

e-Learning in Continuing Pharmacy Education is effective and just as accepted as on-site learning

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Abstract

Background: Educators report advantages of e-learning: improved open access to education, time and place flexibility of e-courses. There are also limitations of e-learning: high dropout rates, lack of management oversight, lack of student support, lack of sufficient interaction between tutor and users.

Aims: The aim of this study was to compare remote courses to on-site courses based on knowledge change and level of acceptance.

Methods: A course was provided using two modalities: an e-course (intervention) and an on-site course (control). Participants were tested to evaluate changes in knowledge. Also, the acceptance questionnaire was utilised.

Results: Both intervention (n=541) and control groups (n=251) increased their scores on the knowledge test. However, the scores did not differ between groups ($p>0.05$). Both groups were equally satisfied with their respective teaching modalities ($p=0.1$).

Conclusion: It was noticed that younger pharmacists attended e-learning courses more often. The study showed that e-learning was just as effective in conveying knowledge as on-site learning. Learners in both groups were equally satisfied.

Keywords: continuing pharmacy education, e-learning, pre-test, post-test.

Introduction

Educators report key advantages of e-learning such as improved open access to education, including full degree programmes, or better integration for non-full-time students, particularly in continuing education (Ahmad, 2010). Moreover, there is provision of tools to enable students to independently solve problems, as well as time and place flexibility of attending courses (Dalsgaard, 2013).

However, there are limitations of e-learning reported by users and tutors. The report in the Chronicle for Higher Education found that institutions speak about dropout rates ranging from 20 to 50% for distance learners (Frankola, 2001). There are noted in many e-learning courses that there is a lack of management oversight, lack of student support, and lack of sufficient interaction between a tutor and users (Frankola, 2001).

E-Learning has become important in the process of continuing education of pharmacists. Continuing pharmacy education (CPE) is mandatory in Poland

(Ministry of Health of the Republic of Poland, 2001). At present, more than 80% of professionally active pharmacists in Poland take part in courses carried out with the use of e-learning platforms (Nesterowicz *et al.*, 2014).

The main issue for healthcare courses is the lack of quality assurance related to the increase of knowledge (Carswell & Venkatesh, 2002). Also, understanding students' acceptance of e-learning is considered the most major step toward implementing and developing a successful e-learning environment (Butorac *et al.*, 2011).

The aim of this study was to compare e-learning to on-site learning in terms of knowledge retention rates and the level of acceptance amongst pharmacists. Two research questions were posed: 1) How does e-learning contribute to increase knowledge of pharmacists in comparison to traditional learning? 2) How do today's pharmacists accept e-learning courses as means for CPE in comparison to on-site learning methods?

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Methods

The course 'Proper Monitoring of Blood Pressure and Chosen Laboratory Parameters Important for Patients with Hypertension' was provided as an e-learning course for pharmacists to an intervention group and as an on-site course to attendees forming a control group. The two CPE modalities provided the same content.

The intervention group consisted of pharmacists trained by e-learning by means of the platform e-duk@cja where they were registered and the control group included pharmacists taught on-site in a conventional way. The participation in the research was voluntary. The intervention group gained access to the course by registering on the e-learning platform e-duk@cja. As a standard procedure e-courses defined as educational materials and respective tests are validated regarding their content by a scientific committee of three professors of pharmacy from the Jagiellonian University, before being put on the platform e-duk@cja. The on-site course was repeated for different groups from March until July 2011 during official meetings of pharmacists organised by the Regional Pharmaceutical Chamber, once at the conference about pharmaceutical care and also during the specialisation. All pharmacists were included in the CPE program in order to obtain educational credits. The on-site course was repeatedly and consistently delivered as a two hour long session and was led by the same teacher. The study population represented pharmacists from community and hospital pharmacies and those who worked at faculties of pharmacy and pharmaceutical wholesales. The study was approved by Bioethical Commission of the Jagiellonian University in Krakow, Poland, opinion no. KBET/235/B/2010.

