

# Web-based Virtual Simulation of Prescription Order: Development and Evaluation

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## Abstract

**Background:** Development of skills related to reading and interpretation of prescription order is an important topic in the introductory pharmacy practice. However, a wide range of handwritten-prescription orders along with limitations in practice time and faculty resources affect the outcomes of the practice. **Aims:** A web-based software for virtual simulation of handwritten-prescription orders was developed, and the effectiveness of its implementation was assessed. **Methods:** After developing the database and necessary tutorials and indexes, a collection of handwritten-medication orders was uploaded to the website. Based on the readability, prescription orders were classified into 3 levels, subsequently, essential drug information of each item in the prescription was added to the software. After the program implementation, user satisfaction and effectiveness were assessed by a questionnaire survey. **Results:** Students agreed that virtual simulation program enhanced their pharmacy-related skills and knowledge. **Conclusion:** Prescription reading software was viewed favorably by pharmacy students. Therefore, this simulation software could be implemented to the pharmacy education program.

**Keywords:** Web-based simulation, handwritten-prescription order, reading

## INTRODUCTION

To fulfill the pharmacist's role as an integrated part of health care, both theoretical knowledge and practical skills are required<sup>1</sup>. Experimental education is a major component of the pharmacy curriculum<sup>2</sup>, which offers an opportunity to apply a theory to practice. An important skill that a student could gain through experimental practice is the ability to correctly read and interpret a prescription order. However, some inherent limitations of the traditional practice in pharmacy set-ups, such as limited instruction time, limited space, and a diverse range of handwritten-prescription orders could affect the outcomes. A solution to overcome these limitations is the use of computer and web-based technologies that offer a unique opportunity for the progress of interactive simulation techniques<sup>3</sup>. These techniques offer anytime and anywhere delivery and, therefore, could cover most drawbacks of traditional learning<sup>4</sup>.

In current work, a web-based simulation environment was developed to improve students' skills in reading and interpretation of prescription orders. As the simulation learning system cannot completely substitute for a preceptor-student relationship, thus an integrated learning method was utilized. After implementation of the integrated learning method, the students' perceptions were assessed by a questionnaire survey.

## METHODS

## Software

According to the requirement of the group, a web-based SQL database was developed by Asreshetab Co. (Tehran, Iran). The software design was oriented toward a simulation learning approach. The program contains about 500 handwritten-prescription templates associated with the information related to each template. Based on the writing illegibly, the prescription orders were classified into three categories, including elementary, intermediate, and professional levels. Different components of each prescription order such as drug name, dosage form, strength, quantity prescribed, and direction for patients were retrieved by an expert pharmacist and after double-checking by another

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pharmacist, data was uploaded to the database. In addition, for each item in the prescription orders, essential data including drug information, pregnancy, and lactation risk categories, a recommendation to the patient and prescription drug interactions were added to the "Prescription Tips" section. Furthermore, several useful tutorials and indexes were added to the website.

To track the student grades by faculty staff, a log-on system was designed. Each user enters the website by using a username and password. While Students enter the homepage, they can select a course, a drug information list or a quiz. When a quiz selected, the desired level should be determined in the next step. In each level, 15 interactive questions regarding the prescription order reading along with five multiple-choice questions about the course materials will randomly be displayed on the screen. When a prescription order displayed on the left pane of the quiz screen, the student should select the correct answers from drop-down lists on the right pane. As shown in figure 1, drop-down boxes are presented for each component of a prescription order, including drug name, strength, dosage form, the amount to be dispensed, and directions to the patient.

Responses could be checked promptly by clicking on a relevant icon. Correct answers are verified with the smiley icon. There was no time limitation for completing the exam at the elementary level and the students have three opportunities to correct their answers. The number of opportunities decreases in the intermediate and professional levels. Furthermore, the illegibility of prescription order is increased in the higher levels.

During the exam, students could access drug information in relation to prescription by clicking on the "Prescription Tips" icon, located at the top of the screen. "Prescription Tips" contains brief information for each item regarding dosage forms, strengths, adverse effects, pregnancy category, lactation category, a recommendation to the patient, and drug interactions.

After completing the exam, responses are automatically graded. Scores are generated individually for each component of prescriptions (e.g. drug name, dosage form, and direction to the patient). Furthermore, to increase competition and improve students' engagement, the best recorded scores of all users were saved and displayed in future quizzes.



**Figure 1.** Entry screen to prescription order simulation (prescription order in the left pane of the screen; response entry in the right pane of the screen).

### Collection of prescription orders

Around 2000 prescription order was randomly selected from 20 community pharmacy located in the Sistan region. These prescription orders were reviewed by a professional pharmacist and prescription with the same handwriting or similar drugs excluded. Finally, about 500 prescription orders were selected. To address ethical considerations, the patient's surname and physician name, and license number were erased from the prescription orders. This study was approved by Zabol University Ethics Committee.

