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THE EFFECTIVENESS OF E-LEARNING IN THE CONTEXT OF SELECTED MEDICAL SUBJECTS

Abstract: The paper presents an attempt to assess methods for measuring the efficiency and quality of e-learning classes conducted on the basis of the selected medical subjects at the Faculty of Health Sciences of Medical University of Bialystok. Presented are the most important elements that should be used in the study of the quality and efficiency of e-learning. The effectiveness of e-learning ranged from 76% to 82% according to Kirkpatrick's model. Moreover, the e-learning method of teaching was rated by students as more convenient and easier due to continuous access to interactive learning materials.

Key words: e-learning, the LMS/LCMS class system, efficiency and quality of education

Introduction

Recently, new forms and methods of teaching are increasingly used in education at the academic level. Traditional teaching methods (lectures, seminars) are, in many cases, replaced or supplemented by distant methods. They include interactive multimedia presentations, films, sound recordings and computer animations and others. Educational content is transmitted via the Internet or locally via intranet or extranet.

Higher educational courses related to medical disciplines such as nursing, midwifery, physiotherapy, emergency medicine require students to master the wide range of information in many medical fields. Traditional lectures or seminars are usually limited to place and time. That makes assimilation of knowledge often difficult and inadequate. Distant learning forms (like e-learning platform class LMS/LCMS) provide different opportunities.

The content is delivered by means of modern forms of communication and throughout a wide range of time. It provides the opportunity to make study more effective. A well prepared e-learning course contains an appropriate selection of didactic material and forces students to improving their efficiency in the educational process. The specificity of medical studies requires many practical skills that are hard to be replaced by e-learning form of activity. But many elements of theoretical knowledge can be successfully transmitted in a form of distant learning [1, 2, 3, 4].

In the article, the authors attempt to assess the effectiveness and quality of e-learning courses conducted on the basis of the selected medical subjects at the Faculty of Health Sciences, Medical University of Bialystok, Poland.

Efficiency and quality of teaching

The traditional process of teaching of medical students is a complex process consisting of several essential elements: theoretical (lectures, seminars), practical and specialist courses (mainly clinical). Some components of this process can be replaced by the formula of e-learning. This means that a well prepared e-learning course is able to improve the traditional teaching process in the field of medicine. But the question remains: how effective are these changes?

An important factor in assessing the quality of education is its efficiency. In the evaluation of the effectiveness of distant learning a model of an "e-course" is commonly implemented, in which the teaching material is placed as separate lessons on an IT platform in an electronic format.

The quality of education consists of substantive and methodological content of teaching materials and learning purposes compatible with the selected model of teaching: a model of traditional or e-learning. In the case of an on-line model, it is important to add technical aspect of informatics solutions (reliability, functionality, ease of use of the e-learning method).

The effectiveness of education is usually understood as the degree of fulfillment of educational goals. Effectiveness of teaching can also be defined as an improvement in the performance of a chosen activity. The result of education is mastery in new content, that is the ability to acquire knowledge (amount of knowledge absorbed per unit of time for the total amount of knowledge). It can be measured by a spectrum of different tests, colloquies and speeches to the forum [5].

The growth in knowledge can be calculated according of the following formula:

$$\text{Indicator of growth of knowledge} = \frac{\text{test results after the training} - \text{test results before the training}}{\text{results to be achieved} - \text{the test results before the training}} \times 100\%$$

The results obtained are values ranging from 0 to 100%, which are in direct proportion to the amount of knowledge students have acquired during the course [8].

Studies on the quality of e-courses shall include the following elements:
- evaluation of prepared teaching materials (in terms of content, logical structure, and understanding),
- personal needs of students due to lack of direct contact with the lecturer replaced by forums, chat, video conferencing,
- evaluation of teaching methodology used to set learning objectives (learning by assimilation – lecture, work with a book, learning by discovery – the method of cases, exchange ideas, educational games, learning by experiencing (video, slideshow, art), learning by doing (the method of cases, simulation of the phenomena in question exercises),
- evaluation of the way of organization of an e-course,
- evaluation of self-activity of students (statistics of logins students to the platform, time spent on the acquisition of knowledge, the activity of students in the various modules (based on the latter, it can be defined as the complexity of the course),
- assessing the teaching process (mentoring, guidance on the accuracy of the solutions, hint system).

