An Implementation of the Nursing Education APP with Intelligent Question Setting Schemes

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Abstract. The number of clinical nurse is insufficient which causes the nursing manpower in the hospital is short staffed in recent years. However, the burden of patient care did not decrease but increase on the contrary. Therefore, the way to build a small and strong medical team under the existing manpower is to start with the enhancement of basic skills and the strength of nursing education and training. With the increasing application of mobile APP, applying of them to education and training in various professional fields has become more and more popular. In this study, an intelligent learning APP for nursing students is established according to the actual needs of the nursing students and clinical staffs. In addition to the basic nursing education functions, in particular, it provides an intelligent learning situation analysis and exam questions selection model in order to allow users to obtain a more targeted and personalized training environment during the learning process. The experimental results show that the mobile nursing education and learning system established with the APP can promote students’ learning efficiency and outcomes by about 34%, and it also gets a good responses in terms of satisfaction.

Introduction

In recent years, the problem of insufficient nursing manpower has been one of the focuses of the society when mentioned about the topic of medical human resource. In Taiwan, the tightness of nursing staff in medium and large hospitals and the excessive turnover rate have jeopardized the normal medical operation and reduced the quality of medical care. Only 60% of nursing graduates are working in hospitals. The shortage of nursing manpower in Taiwan does not lie in the shortage of nursing staff, but in the employment rate of nursing students and the low willingness to long-term stay in the hospital. This problem becomes worse in the short term due to the serious shortage of children and the increasing demand for medical staff for aging people. In summary, it is more pragmatic to strengthen the professional skills of current practitioners and reduce the professional threshold for newcomers. On the other hand, in the information age of the 21st century, the demand for professional knowledge by medical staff has increased with the rapid development of medical information. At the same time, how to use the communication technology to educate and train employees in various fields has become a hot topic [1][2]. The advancement and popularization of mobile technology and wireless communication technology have made the use and model of ubiquitous learning using mobile phones or tablets more prosperous [3]. Using "learning on the move" or "learning across different contexts" will be able to incorporate a multi-carrier learning model in the education strategy. If a tailor-made education-specific nursing APP system which is capable to connect the back-end information system platform can be established, it will not only make good use of the medical information system currently purchased by the hospital but also use the learning vehicles to help the school nursing students to strengthen their professional knowledge and enhance their professional skills [4][5][6].
System Description

After user logins to the system, the user is distinguished as the student or the teacher. If the user is identified to the teacher, the following options will appear to be selected:

1. Analysis of exam results.
2. Analysis of the questionnaire.
3. Data upload and update.
4. Connection the hospital-side database.

If the user is identified to the student, the following functions will be presented:

1. Professional knowledge:
   It is divided into internal medicine, surgery, gynecology, pediatrics, orthopedics, oncology and psychiatry. The content of each subject includes the key points of each nursing specialty, the grading and self-practice, and the professional knowledge part which is provided by the nursing department specialists in consideration of the teaching content of the nursing department and the national examination.

2. Exam preparation:
   Includes the school exam question bank, the upgrade exam question bank and the national exam question bank. The exam secret-book will be comprised of data collecting from the Internet and the experience of people who passed the exam.

3. Situational simulation exercises:
   This part is mainly designed to match the OSCE [7] nursing professional capability certification. At present, the Objective Structured Clinical Exclusion (OSCE) adopted by medical education belongs to the semi-simulated clinical situation mode test, and has been widely used in medical education, nursing, dentistry, psychology, etc. This component is designed by referring to the opinions from the professional teachers of the nursing department to design the situation simulation models.

4. Questionnaire survey:
   It includes functions such as user satisfaction survey and feedback.

5. Nursing new knowledge:
   It includes test information, study information, certification information and new knowledge of domestic and international nursing technology.

