Title: Efficiency of E-learning in an Information Literacy Course for Medical Students at the Masaryk University

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Abstract

Purpose: The main goal of this paper is to argue E-learning can be a viable alternative teaching method for Information Literacy according to a comparison of librarian's time spent face-to-face teaching with tutoring the E-learning course, average time spent a week on learning by the students, time flexibility of E-learning, students' satisfaction with E-learning and students' ability to gain practical skills and theoretical knowledge through E-learning.

Design/methodology/approach: Satisfaction of medical students with E-learning and their average weekly time spent learning was assessed through surveys designed in Google Documents. Weekly time spent by students learning in class and the number of librarian teaching hours were set by the university schedule and time spent on tutoring E-learning was measured. Details of accesses to study materials and submission of tasks as well as exam results were collected from Masaryk University Learning Management System.

Findings: In 2011 50% less time was expended on tutoring E-learning than time spent with the same number of students in the previous three years in the classroom. One third of the students learned for more hours a week with E-learning than students in class. No significant difference in gained theoretical knowledge between these students was found. On average 90% of tasks submitted to E-learning were correct the first time. E-learning was appreciated by the students for its time (93%) and space (83 %) flexibility, the online materials (62%) and self-managing learning time (55%). Details of access to the study materials confirmed time flexibility.

Originality/value: Due to time saved and considering the lack of any significant difference in the knowledge gained by students, E-learning can be a viable alternative teaching method for Information Literacy.

Keywords: advantages, efficiency, E-learning, evaluation, Information Literacy, academic library, librarians, Masaryk University, medical students

Introduction

Information Literacy (IL) has been an essential part of university curriculum for more than thirty years.(Pinto et al., 2010) Due to the development of information and communication technologies the libraries must adapt to the needs of their users and provide IL activities also in e-environments.(Nazari and Webber, 2012) One possible solution is to incorporate E-learning as another teaching method. However, in recent years several studies have discussed advantages and disadvantages of E-learning in Information Literacy activities. Perceived disadvantages include Learning Management Systems (LMS) lacking a study material depository, a discussion group, chat rooms, applications for online examination, testing and scheduling and applications for online examination. Further problems discussed relate to copyright of used study materials, changing the learning style of the learners from face-to-face (F2F) lessons to E-learning, lack of students' motivation for self-study. Above all the main disadvantage has been found to be the amount of time-consumption involved in learning.(Conole, 2004; Childs et al., 2005; Davis et al., 2008; Heinze and Schnurr, 2008; Ellaway and Masters, 2008; Masters and Ellaway, 2008; Robinson et al., 2005; Wuensch et al., 2008)

However, advantages can be found in time and space flexibility for students and teachers, simpler delivery of the study materials, increasing knowledge of working with new information technologies, training the students to apply the learned knowledge to real learning tasks, and increasing the number of participants.(Heinze and Schnurr, 2008; Hernández, 2010; Joint, 2003; Reime et al., 2008; Robinson et al., 2005; Tsai, 2009)

According to this debate there is a need to demonstrate E-learning possibilities in IL based on concrete data. In this article the findings at Masaryk University Campus Library (MUCL) are presented and discussed including a comparrison of librarian's time spent F2F teaching with tutoring the E-learning course, average time spent a week on learning by the students, time flexibility of E-learning, students' satisfaction with E-learning and students' ability to gain practical skills and theoretical knowledge through E-learning.

Background

In 2007, after two years of teaching an information literacy course at the Faculty of Science, Masaryk University, Czech Republic, the author of this paper (hereinafter referred to as "librarian") has moved to MUCL where from 2008 he started to teach the same course for the Faculty of Medicine, Masaryk University. The IL courses at both faculties were almost identical. They were structured into 10 two hour F2F lessons whose content was same except for one lesson about subject specific databases (medical students were familiarized with biomedical databases while students from the Faculty of Science with natural scientific databases). Lesson topics corresponded with the Information Literacy Competency Standards for Higher Education(American Library Association, 2000) and the information literacy strategy for Czech universities(Association of Libraries of Czech Universities, 2008) which means the students were acquainted with research strategy, avoidance of plagiarism, searching for scientific information using online resources, creating bibliographic references, using reference managers etc.

