Comparison of the effectiveness of three educational methods (e-learning, lectures and blended) on pharmacy students' knowledge of non-prescription drugs

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Abstract

Introduction: Non-prescription medications are increasingly used all over the world and therefore pharmacists should be able to counsel the patients on their proper use and safety. Pharmacy students take courses in this area and given its importance, teaching innovations and different methods are used by schools and institutions. This study was designed to compare the effectiveness of different delivery methods on students' knowledge of non-prescription drugs.

Methods: This interventional study was conducted with pharmacy students at the Ahvaz Jundishapur University of Medical Sciences in the year 2015-16. In this study, topics were divided into three groups, (lecture-based, electronic teaching and blended approach). At the beginning and end of each session, pre- and post-tests were performed and the students took a final exam at the end of the semester. The mean difference of the final exam scores for topics taught using each method was compared. Students' post-test scores were compared to their pre-tests and analysed.

Results: The students' final exam mean scores out of 20 points were: 16.166 ± 0.332 in the e-learning group; 13.751 ± 0.164 in the lecture group, and 16.388 ± 0.195 in the blended methods group . The results showed that the e-learning and blended methods had a more positive effect on the final exam scores for pharmacy students knowledge of non-prescription medication course.

Conclusion: This study demonstrates that a blended learning method and an e-learning approach can positively influence students' knowledge towards non-prescription drugs.

Keywords: *e-Learning, Blended, Lecture, Non-Prescription, Pharmacy, Student*

Introduction

Training has been recognised as a factor of change and progress in students (Sadeghi, 2014). With the development of information technology, educational systems need to be changed proportionately to conditions and time as well as other systems (Manolis, 2013). In addition, improving the quality and methods of education is very important in the medical field, and its importance is gradually unfolding (Zolfaghari *et al.*, 2007). Traditional educational methods (lecture-based) have disadvantages such as being instructor-oriented, having high costs, being attendance-centred, space and time-limited, *etc*. (Jilardidamavandi, 2011; Stricker, Weibel & Wissmath, 2011). In the past two decades, e-learning (learning via electronic media and electronic technologies) has been introduced in pharmacy education (Salter, 2014). The advantages of e-learning include facilitation and expedition of the training process and the possibility of reviewing training programmes. But it also depends on the self-motivation of students to study and requires the use of an electronic device or computer (Thurmond & Wambach, 2004; Lee, Yoon & Lee, 2009). Blended education is a combination of two or more teaching methods (Fathnejad & Mokhtari, 2007; (Khazaei, Rashedi & Barati, 2012). Recent studies suggest that students can benefit from combining a face-to-face education method with an e-learning approach more than any of the teaching methods alone (Khan & Fareed, 2001).

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The present study was designed to compare the effectiveness of three teaching methods used by faculty members for pharmacy students. The course selected for this purpose was 'Non-prescription Medication Therapy'. Non-prescription medications are increasingly used all over the world and therefore pharmacists should be able to counsel patients on their proper use and safety. Pharmacy students take courses in this area and given its importance, teaching innovations and different methods are used by schools and institutions (Non-prescriptions Medicine Academy Steering Committee, 2014).

Methods

This interventional study was conducted in the 2015-2016 academic year, at the Pharmacy School of Ahvaz Jundishapur University of Medical Sciences, after the approval of the ethics committee.

The 'Non-prescription Medication Course' was taught by the clinical pharmacy department. Four faculty members, all clinical pharmacy specialists, and assistant professors were involved in this study.

All pharmacy students enrolled in the 'Non-prescription Medication Course' were informed of the blended and electronic approaches to teaching the course's basic knowledge content, along with the former lecture-based method. The course was described at the first class session (orientation). Twenty-three course topics were evaluated in terms of easiness, the time needed for teaching and being interesting for the students. The topics were subsequently divided into three groups (lecture-based, electronic-based, a combination of these two (blended)). All four teachers recorded their electronic-based and blended topics, with audio-visual presentations prior to the beginning of the course, and all of them were involved in all three methods of teaching. Pre- and post-tests were designed and performed at the beginning and end of each session for every topic taught using one of the three methods. These three sets of course topics were randomly scheduled through the semester, but the delivery method of each session was declared in the course syllabus.