According to Kirkpatrick [7] an evaluation of effectiveness of e-learning should include:
- student satisfaction survey (system evaluation questionnaires) – this is the <u>level of response</u> according to the Kirkpatrick's model,
- testing students' knowledge growth rate (in the way mentioned above – this is the <u>level of science</u> according to the Kirkpatrick's model,
- study of behavior and performance of students (observation and analysis of work) – this is the <u>level of behavior</u> according to the Kirkpatrick's model,
- examination of the financial effects of the project (level of return of investment in education) – that is the <u>level of results</u> by Kirkpatrick's model [6, 7].

In summary, the problems in assessing the quality and effectiveness of e-learning can be grouped in two interdependent aspects: assessing the level

of e-course preparation and the evaluation of blended learning (traditional and e-learning) and their compatibility.
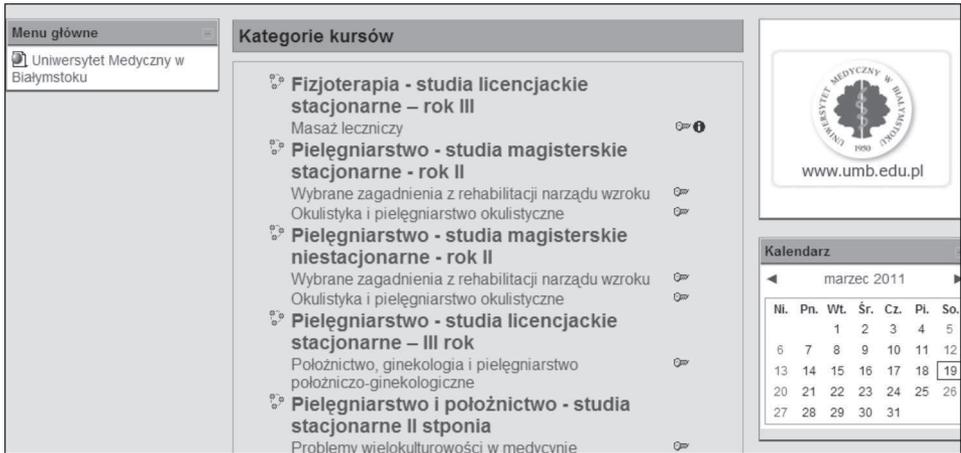
Measuring the effectiveness of e-learning based on selected medical subjects

Material and methods

The study was conducted among 325 full-time, second degree students of Medical University of Białystok, in the Faculty of Health Sciences. The investigation was approved by the Regional Committee for Medical Research Ethics, and all students gave their consent before participation.

For the purposes of research four subjects in the form of distant learning (e-courses) have been prepared. They were: obstetrics, gynecology and obstetrics-gynecology nursing, ophthalmology and ophthalmic nursing, rehabilitation of visual organ and therapeutic massage.

The students of each group (subject) were divided into two subgroups within the same subject. One subgroup had a distant model of education, based on e-learning platform implemented on the class LMS/LCMS (Moodle) system (Figure 1). The second subgroup had classes in the traditional model of education (control group).

Figure 1. The main window of e-learning platform system class LMS/LCMS (Moodle)

At the end of each course evaluation survey was carried out on the above mentioned aspects of testing the quality and effectiveness of e-learning as compared to the traditional teaching model. The questionnaire survey con-

sisted of three parts: sociodemographic data, opinions about the activities carried out and opinions about the effectiveness of education. For each subject final exams were conducted in form of a single-choice test simultaneously in both subgroups. Professional knowledge in both subgroups was compared by assessing final scores ranging from 2 (bad) to 5 (very well). Degree of satisfaction with the selected activities (process of teaching, material availability, etc.) was assessed using specially designed questionnaire.