However, the librarian and his colleagues have found this teaching time consuming because they, just like most Czech university librarians, do their IL activities along side other work at the library (acquisition, cataloguing, loaning desk etc). They have decided to transform both courses into E-learning because of above mentioned proclamations about the time and space flexibility of E-learning, saving the time of librarians as well as a possibility to increase the number of information literate students. They also have had excellent conditions to prepare an E-learning course because in accordance to the European Union declaration of supporting integration of information and communication technologies in education(Council, 2003) and the Masaryk University strategic plan(Masaryk University, 2010, p. 70) the university has developed its own LMS which is complied in consideration of the above requirements. This LMS includes an interactive website allowing structuring of the course including the topics with study materials, videos etc., a repository with study materials and homework vaults enabling students to submit their tasks, testing, examining and survey applications as well as discussion groups.(Brandejsová and Brandejs, 2006; Brandejsová et al., 2008; Matěj et al., 2009) The university also offers full personal and technical support in preparing online study materials for its staff who must only prepare texts in a word processor with a suggestion for didactic conception and submit them to graphic designers who transform the documents into their final online study material in various forms (HTML, Flash, video, audio etc.).

Since autumn 2008 both courses have been taught only through E-learning and the librarian himself has tutored only the course for the Faculty of Medicine. The E-learning course for the medical students has been structured into 12 topics which include the librarian's own study materials because there are not many E-learning study materials available in the Czech language. The students have been obliged to learn from the study

materials and complete several tasks to demonstrate gained practical skills (finding a shelf number in the university catalogue and articles via Web of Science or Metalib, getting the information on journal or article fulltext availability via electronic journals portal or Medline, filling in a request form for an interlibrary loan, detecting signs of plagiarism, generating a list of references via EndNoteWeb, comparing the quality of journals by scientometric indicators and evaluating the information quality of a website).

In 2011 the librarian has decided to verify whether the E-learning IL course for medical students really was more effective than F2F lessons. He has summarized outcomes from surveys on medical students' satisfaction with E-learning and average time spent a week on learning. He has also summarized data on time of day of students' accesses to the online study materials in LMS to verify time and space flexibility of E-learning. He then collected data on students' ability to gain practical and theoretical knowledge through E-learning. Finally he measured his time spent by tutoring the E-learning course to compare with his own time spent by F2F teaching at the Faculty of Science. This comparison between faculties had to be made because at the Faculty of Medicine he taught F2F only for one semester and more data was needed for relevant comparation. As mentioned above both F2F courses were almost the same and, as several studies have displayed(Coulter et al., 2007; Resnis et al., 2010; Secker and Macrae-Gibson, 2011; Szarina, 2010; Tennant and Miyamoto, 2002), the comparison of outcomes from students studying different disciplines is not unique, and in this librarian's case, comparing almost identical courses, it seems especially reasonable.

The hypotheses and methods

Therefore Masaryk University LMS complies with technical requirements mentioned in the introduction, the librarian has not dealt with technical issues and has focused only on verifying the efficiency of E-learning in its reduction of time consumption, time flexibility, effectiveness of the teaching of theoretical knowledge and practical skills as well as on assessing medical students' satisfaction with the E-learning. He has outlined six hypothesis:

Hypothesis 1: Tutoring E-learning is less time consuming than F2F teaching.

The librarian counted the number of hours expended from autumn 2005 to spring 2008 on the F2F teaching including the time spent on supervising students' final exams. Unfortunately, the time expended on preparing Power Point presentations or printed study materials for F2F teaching wasn't measured on that occasion. In 2011, when the E-learning course had reached its final form of didactic conception and design, the librarian recorded the number of minutes spent updating information on the interactive website, checking functions of links to the study materials, communicating with the students via e-mail or discussion group and checking the students' tasks. The gained minutes were then converted into hours. Although the hours from previous semesters hadn't been measured, the librarian attempted to estimate them by multiplying the number of medical students in the previous semesters by the average amount of the librarian's time spent on one student in 2011 (1,9 hours each semester).

Hypothesis 2: The average number of hours a week spent by the students in the classroom is similar to the time spent by the medical students with learning the online study materials.

According to the university schedule the students from the Faculty of Medicine and Faculty of Science spent an average of 2 hours a week at the classroom. Whether they spent any time learning at home is unknown because they finished their studies and could not be consulted. Information on the number of hours a week spent by the medical students learning online study materials and doing the E-learning tasks was collected by surveys designed in Google Documents which included a multiple-choice question on the time spent (less than 1 hour, 1-2 hours, 2-4 hours etc.).

Hypothesis 3: E-learning has allowed the medical students to study at any time.

Details of the medical students' use of the online study materials have been taken from the LMS which saves the date and time of any access.

Hypothesis 4: Most of students are satisfied with E-learning.