For lecture-based sessions, the students attended two hour classes (with a 15 minute break time) and face-to-face teaching was used. Case studies formed the main part of all blended and lecture-based sessions. For electronic-only sessions, students completed a pre-test of the topic at the end of one blended or lecture-based topic, then received the electronic content, This was followed one week later by the post-test at the beginning of the next session.

Non-prescription drugs for cold and flu, haemorrhoids, headaches, dysmenorrhea, nausea and vomiting, motion sickness, nappy rash, and head lice were delivered electronically. Non-prescription drugs for common ear problems, sore throat, cough, eczema, wart, eye problems, and thrush were taught via the blended method and non-prescription drugs for allergic rhinitis, mouth ulcers, heartburn, indigestion, athlete's foot, musculoskeletal problems, constipation, and diarrhoea were delivered by lectures only. A questionnaire was also designed to evaluate students' satisfaction level with the course's quality and was completed by them at the time of the final exam.

Statistical analysis

Using SPSS v.22.0 software, the data from the study were analysed. The Tests of Between-Subjects Effects were done to evaluate the effect of factors (teaching methods) on the data with the significance level of p-value <0.005. The pairwise comparisons test was performed to determine the presence or absence of difference in the students' mean scores of between different educational groups. Descriptive statistical information was also obtained from the data.

Results

Sixty-three students enrolled in this study and 57 completed study (30.5% male, 68.5% female). The students who were absent for one or more of the tests were excluded from the study. Table I describes the pre- and post-test knowledge scores of the students.

The students' final exam mean scores out of 20 points were 16.166±0.332 for the e-learning group, 13.751±0.164 in the lecture -based group, and 16.388±0.195 for the blended methods group. The score differences between groups in pre-tests were not statistically significant, which indicates that the subjects had the same knowledge at the beginning of this study (p-value= 0.080). The significance of group post-test suggests that the groups had changed significantly, and that different methods had different effects.

According to the results from Table I, the difference between pre-test and post-test mean value scores in different educational methods show that the blended approach generated the greatest difference in the mean values of pre- and post-test scores. This suggests that when the blended learning methods were used, the post-test scores mean has risen considerably compared to the pre-test. Since the subjects were not different at first (in terms of score and previous information about non-prescription therapy topics), and the difference was created after the teaching, then one can conclude that the difference comes from the method of teaching.

Table I also shows the dependent t-test results in the table above ($p< 0.005$), which are statistically significant. This significance shows that all teaching methods have been effective. In other words, a significant mean difference can be seen in score results of pre- and post-test. However, since the test cannot indicate which method of training is more effective than others in increasing the mean score difference between pre-test and post-test, the pairwise comparisons test was used, which reveals the presence or absence of difference between different educational groups.

Table I: Mean scores of students in each method of learning

Teaching method	Mean of pre-test scores	Mean of post-test scores	Mean difference	t	p-value
Lecture	8.915±0.288	13.751±0.676	4.835±0.676	-14.138	0.000
Electronic	11.677±0.323	16.166±0.332	-4.488±0.877	-10.260	0.000
Blended	10.085±0.253	16.388±0.195	6.302±0.587	-21.23	0.000

In the pairwise comparisons test conducted to determine the presence or absence of difference in mean scores of students between different educational groups, the following results were obtained (Table II).

The results of this test (Table II) show that the improvement of mean post-test scores compared to the mean pre-test scores is significantly different amongst the three teaching methods, with the blended and electronic methods having a higher improvement in post-tests.

Table II: Pairwise comparisons of course scores

Group 1	Group 2	First group post-test scores mean	Second group post-test scores mean	Mean difference	p-value
lecture	Electronic	13.751	16.166	-2.583	0.000
	Blended		16.388	-2.668	0.000
Electronic	Lecture	16.166	13.751	2.583	0.000
	Blended		16.388	-0.085	0.721

The level of significance between groups is considered as SD <0.005

The comparison of the blended method with electronic methods does not show a significant difference.

