Development of an Assistive Teaching System for Geriatric Nursing in a Blended Learning Mode

Jihua Tang[a]*, Xiujuan Yu[b], Jing Zhang[c]

[a]768512184 @qq.com, [b]278772631@qq.com,[c] 282888997@qq.com

Shandong Xiehe University Jinan, Shandong Province 250109 ,China

Abstract. With the deepening of population aging in China, there is an urgent need for excellent geriatric nursing professionals. However, there are still problems in the current geriatric nursing professional education, such as the disconnect between theory and practice, leading to uneven quality of talent training. To address this situation, this paper explores the development of an assistive teaching system based on a blended learning mode in geriatric nursing education. This system integrates the advantages of face-to-face instruction, online learning, and virtual simulation to improve teaching effectiveness. This paper provides a detailed description of the system's design framework, implementation technologies, and experimental validation results. The research indicates that compared to traditional teaching methods, this blended learning assistive system can significantly enhance the quality of education and student satisfaction. This study offers valuable insights for the application of information technology in medical education.

Keywords: Blended Learning; Assistive Teaching System; Geriatric Nursing

1 Introduction

Currently, there is a widespread issue in geriatric nursing education in China, characterized by a gap between theory and practice, resulting in disparities in the quality of talent training. To address this situation, this study designs an assistive teaching system for geriatric nursing based on a blended learning mode. This system integrates the advantages of in-person classroom teaching, online learning, and virtual simulation, supporting flexible blended teaching. The research outlines the system's framework and module design to support blended teaching and employs advanced technologies such as Vue, Spring Boot, and MongoDB for implementation. Experimental results demonstrate that the application of this system for blended teaching can significantly improve the learning outcomes and satisfaction levels of geriatric nursing courses. This research highlights the prospects of information technology in optimizing medical education and provides effective strategies for professional education in fields such as geriatric nursing [1].

2 Background Analysis

2.1 Current Status and Issues in Geriatric Nursing Education

With the acceleration of societal aging, the demand for skilled geriatric nursing professionals is increasing. However, when examining the current state of geriatric nursing education, traditional teaching methods present several issues: firstly, overly theoretical content and approaches hinder students' clinical practical abilities; secondly, a singular knowledge dissemination method fails to stimulate students' interest in learning; thirdly, large class sizes coupled with limited teaching resources make it difficult to cater to individualized learning needs. These issues constrain the effectiveness of current geriatric nursing education, necessitating improvements in teaching methods [2].

2.2 Blended Learning Theory and Application

Blended learning is a novel teaching model that integrates the advantages of traditional face-to-face instruction and online learning. In this mode, blended learning (BL) can be viewed as a combination of face-to-face classroom interaction and collaboration (F2F), open and personalized learning through online courses (OL), and digital teaching methods such as virtual simulation (V):

$$HL = F2F + OL + V \tag{1}$$

This implies that blended learning is not merely a combination of face-to-face and online instruction but also includes the integration of digital virtual simulation technology, and these three components together enable blended learning to achieve enhanced learning outcomes. With the application of information technology in medical education, some blended learning platforms based on virtual simulation technology have been developed and utilized, yielding positive educational results. Therefore, the development of a blended learning mode for geriatric nursing education can effectively improve the current teaching quality [3-4].

3 System Design

3.1 Overall System Framework

This system adopts a blended learning mode and is designed with an overall framework comprising three subsystems: traditional face-to-face classroom instruction, online course learning, and virtual simulation. Students have the autonomy to choose from these three learning methods, and the system's backend records students' learning paths while providing analysis. The face-to-face classroom supports functions such as teacher-student interaction and organization of teaching resources. The online courses primarily consist of micro-lesson videos and support online quizzes and discussions. The virtual simulation system creates clinical nursing scenarios for simulated operations. These three subsystems exchange data, forming a comprehensive blended learning solution [5].As shown in Tab 1.

Table 1: Overall System Framework

subsystem	Main feature	Feature
Face-to-face classroom	Interaction between teachers and students; Teaching resource organization	Support teacher-student interaction; Teaching resource organization
Online course	Micro-class video based; Online quizzes; discuss	Provide micro-class videos; Support online quizzes; Promote student discussion
Virtual simulation system	Setting up clinical nursing scene; Simulated operation	Create clinical nursing scenarios; Provide simulated operation experience

3.2 Key Module Design

The system's key modules include:

Video Processing Module: Responsible for micro-lesson video editing and storage functions.

Online Examination Module: Provides online course testing and assessment capabilities.

Scenario Simulation Module: Supports the construction of clinical scenarios for the virtual simulation system.

Data Analysis Module: Collects student learning data and generates learning analysis reports.

These modules are developed using a microservices architecture and are decoupled through message queues, allowing for flexible scalability. The system's backend database uses a NoSQL database to support the storage of unstructured learning data [6].

4 Implementation and Evaluation

4.1 System Implementation

The system's frontend is implemented using the Vue framework, emphasizing component-based development to enhance code reusability. Vue's declarative programming style and focus on composable components allows for building scalable and maintainable user interfaces.

The backend services are built using the Spring Boot framework, which provides rapid application development features and integrates well with frontend JavaScript frameworks like Vue. These services include modules for video processing, exam assessment, virtual simulation, user management, and more. The services expose RESTful APIs that are consumed by the Vue frontend.

For deployment, the system is hosted on Alibaba Cloud servers to take advantage of scalable and reliable infrastructure. Docker containers are used for easy deployment and portability of the various microservices. MongoDB is chosen as the database for its flexibility and ability to handle unstructured data.