Medical students' satisfaction with essential aspects of E-learning (time and space flexibility, exclusively online study materials, self-studying at own pace without contact with other students and necessity of having a PC with Internet connection) was measured through a survey designed in Google Documents. The survey included questions based on a five-point Likert scale where 1 signifies the students' absolute satisfaction with the above-mentioned aspects of E-learning and 5 signifies their absolutely dissatisfaction. The results were summarized into three groups where 1 and 2 on a scale means satisfaction, 3 is neutral and 4-5 represents dissatisfaction. In a results section only findings on satisfaction with the advantages and on dissatisfaction with the disadvantages are presented to facilitate brevity and clarity of the prevailing opinions.

Hypothesis 5: Most of the medical students were able to use the acquired knowledge in practice.

The ability of students to gain practical skills in E-learning was counted by a number of the medical students whose submitted tasks were correct first time. This number was gained from LMS homework vaults where all tasks had been submitted and saved.

Hypothesis 6: There are no significant differences between the theoretical knowledge gained in the F2F lessons and the E-learning.

A comparison of students' ability to gain theoretical knowledge in F2F lessons and E-learning is based on a percentage number of students' correct answers in the final exams containing questions on IL topics common to both.(Craig and Corrall, 2007; Ivanitskaya et al., 2006; Knight, 2006; Kurbanoglu et al., 2006; Mulherrin and Abdul-Hamid, 2009; Staley et al., 2010) The tests were mandatory for the students from autumn 2005 to spring 2010 and optional in autumn 2011. The answers have been summarized into topic groups: a) Library Catalogues, terminology = questions on using the library catalogue, library terminology etc., b) Plagiarism = basic rules of publication and citation ethics and creation of bibliographic references, c) Effective Searching = using Boolean operators, wildcards, identification of keywords etc., d) Scientometry = knowledge about impact factor, SNIP, SJR or h-index, e) Bibliographic References = creation of bibliographic references, electronic information resources = configuration of a remote access, using SFX linking service etc. Just as the time spent by students learning was measured so too were the answers of medical students from the E-learning group compared with the answers of the students who passed the courses in class.

Results

1) *The time spent by the librarian on F2F teaching and tutoring the E-learning course*

Table 1 shows that from autumn 2005 to spring 2008 the librarian spent 185 hours teaching and supervising 176 students from the Faculty of Medicine and Faculty of Science in class while in 2011 he spent only 94 hours on almost same number of medical students (180) in the E-learning course. As stated above the number of hours for a period autumn 2008 – autumn

2010 is an estimate calculated by multiplying the number of students in the semester by the average amount of the librarian's time spent on one student in each semester of year 2011.

	Faculty of Science			Faculty of Medicine		
	No. of Students	No. of Hours (teaching)	No. of Hours (final exams)	No. of Students	No. of Hours (teaching)	No. of Hours (final exams)
Classic lessons						
autumn 2005	18	10	1	x	x	x
autumn 2006	46	33	1,5	x	x	x
spring 2007	30	20	5	x	x	x
autumn 2007	24	35	1,5	x	x	x
spring 2008	23	35	4	35	35	4
TOTAL	**141**	**133**	**13**	**35**	**35**	**4**
E-learning						
autumn 2008	x	x	x	43	/23/	2
spring 2009	x	x	x	23	/12/	4
autumn 2009	x	x	x	59	/31/	4
spring 2010	x	x	x	37	/19/	2,5
autumn 2010	x	x	x	96	/50/	0
spring 2011	x	x	x	52	27	0
autumn 2011	x	x	x	128	67	0
TOTAL	x	x	x	**438**	**229**	**12,5**

Table 1 – The librarians's time spent on teaching in class and tutoring E-learning (from 2005 to 2007 the number of lessons increased from 5 to 10 due to an expansion of topics)

2) *An average number of hours a week spent by the students with learning in the F2F courses and the E-learning*

In class the students from the Faculty of Medicine and Faculty of Science always spent 2 hours a week where five lessons were organized in autumn 2006 and autumn 2006 and after

topic extension ten lessons between spring 2007 and spring 2008. These students were not obliged to do any task outside of class and it is unknown if they studied at home.

Results from the surveys (Table 2) show in E-learning 62% of the medical students spent less than 2 hours a week learning, 33% spent 3-4 hours a week and only 5% spent 5 or more hours a week. The learning included studying the study materials and doing the tasks.