In both modalities participants could communicate amongst one another and with a tutor. During the on-site course pharmacists had an opportunity to ask questions and discuss with a tutor and other attendees face-to-face. The e-learning platform contained an online forum where any user could express feedback about the course, start a discussion or raise questions which could be seen and answered by other users or a tutor. Furthermore, every user owned an internal mailbox where s/he could receive messages from a tutor or send his/her own messages (Nesterowicz *et al.*, 2014).

Knowledge Test

In order to check the changes and/or increase in knowledge, participants were asked to answer a knowledge test with regard to the content of the course before and after the educational intervention. The test was designed as 15 multiple choice questions where each question included one correct answer and three distractors. A correct answer scored one point toward the total mark of 15 points, and an incorrect answer scored zero. The same test was conducted online for the intervention group and on paper for the control group. The participants were able to sit the pre- and post-test online or paper test only once. After completing the pre-test, participants did not have access to correct answers.

Acceptance Questionnaire

In addition to the knowledge test, a voluntary acceptance questionnaire was distributed to measure the participation and acceptance level of e-learning and on-site courses.

The acceptance questionnaire addressed the first two levels of the Kirkpatrick model (reaction and learning) (Kirkpatrick & Kirkpatrick, 2006). It comprised 11 questions: two yes-no, three open, four Likert-type and two questions with some suggested answers or provide free text in a category called 'other'.

Analysis

The programmes Statistica v.10 and SPSS v. 19 were used for statistical analysis. A two-tailed p -value of <0.05 was considered to show the statistical significance difference or relationship. Data were firstly entered into an Excel sheet and then transferred to SPSS. Afterwards, the quality of data was checked for outliers and errors using explorative commands for variables' descriptions.

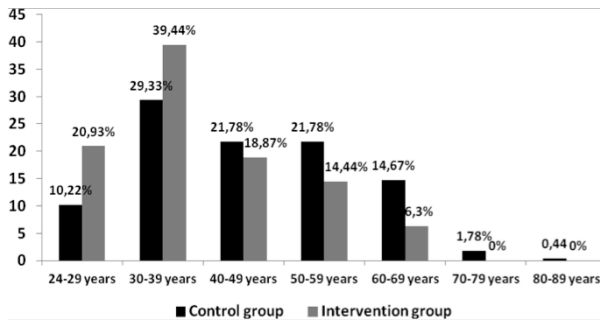
For within- and between-group comparisons of the pre- and post-tests of knowledge the Wilcoxon signed-rank test and the Mann-Whitney U test were performed, respectively. After checking for the normality of the age distribution by Kolmogorov-Smirnov and Shapiro-Wilk tests, the Mann-Whitney U test was also used to compare the age distribution between the two groups. The chi-square test was used to compare the frequency of each gender between two groups. Analysis of covariance (ANCOVA) was done in order to adjust the age difference between groups and change in knowledge. Results of the acceptance questionnaire of both courses were analysed by the Mann-Whitney U test. Reliability analysis was performed using the Cronbach's alpha coefficient for the acceptance questionnaire. Moreover, Spearman correlation was used to assess the internal consistency of the knowledge test by evaluating the univariate correlation of each item with the sum of the scores for the entire test.

Results

Demographics

There were 541 pharmacists in the intervention group and 251 in the control group. In both groups more women participated than men, 85% (458 out of 541) and 89% (223 out of 251) in the intervention and control group, respectively. In between group comparison, there was not statistically significant difference in gender distribution ($\chi^2=2.946$, $p=0.0861$). The average age in the intervention group was 39 years ($SD=11.04$) and in the control group 45 years ($SD=12.79$). The age distribution was not normal according to both Kolmogorov-Smirnov and Shapiro-Wilk tests ($p<0.001$). The Mann-Whitney U test showed that the mean rank of age of attendees from the intervention group was significantly lower (Z value= -5.82 , $p<0.001$). The stratification of age in each study group is presented in Figure 1.