### Questionnaire

The questionnaire was comprised of 4 free response questions and 16 multiple-choice questions. Free-response questions were related to the information regarding the age and gender of participants, student's suggestions, and the major advantages or disadvantages of the website.

### Analysis

Multiple-choice questions were presented on a five-point scale: (a) strongly agree, (b) agree, (c) neutral, (d) disagree, and (e) strongly disagree. The ordering of responses was ranked from -2 to +2 (a five-point scale). At each scale point, the percentage of the answers was multiplied by the scale value to provide an agree/disagree measure. The calculated values ranged from +200 demonstrating strongly agree to -200 meaning strongly disagree.

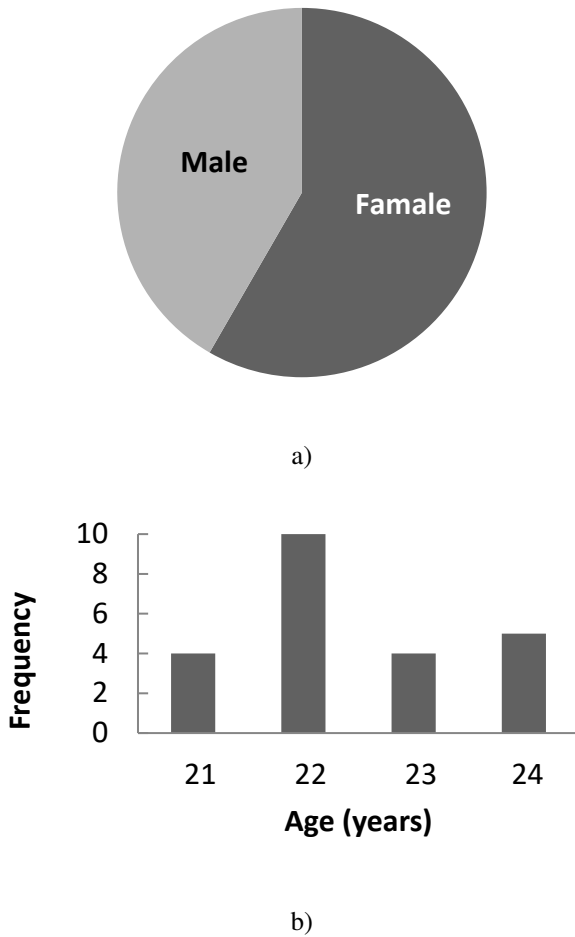
### Population surveyed

The software was implemented to all doctor of pharmacy students (n=24) entering Zabol College of Pharmacy. Previously, all students had been passed community pharmacy-related didactic courses. Both software implementation and introductory pharmacy practice experience were started in February 2010. Before starting the experiment, all students were invited to a meeting, and the

practice plan was explained for them. After completion of the practice, all students completed a satisfaction survey.

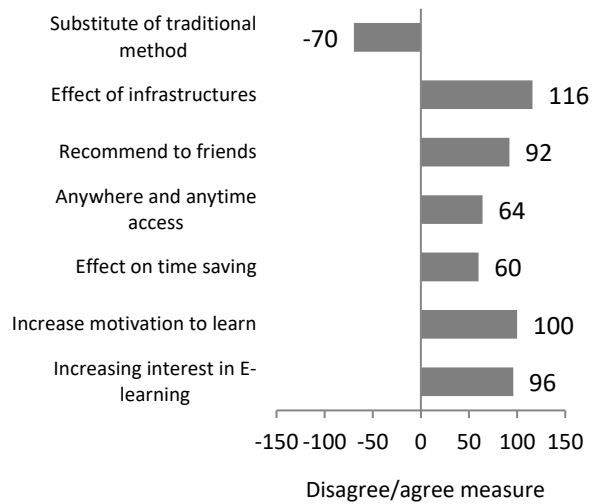
## RESULTS

23 students completed the questionnaire survey. The profiles of the participants are represented in figure 2. The Mean age of the respondents was 22.4 years (standard deviation; SD=1.0) and 61% were male.



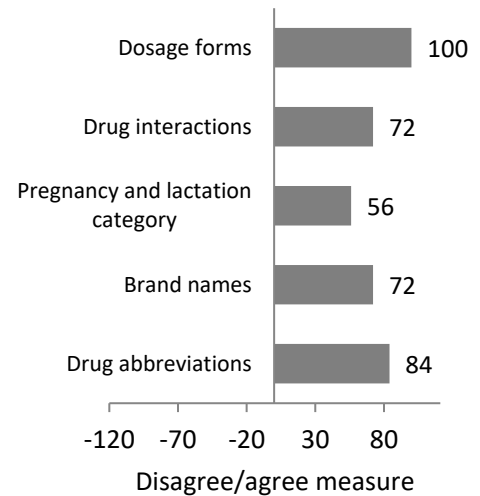
**Figure 2.** Personal details of respondents a: age, b: sex

As shown in figure 3, students agreed that using the website increases their motivation to learn and also enhances the interest of future e-learning. Also, they somewhat accepted that this approach will lead to saving time and can be accessible anytime and anywhere. Most of the students recommend the website to their friends. Respondents believed that infrastructures such as broadband-internet and high-speed computers have a significant impact on the extent of interest. Despite all positive comments, students still insist that the website cannot be as a substitute for practice in pharmacy set-up.