	No. of Recipients	0-2 hrs	3-4 hrs	5-6 hrs	7-8 hrs	9 and more hrs
autumn 2008	22	59	41	0	0	0
spring 2009	14	50	50	0	0	0
autumn 2009	20	80	15	5	0	0
spring 2010	21	81	14	0	0	5
autumn 2010	41	83	17	0	0	0
spring 2011	24	17	67	17	0	0
autumn 2011	86	66	29	3	0	1
TOTAL AVERAGE		**62**	**33**	**4**	**0**	**1**

Table 2 – The percentage of medical students who spent a specific time learning through

3) *Times when the medical students studied online study materials*

Table 3 shows the medical students accessed the online study materials all day and week, especially on Monday and Sunday and in the afternoon and evening. Similar results were found in the times of submission of the tasks where 16% of the medical students submitted the tasks on Monday and Tuesday, 14% on Wednesday, 13% on Thursday, 11% on Friday and Saturday, and 20% on Sunday.

	autumn 2008	spring 2009	autumn 2009	spring 2010	autumn 2010	spring 2011	autumn 2011	Total average
Monday	105	205	350	283	457	280	1500	530
Tuesday	90	145	305	153	531	245	1279	458
Wednesday	147	170	403	243	323	257	1001	424
Thursday	108	164	705	241	394	322	894	471
Friday	100	114	321	272	276	217	768	345
Saturday	110	71	353	232	363	226	914	378
Sunday	206	133	644	427	428	368	1527	622

6 – 9 a.m.	23	15	47	66	40	38	209	73
9 - 12 a.m.	144	121	339	163	437	241	1324	461
12 a.m. - 2 p.m.	106	122	342	185	416	234	1086	415
2 – 5 p.m.	224	233	590	358	592	399	1490	648
5 – 7 p.m.	131	132	491	284	387	285	1085	466
7 - 10 p.m.	127	179	759	512	608	437	1791	736
10 p.m. - 6 a.m.	79	177	677	313	255	300	835	439

Table 3 – Times and number of student accesses to the online study materials in the E-learning

4) *The medical students' satisfaction with the E-learning*

The medical students found (table 4) more advantages than disadvantages in the E-learning when an average of 93% respondents were satisfied with time flexibility, 83% with space flexibility, 62% with the study materials in online form and 55% with possibility to study at own pace. An average of 13% respondents were dissatisfied with a necessity to study on their own without contact with other students and only 7% were dissatisfied with the necessity of having a computer connected to the Internet and the online form of the study materials.

	No. of Recipients	Advantages				Disadvantages		
		time flexibility	space flexibility	only online study materials	studying at own pace	self-studying without contact with other students	neccesity of having pc connected to the Internet	online study materials instead printed materials
autumn 2008	22	82	59	32	50	14	14	18
spring 2009	14	100	93	79	64	14	0	0
autumn 2009	20	95	80	35	55	15	0	10

spring 2010	21	90	67	38	43	5	24	5
autumn 2010	41	100	95	93	0	0	0	0
spring 2011	24	92	92	88	88	21	0	4
autumn 2011	86	91	92	69	85	23	11	12

Table 4 – The percentage number of the medical students' opinions on advantages and disadvantages of the E-learning

5) *The ability of medical students to gain practical skills in E-learning*

The percentage numbers of the medical students (table 5) who completed the tasks correctly the first time show no one had any problem with completing a request form for interlibrary loan, 94-97% of them were able to search a shelf number in the university catalogue, to get the information on journal availability via journals portal and article availability via Medline and to compare the quality of journals by scientometric indicators. Most of the students (86%) were also able to search in Web of Science or Metalib and evaluate the information quality of a website. More than two thirds of the students (72%) successfully detected signs of plagiarism.

	No. of students	searching a shelf number in the university catalogue	filling a request form for interlibrary loan	searching in Web of Science or Metalib	getting the information on journal availability via journals portal	getting the information on article availability via Medline	creating a list of references in EndNote Web	comparing the quality of journals by scientometric indicators	detecting signs of plagiarism	evaluating a quality of information on a found website
autumn 2008	43	x	100	84	x	x	94	x	x	x
sprin	23	x	100	92	x	x	94	100	x	x

g 2009										
autumn 2009	59	x	100	96	x	x	89	96	x	x
spring 2010	37	x	100	100	x	x	92	100	x	x
autumn 2010	96	99	100	89	93	92	52	97	x	x
spring 2011	52	97	100	80	98	98	82	91	75	x
autumn 2011	128	95	x	60	98	92	59	92	69	86

Table 5 – The percentage of medical students who completed the tasks correctly the first time (*x* means a task wasn't included in the semester)