Figure 1: The stratification of age of attendees in each study group.



Knowledge Test

Table I summarises the results for reliability analysis of the knowledge test by the assessment of internal consistency of each item. As it is shown, most of the items had statistically significant correlation with the sum of the scores of the knowledge pre-test in the control group.

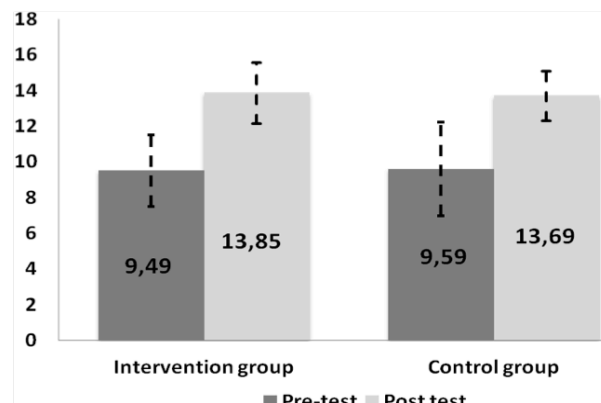
Table I: Spearman correlation of each item for internal consistency of the knowledge pre-test in the control group (n=251).

ITEM	Spearman Rho	P-value
Item 1	0.380	<0.001*
Item 2	-0.108	0.132
Item 3	0.413	<0.001*
Item 4	0.209	0.003*
Item 5	0.342	<0.001*
Item 6	0.171	0.017*
Item 7	0.116	0.103
Item 8	0.313	<0.001*
Item 9	0.174	0.015*
Item 10	0.163	0.022*
Item 11	0.094	0.188
Item 12	0.222	0.002*
Item 13	0.481	<0.001*
Item 14	0.216	0.002*
Item 15	0.184	0.009*

* Statistical significant correlation ($p < 0.05$)

The mean of the knowledge score in pre-test was 9.5 (SD=2.0) and 9.6 (SD=2.6) among the intervention and control group, respectively; no significant difference was observed (Mann-Whitney U: Z value= -0.314, $p=0.753$). The increase of knowledge within each group before and after the course was significant (Wilcoxon Rank: Control group: Z value= -11.12, $p < 0.001$; Intervention group: Z value= -19.32, $p < 0.001$). However, the groups did not differ significantly in change of knowledge (Figure 2). The mean percentage of total changes in knowledge score was 29.0% (SD=16.4) and 27.2% (SD=19.2) in intervention and control groups, respectively. The results of the Mann-Whitney U test showed that the difference in the mean rank of these percentages is not statistically significant (Z value= -0.987, $p=0.324$). Analysis of covariance demonstrated no between-group difference in the changes of knowledge score even after statistical adjustment for the baseline difference in the age of attendees (ANCOVA: F value=1.41, $p=0.236$).

Figure 2: The average results of the pre- and post-test in each study group (intervention group, n=541 control group, n=196, the dotted lines present visually the 95% confidence intervals).



