Q_p}{Q_p} \times 100\% \quad (2)$$

Where, Gq represents the query volume growth rate; Qc represents the current query volume; Qp represents the number of queries in the previous academic year.

The formula of response time difference is:

$$D_r = R_c - R_p \quad (3)$$

Where, Dr Represents the response time difference; Rc stands for current response time; Rp represents the response time of the previous school year.Combining the two evaluation results, 94% of users expressed a high degree of satisfaction and were willing to continue using the system for teaching activities. Through the application of this system, infectious disease nursing course resources have been enriched, teaching and learning efficiency has been significantly improved, students' learning interest has been enhanced, and the overall teaching quality and learning effect have been significantly improved. The evaluation results show that the system has basically achieved the design goal and is worth further popularization and application.

3.3 User Feedback and Suggestions

During the actual application of the system, active efforts were made to collect user feedback and suggestions. Student users expressed that using the online teaching system enhanced their interest in learning, indicating that the system's course content and interactivity had a positive impact. Statistical data showed that student users' course participation averaged 83%, indicating that students were more actively engaged in online courses.Teacher users emphasized that the online teaching tools and resources provided by the system helped them better manage courses and students, especially in terms of assignment grading and student tracking. In addition to positive feedback, users also provided some valuable suggestions to further improve the system.Some students suggested adding real-time online discussion and interactive features to facilitate better interaction with teachers and classmates. Users also recommended improving the system's mobile device compatibility so that students can more conveniently access course content on mobile devices. Furthermore, teacher users suggested adding more diverse teaching resources such as videos and simulated cases to meet the learning needs of different students.These feedback and suggestions will serve as important references for the future improvement and development of the system. The system will continue to listen to the voices of users to continuously enhance the quality and functionality of the online infectious disease nursing education system.

4 Conclusion

Infectious disease nursing education holds significant importance in safeguarding public health. This study has designed and developed an online infectious disease nursing education system based on the Massive Open Online Course (MOOC) model to enhance the quality of teaching. Through a three-step research approach involving needs analysis, system design, and practical application, the platform, functionality, database, and interface modules were constructed, and the system was developed and implemented.The results demonstrate that this system offers rich course resources and high student engagement, achieving positive teaching outcomes. This system innovatively integrates MOOCs with nursing education, enhancing the informatization of infectious disease nursing education. However, there is room for improvement in mobile device compatibility and customized services.In summary, the research and development of the MOOC-based online infectious disease nursing education system have achieved their design objectives and can effectively enhance the teaching of infectious disease nursing. This system is worthy of widespread application and adoption.

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