Operation of Intelligent Question Setting System

In order to establish an individualized test assessment system for variable personal response models, the system environment as shown in Figure 1 is first established. The individual student's basic information (such as age, grade, class, etc.) and the selected test subjects and grades are recorded in the personal exam information data sheet. All the different levels of difficulty and different types of questions were recorded in the exam questions bank. In the student score table, the results of all students in different subjects are stored. The request and the result of the response sent by the APP will be interacted by the server page and the database in the server side. When the server page received the exam result, after the client-side data is parsed, the analysis module is used to call the relevant data tables to determine the appropriate question group of the user, and then the question retrieving module will be used to retrieve the questions and return them to the client-side. The basic principle of the design scenario is to collect the wrong-answered questions from the user to the wrong answering set. If the user's wrong question is included in the wrong answering set, the weight of the selected question will be increased, and the wrong-answered rate with its weighted value are stored in the personal exam information form as the selection basis for the next run. In the next question selection process, the questions easy to wrong-answered are selected based on the different types of questions and the number of questions in each test type. Therefore, the strategy for selecting a question is not only to let the user re-answer the wrong question, but also considering the global situation according to the user's answering history and the weights of all users' answers. In this way,
the adjustment of the problem set can be achieved for individual error-prone questions and question types, and hence achieves the personalized test mode.

Experiment Results

The adopted development platform of this study is ASP/SQL server 2008, PHP/MySQL and APP inventor 2. The system database contains the student basic information and assessment history data table, the test questions database table, and the overall student response record table. Other data tables includes the questionnaires, behavioral analysis data sheets and physiological parameter records table. The basic information form of the student records the basic data including the student number, gender, age, grade, and the scores about the specialist practice, self-assessment and situational simulation exercises. The questionnaire table is used to record the results of previous questionnaires and its scores. The behavior analysis sheet records the number of logins, login time and interest tracks for the use for future research and development of recommendation system. The physiological parameter record table is used to record the physiological data measured from the devices in the home care system to as the reference for analyzing of capability of student's self-emotion management. For the selection of subjects, 120 nursing students were selected, and the average age was 20±1.63 years old. The experiment time was proceeded within one semester. There are three indicators to be examined, which are (1) Improvement rate of score: it represents the changes in learning performance, including personal improvement rate and overall improvement rate. (2) The hit rate of the test questions: It means that the questions provided are if indeed the user's error-prone questions. This indicator is returned by the user, so it is an objective indicator. (3) Usage time variation rate: it measures the engaged learning time of the user after intervention through the APP. This value can be calculated based on the login and stay time stored in the database. (4) Impact of investment time on performance: it evaluates whether the amount of time users use APP will have a significant impact on their exam performance. It can be seen from Figure 2(a) that there is a significant increase in the overall score improvement rate for all use cases (approximately 30% improvement). Figure 2(b) shows that all users assure the high hit rate of the test questions, especially for users who are often wrong-answered (i.e., low score group). Figure 3 shows that more than 80% of users use the APP for more than 2 hours a day, and the integrity and importance of the question bank will determine the willingness of the user to use the APP to some extent. Finally, it is found through the results of the t-test the usage time is significant for both the male or female group (the number of male students is much smaller than the female group), regardless of whether it is for low, medium or high grouping, especially for users low score group.
Conclusion

The application of mobile phones in the education and training field has become increasingly common. This study adopts this kind of platform with its convenience, immediacy and interactivity to build a learning-oriented APP system, which brings practical benefits to the nursing students. The implemented APP provides an intelligent learning situation analysis and question selection module to enable users to obtain a more targeted and personalized training environment during the learning process. The experimental results show that the established nursing education mobile learning system APP can increase the learning efficiency by about 34%. The future research direction includes the combination and expansion of the APP and the nursing treatment guidance system, the design of home and long-term care applications and the automatic patient evaluation and nursing diagnosis system.

![Figure 2. (a) Overall score improvement rate. (b) Hit rate of the test questions.](image)

![Figure 3. Statistics for usage time.](image)

Reference