Acceptance Questionnaire

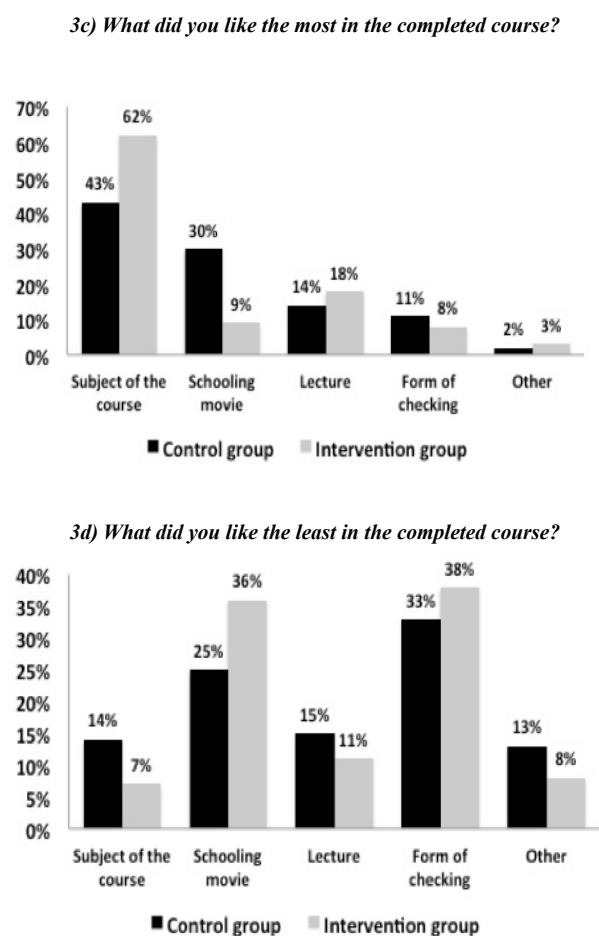
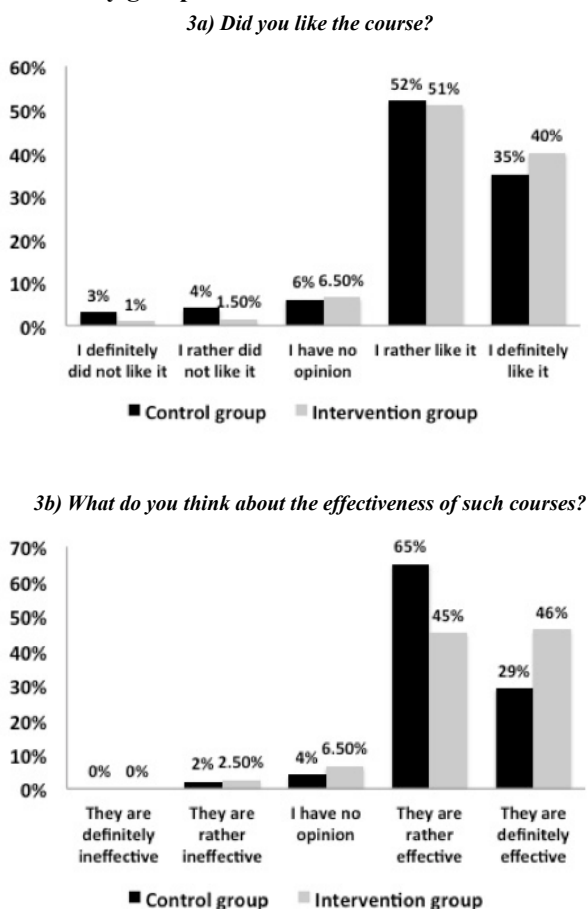
Participants from both groups answered the question that asked if they had had previous contact with e-learning related to CPE. As it was noted, the majority of attendees from both groups had taken part in e-learning courses on a prior occasion: 88% (468/531) from the intervention group, and 96% (214/223) from the control group.

Reliability analysis was performed for relevant items (excluding second and fourth questions which asked about the previous history of participating in e-learning and conventional courses and the sixth and seventh questions on the priority of the course materials) on data from the intervention group. The Cronbach's alpha coefficient of reliability was calculated as 0.58 (95% CI: 0.51-0.64, $p < 0.001$) for the first, third, fifth and eighth questions in the acceptance questionnaire.

There were 91% of respondents from the intervention group and 87% from the control group who liked their course (Figure 3a). There were 91% from the intervention group and 94% from the control one who thought that such courses were effective (Figure 3b). The most valued aspect in both groups was the subject of the course (Figure 3c). There were 18 individuals (3%) from the intervention group who provided answers in the category 'other'. They expressed their appreciation about the form of the course, one emphasised the flexibility of time and place connected with the e-learning course. Also highly valued was the simplicity and practicality of the content. Some attendees were satisfied with the test of knowledge and with the fact that in parallel to the course, the research on its effectiveness was being measured.