The computer software package Statistica 9.0 PL (Statsoft Inc., Poland) was used for the data analysis. A $p < 0.05$ was considered statistically significant.

Results and discussion

In the study dominated students from cities of more than 80 thousand inhabitants (table I). All the persons from the e-learning group had continuous access to the Internet, while among the 173 people in the control group only 22 persons (12%) did not have permanent access to the Internet. Daily use of the Internet declared more than 68% of the students in both subgroups.

Table I

Characteristics of socio-demographic groups of students surveyed

	e-learning method (n = 152)		traditional method (n = 173)	
	No. of persons	(%)	No. of persons	(%)
Domicile				
City > 80 thus. inh.	98	64%	106	61%
City < 80 thus. inh	36	24%	26	15%
village	18	12%	41	24%
Permanent access to the Internet				
yes	152	100%	151	87%
no	0	0%	22	13%
How often do you use the Internet?				
daily	120	79%	117	68%
almost daily	20	13%	17	10%
regularly 2–3 times a week	11	7%	19	11%
once a week	1	1%	3	2%
several times a month	0	0%	11	6%
occasionally	0	0%	6	3%
do not use	0	0%	0	0%

Comparable results were obtained with final exams in both subgroups with a slight predominance of the average ratings in subgroups of e-learning at the mean level of 0.23 pts, which was statistically significant ($p < 0.05$). The difference was mostly evident in the subject – obstetrics, gynecology and obstetrics-gynecology nursing (0.33 pts), which was statistically significant ($p < 0.05$). There was no statistically significant difference between both subgroups in two subjects related to ophthalmology (0.12 pts, $p > 0.05$). Slightly higher average final score difference (0.2 pts.) was obtained in the subgroup of traditional method in the subject: therapeutic massage. Still, it was not statistically significant ($p > 0.05$).

All the students (100%) of the e-learning group declared their willingness to participate in this method of teaching again while only 62% students of the traditional group were interested in this method. Degree of preparation of the learning content has been rated good and very good by 96% of students in the group of e-learning and by 93% in the traditional group. Equally high was rated the possibility of distant learning methods to enhance the effectiveness of education (94% students of e-learning group *vs.* 91% students of traditional method).

E-learning method as a way to widen the knowledge and skills of students positively evaluated 93% respondents from the e-learning group.

The effectiveness of learning can be presented in two ways: educational and financial [9]. Educational dimension is, inter alia, an increase in knowledge of the student. In this study the e-course students remembered better theoretical knowledge of the course (68% compared to 63% in the traditional method). The effectiveness of the e-learning process was as high as 90% in the e-learning group, which can be related to good accessibility of the e-learning platform and the readability of educational materials placed there. The financial aspect is the cost (meaning relationship between of acquired knowledge and the implementation cost) has not been performed yet.

Our results indicate a high level of usefulness of e-learning classes. High popularity of the e-learning form may result from permanent and interactive access to the knowledge offered in the on-line course (lesson, quiz, task, activity SCORM, and forum). A student may repeatedly refer to the previously analyzed issue, which eases learning and acquiring knowledge, and also checking his/her knowledge in the area [1, 2].

The obtained results allow us to conclude that further development of distant education can be a very good form which will supplement traditional education rather than replace it completely. It is essential to continue additional research and analysis in this area and discuss the problem of ef-

ficiency and quality of e-learning in higher education, especially in terms of widening learning opportunities for people studying in medical fields.

Conclusions

1. Basing on the performed analysis it can be concluded that the effectiveness of e-learning ranged from 76% to 82% according to Kirkpatrick's model.
2. The e-learning method of teaching was rated by students as more convenient and easier due to continuous access to interactive learning materials.
3. Automated testing of knowledge implemented on the e-learning platform encourages students to regular work and self-study.
4. Substantively and methodologically well prepared didactic materials presented full-time on the e-learning platform increase the opportunity to prepare students themselves for final examinations in the respective fields of knowledge.

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