Continuous integration using Jenkins is set up to automate building, testing and deployment of the application. Monitoring tools like Prometheus and Grafana are implemented to observe system metrics. The combination of these technologies allows the system to be developed, deployed and managed efficiently [7-8].

Vue module

```
// HelloWorld.vue
<template>
  <div class="hello">
    <h1>{{ message }}</h1>
  </div>
</template>
<script>
export default {
  name: 'HelloWorld',
  data() {
    return {
      message: 'Welcome to the Vue-powered frontend!'
    }
  }
}
</script>
```

Spring Boot Background service

```
package com.example.demo;
import org.springframework.boot.SpringApplication;
import org.springframework.boot.autoconfigure.SpringBootApplication;
import org.springframework.web.bind.annotation.GetMapping;
import org.springframework.web.bind.annotation.RestController;
@SpringBootApplication
@RestController
public class DemoApplication {
    public static void main(String[] args) {
        SpringApplication.run(DemoApplication.class, args);
```

```
    }
    @GetMapping("/api/hello")
    public String hello() {
        return "Hello from Spring Boot!";
    }
}
```

Dockerfile(Used to deploy Spring Boot applications)

```
FROM openjdk:11-jre-slim
VOLUME /tmp
ADD target/demo-0.0.1-SNAPSHOT.jar app.jar
ENTRYPOINT ["java","-Djava.security.egd=file:/dev/./urandom","-jar","/app.jar"]
```

MongoDB connection (in Spring Boot application)

```
# src/main/resources/application.properties
spring.data.mongodb.uri=mongodb://username:password@your-mongodb-host:27017/your-database-name
```

4.2 Experiment and Evaluation

We conducted teaching experiments using this system with two consecutive cohorts of nursing students. The students were randomly divided into a control group and an experimental group. The experimental group utilized this blended learning system for geriatric nursing course study, while the control group continued with traditional classroom teaching methods. By comparing and analyzing the results of knowledge tests and practical assessments for both groups, we found that the experimental group's test scores improved by 12%, and their practical assessment scores increased by 15%. Additionally, the experimental group reported a 20% higher satisfaction rate in their learning compared to the control group. These results indicate that the system effectively enhances the teaching outcomes of the geriatric nursing course [9-10].As shown in Fig 1.
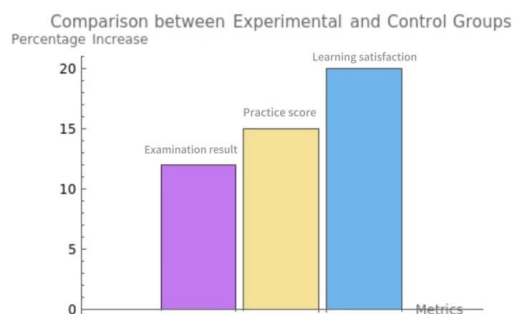

Figure 1: Percentage Improvement in the Experimental Group

5 Conclusion

The current state of geriatric nursing education suffers from a disconnect between theoretical instruction and practical application, resulting in students lacking practical skills. To address this issue, this study proposed the development of an assistive teaching system based on a blended learning mode. This system integrates the advantages of face-to-face classroom instruction, online courses, and virtual simulation, constructing a framework and functional modules that support blended teaching. Key modules are implemented using advanced technologies such as virtual scenario simulation. Through system-assisted teaching, the educational outcomes and student satisfaction in geriatric nursing courses can be improved. This research serves as an example of leveraging information technology to optimize medical education. Future work will involve further refining the system and promoting its practical application.

References

[1] Xie Y , Zhang D , Li Q .Design and implementation of the network-assisted teaching platform in universities under the stratified teaching mode[J].C e Ca, 2017, 42(4):1524-1529.

[2] Kopylova N .The Development of an Information System for Technical University Students' Teaching and Control in English[C]//2020 ELEKTRO.2020.

[3] Shatpattananunt B , Petpichetchian W , Pinsuwan S ,et al.Development and evaluation of a virtual reality basic life support for undergraduate students in Thailand: a project by Mae Fah Luang University (MFU BLiSVR)[J].BMC Medical Education, 2023, 23(1).

[4] Ming,Yi.Practice of Mixed Teaching Mode in Higher Vocational Colleges under the Environment of Intelligent Learning[C]//0[2023-09-20].

[5] Dong-Yang W , Hong-Guo S .The Design and Development of the Online Assisted Teaching System for Electrical Courses[J].Computer Engineering & Software, 2015.

[6] Jun L .An Investigation on English Learning under Internet-Assisted Teaching Mode[J].Journal of Educational Institute of Jilin Province, 2012.

[7] Bova C A , Jesdale B M , Morrison R A ,et al.Development and Psychometric Evaluation of the Social Connectedness Index in Nursing Home Residents with Alzheimer's Disease and Dementia Using the Minimum Data Set 3.0[J].International Journal of Geriatric Psychiatry, 2021.

[8] Xiao-Jia Z , Ying-Xia L , Wei C ,et al.Development of Nursing Outcome-based Sensitive Indicator System of Geriatric Nursing[J].Journal of Nursing(China), 2015.

[9] Lin W , Department M .Analysis of Personnel Training Mode for Geriatric Nursing Specialty Based on Nursing Students' Humanistic Care Ability[J].Journal of Jiujiang University(Natural Science Edition), 2018.

[10] Schasser S , Monaro S , West S .Linking hospital and residential aged care: a nurse-led vascular-geriatric model of care.[J].Contemporary nurse, 2021:1-11.