There were five attendees (2%) from the control group who responded in the category 'other'. Among them three liked the lecturer and his engagement. One stated that knowledge was conveyed in a precise way, another person emphasised the practicality of the subject. The least valued aspect according to attendees from both groups was the form of checking the knowledge (Figure 3d).

Figure 3: Responses to the acceptance questionnaire in each study group.



There were 46 attendees (8%) from the intervention group who answered in the category 'other'. Among them, 15 participants emphasised problems opening the online movie-clip which formed a multimedia part of the course. Four participants did not like the test of knowledge. Three participants complained about the research pre-test or questionnaire before getting to the content of the course or final test. One complained about the quality of the movie-clip and another did not like the form of the lecture as a linear text instead of slides. One of the attendees did not like links in the content. One person complained about the lack of materials and another about the link provided for the website about automatic blood pressure devices which was in English and not in Polish.

There were 24 attendees (13%) from the control group who filled in the category other. Three pharmacists stated that the content was too general. Two people complained about the lecturer. Two participants complained about the late hour of the lecture, one about other attendees coming late and the lack of control over the audience. Three attendees were concerned about the timing. Someone complained they did not receive information about the course in advance and another that there was no more mercury blood pressure devices for sale.

All results from the acceptance questionnaire were compared between the intervention and control group. Statistically, there was no significant difference in satisfaction from the course between the groups ($p=0.1$).

Discussion

The knowledge test conducted before and after the courses showed that the two modalities were equally effective. Consequently, it is safe to say that e-learning has matured into a valid medium to conduct education for pharmacists, matching conventional on-site teaching. Besides, no statistical correlation was found between participants' age and the amount of change in their knowledge in neither of the groups. It was noticed that the majority of attendees from both groups liked the course they attended and found it 'definitely' or 'rather effective'. When compared to each other there were no statistically significant differences related to the satisfactory level of the on-site and the e-course among participants.

Selection of e-learning (intervention) and on-site course (control) was voluntary. We observed some differences in preferences for selecting modalities. A trend was observed towards greater e-learning participation among men, although this difference was not significant (15% in the e-learning and 11% in the on-site course).

The research is relevant since it assesses the effectiveness and acceptance for using e-learning as a new modality for CPE. As an important strength compared to many educational interventions, our study benefits from a large sample size, which makes the findings reliable and generalizable. In the available literature few instances could be found of similar studies on CPE. There is one study published in 2012 which explores the conveyance of skills by e-learning in CPE (Nesterowicz, 2012). The aim of the published study was to compare the effectiveness of an e-learning course to on-site one based on the conveyance of skills of the proper measurement of blood pressure by mechanical sphygmomanometer. There was not statistically significant difference in precision of blood pressure measurement between the intervention (e-learning course) and control group (on-site course), $p=0.94$. Pharmacists trained by e-learning or on-site course represented the same level of precision in measuring blood pressure.

Limitations

The designed study allowed conducting research of two levels of Kirkpatrick's evaluation model: reaction and learning evaluation. There were no studies conducted on further levels: behaviour and results evaluation (Kirkpatrick & Kirkpatrick, 2006). One limit of the study was the period of course delivery which lasted six months. After this period of time there were no additional observations conducted relating to the effects of the course. It is important to mention that all pharmacists who took part in the e-course were already registered on the e-learning platform e-duk@cja before and there was no randomisation of both groups.

Conclusions

Our findings show that e-learning in CPE can be just as effective in conveying knowledge as conventional on-site based learning. There was also high level of acceptance of attendees of e-learning courses verified with the use of Kirkpatrick's evaluation model, and learners in both groups were equally satisfied with the courses. However, it was observed that younger pharmacists took part more often in e-learning courses.

Based on these findings we conclude that e-learning is a viable alternative to conventional on-site CPE.

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