The evaluation of students' satisfaction showed that 84% of the students believed that the blended method was more helpful in understanding lessons compared to the other methods. Sixty-seven% of students believed that the blended method improved their motivation for studying and learning non-prescription drugs topics. The validity based on the consistency of the questionnaire was 0.78.

More than 61% of the students had more satisfaction with the e-learning method than the lecture-based method. Also, more than 61% of students reported that if they could choose to take a topic via electronic method or lecture-based, they would prefer the former. Overall more than 59% of students thought the e-learning approach was useful and appropriate.

Discussion

The aim of this study was to compare the impact of different educational methods on knowledge of pharmacy students, examined by their final score and mean difference of scores of pre-test and post-test. The hypothesis of this study was that the electronic-based teaching and the blended method was at least as effective as lecture-based classes in improving the knowledge of pharmacy students in a non-prescription medication course. It was assumed that the students would be at least as satisfied with these methods as the former lecture-based method (McMillan, 2011). The results suggest that while all three methods were effective in improving the students' knowledge, the blended and electronic methods were more effective. The pre-test results of the 57 students were not significantly different between the three groups (between-subject effect t-test with a $p<0.005$) but the post-test scores had significantly changed according to the delivery method of the subject.

E-learning and blended methods could increase the students' scores of post-test and final exam compared to the lecture-based method. However, comparison of the difference between each session's pre-tests and post-tests shows that all teaching methods were effective in improving the students' knowledge of the topic. The results do not show a significant difference between e-learning and blended method.

In 2006, Bahadorani *et al.*, compared three teaching methods, with the blended method being more effective in improving knowledge and skills of medical students (Bahadorani, 2006). In two similar other studies, in 2008 and 2011, the students' knowledge taught by blended method were higher than the lecture-based method, but the differences were not statistically significant. However, their students were more satisfied with the blended method compared to the lectures. (Kermaniyan, 2008; Momeni Danaei, 2011; Jaffari, 2012).

A study by Wu *et al.* (2006) showed that pharmacy students' scores were significantly higher when the blended method was used (compared to lecture-based methods of teaching). The authors believed that using electronic and virtual learning methods were more dynamic and improved the students' engagement in the learning process. To their knowledge, these methods also had a greater impact on the students' understanding of the scientific content of the topic. In a review study on the effectiveness of blended learning in pharmacy education in 2014, the results showed that e-learning was very effective in improving the students' capacities and skills. Although this method cannot completely replace traditional teaching methods, it can improve the efficiency of lecture-based classes as a complementary method (Noori, 2014). In studies by Ruiz *et al.* as well as Thurmond (2003; 2006), the supporting role of e-learning instead of physical classroom and rejection of its full replacement in education has been emphasised (Ruiz, 2006; Thurmond, 2003).

Limitations and Follow-up

Some of the study limitations were the number of participants, the possibility of students being absent during pre-tests and post-tests, having previous knowledge of the topics, and carry over effects.

It would also have less bias if the participants and the teachers were blind to the study.

To reduce the bias, the content of each topic was reviewed by all four teachers to make sure all the sessions delivered homogenous content of knowledge. The Powerpoint presentations audiovisual characteristics for the electronic sessions were checked to ensure uniformity by one of the department's assistants.

The results of this study would benefit from changing the delivery method of the topics and the rotation of the teachers in the next semesters and the comparison of the results afterward.

Since the results do not show statistically significant differences in the mean scores of pre-test and post-test in training by the e-learning method compared to the blended approach, further research is needed in this area to be able to introduce the e-learning or blended methods as a new method of education to the education process. For a better pharmacy practice performance, the students should be able to store the knowledge delivered to them and remember it for later use (Kopacek, 2010). However, this study did not assess the effect of these methods on the long-lasting knowledge retained by the students, further studies for this issue are needed. Since the stability of information in memory is very important in the fields of medical sciences, electronic retraining courses in this field are very helpful. For further research in this area, the survival and retention rates of different educational methods should be better measured by durability tests.

Conclusion

The results of this study suggest that e-learning and blended methods for teaching non-prescription medication topics are associated with significant improvement in post-test knowledge scores compared to the lecturing method.

Most of the students were more satisfied with the e-learning and blended methods, compared to the lecture-based approach.

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