**Figure 3.** Perspectives of students on the statements regarding the use of the website represented on a -200 (strongly disagree) to 200 (strongly agree) scale.

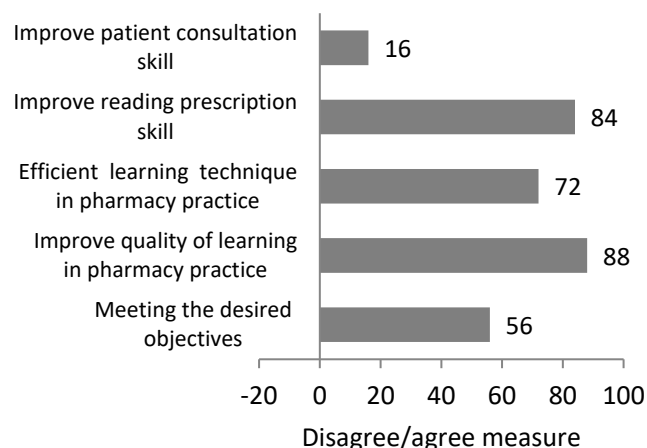
Respondents also stated that the website generally improves their applied knowledge in the fields of drug interactions monitoring, practical aspects of dosage forms, drug safety assessment during pregnancy and lactation and identifying common brand names (Figure 4).



**Figure 4.** Student perceptions of website effectiveness in meeting learning objectives in the field of applied knowledge on a -200 (strongly disagree) to 200 (strongly agree) scale

Students' responses indicate that they believe the desired learning objectives were met and the quality of learning in pharmacy practice was improved (figure 5). Furthermore, students had a positive perception of the website efficiency, and they believed that their skills in reading and interpretation of prescription orders were improved. However, they were not very confident that their consultation skills were improved (figure 5).

A large number of students stated that the capability of promptly checking the correctness of each answer is the major advantage of the program. In contrast, the dependency of the program on the high-speed internet connection was the main criticism. Also, students believed that the range of prescription orders should be more extended.



**Figure 5.** Students perceptions of the program's effectiveness in acquiring pharmacy-related skills and meeting desirable learning goals on a -200 (strongly disagree) to 200 (strongly agree) scale.

## DISCUSSION

Pharmacists are responsible for the safe dispensing of the drug. However, several risk factors affect proficiency in the dispensing process and increase the frequency of medicinal errors. The degree of risk will increase in circumstances, such as drugs with similar spelling /sound and illegible prescription orders. A group of researchers reviewed 1422 handwritten-orders written at a teaching hospital and reported that 18% of the orders were illegible<sup>5</sup>.

In the pharmacy curriculum, students gain most of the required applied knowledge and skills related to the processing of prescription orders, patient consultation, and drug information through pharmacy practice experiences. However, widespread handwritten prescription orders, shortages of time, and other faculty resources encourage this group to develop a web-based prescription simulation software to improve the students' skills related to reading and interpretation of prescription order. In addition, a "prescription tip" is a section of the program that promptly responds to the drug information needs of students during the exam. Additionally, several tutorials related to pharmacy practice are available on the website.

In general, the students reported that simulation software increases their motivation and interest in e-learning methods. According to questionnaire responses, substantial progress was obtained in the practical knowledge and skills of

students. Similar positive feedbacks were also reported<sup>3</sup> with implementing a program that simulates prescription orders. Meanwhile, in a survey conducted on the graduate students of the Mississippi school of pharmacy, the students reported that the problem-based learning method not effectively prepared them for processing prescription orders<sup>6</sup>. In the current study, students felt that their consultation skills improved above average; however, they gave the lowest score to this item (Figure 5). It seems that the program should be improved by the addition of a simulation section related to patient-pharmacist communication.

As anticipated, the respondents insist that the website cannot completely substitute for experience in pharmacy practice.

The apparent advantages of using the software appear to improve the students' control over their own learning without any concern about time and place of learning, saving the faculty resources and its acceptance with users. Furthermore, respondents state that the interesting feature of the program is the capability of instant displaying the correctness of the answers. Major disadvantages were mainly inadequate infrastructure (e.g. slow computers, slow internet connection), lack of computer skills, narrow range of prescription orders in the database, and reduced preceptor-student interactions.

## CONCLUSION

Prescription reading software was viewed favorably by pharmacy students. Students agreed that virtual simulation program increased their pharmacy-related skills and knowledge. Additionally, the participants had positive attitudes toward the program. Therefore, this simulation software could be implemented into the education program along with introductory pharmacy practice to eliminate major challenges such as time and geographical constraints. However, further research are needed to further clarify the learning outcomes of the software.

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