6) *A comparison of students' ability to gain theoretical knowledge in F2F lessons and E-learning*

Results of the final exams (table 6) show various percentages of students' correct answers in taught topics during ten semesters. When the results are averaged the questions on the topic of library catalogues and terminology were correctly answered in 80% cases by the students who studied in class and in 91% by the students from the E-learning, the questions on plagiarism were correct in 87% cases (class) and 91% cases (E-learning), the questions on effective searching were correct in 88% cases (class) and 87% cases (E-learning), the questions on scientometry were correct in 100% (class) and 87% cases (E-learning), the questions on bibliographic references were correct in 85% cases (class) and 78% cases (E-learning) and the questions on electronic information resources were correct in 85% cases (class) and 80% cases (E-learning).

	Class					E-learning				
	autumn 2005	autumn 2006	spring	autumn 2007	spring 2008	autumn 2008	spring	autumn 2009	spring	autumn 2011

	2007						2009				2010	
	FS (n=13)	FS (n=48)	FS (n=28)	FS (n=58)	FS (n=49)	FM (n=35)	FS (n=72)	FM (n=33)	FM (n=32)	FM (n=41)	FM (n=21)	FM (n=109)
Library Catalogues, terminology	72	97	86	60	72	96	92	93	97	94	96	75
Plagiarism	100	96	100	63	77	86	92	95	86	86	94	94
Effective searching	x	94	99	71	90	86	95	93	78	80	90	85
Scientometry	x	x	x	100	x	x	91	88	88	91	92	75
Bibliographic references	85	99	95	62	x	x	84	87	81	79	85	52
Electronic information resources	90	93	89	74	74	88	95	82	86	78	79	64

Table 6 – The percentage of students' correct answers in the final exams (FS = Faculty of Science, FM = Faculty of Medicine, n = number of students who passed the test, x = no question as the topic wasn't chosen in the test)

Discussion

Although the librarian seems to spend more time tutoring E-learning than teaching in class, considering the increased number of the students E-learning can be assumed to be less time-consuming. It may be argued that only hours for two semesters in 2011 are compared to the data from five semesters. However, between autumns 2008 and 2010 the E-learning included fewer tasks the checking of which is the most time-consuming for the librarian, so in fact the estimated number of hours for this period could be fewer and can be depended on to confirm that E-learning is time-saving. It must be also noted that the time spent tutoring the E-learning included the time spent preparing or updating the study materials, while the determined time of F2F is higher even without including the hours spent in preparation of presentations and printed study materials. It appears that concerns about time consumption of including student-teacher electronic communication in tutoring through E-learning(Wuensch et al., 2008) are

unfounded. On the contrary, using E-learning in the IL saves the librarian's time and the library's budget(Kraemer et al., 2007; Nichols et al., 2003) as saved time can be spent on other work. Therefore the first hypothesis that tutoring E-learning is less time-consuming than F2F teaching has been confirmed. Previous claims(Hernández, 2010; Nichols et al., 2003) about a possibility of E-learning increasing the number of learners have also been confirmed.

Different results have been found in the average number of hours a week the students spent learning. While the students spent only two hours a week with the in class learning, only 65% of the medical students spent the same or less time studying the E-learning study materials. However, this difference needn't be considered as very weighty because the students who learned in class were not obliged to do any tasks at home while the medical students who learned through E-learning were. Another cause of this difference is the number of hours in class had to be adapted to the university timetable counting two hours a week on one lesson while in the E-learning the students learned at their own pace. A similar measurement at the University of Wyoming specialized in the time spent by students with a 131 page tutorial shows a difference in learning time of an average of 6 to 40 minutes.(Tronstad et al., 2009) These differences in individual's learning time at MUCL as well as at Wyoming support opinions on the capability of E-learners across scientific disciplines to learn at their own pace which may be related to the variety in personal study habits of the students.(Delfino and Persico, 2007; Robinson et al., 2005; Stansfield et al., 2004) Therefore although the second hypothesis hasn't been confirmed the information above suggests that differentiation between the average number of hours a week spent by the students in class and in E-learning is insignificant. Despite this the differentiation requires further research to detect its causes, which may be different students' study habits, motivation for self-study, incomprehensible study materials etc.

Although the medical students are generally busy and have different schedules (they are from different classes, had to travel between faculty hospitals and the campus), the medical students from the E-learning group learned the study materials and did the tasks on all the days of the week. A higher number of accesses to the study materials on Monday, the day the tasks were published, and Sunday, the day of the deadline. The accesses during whole day, especially after lunchtime, show the students learned between other faculty courses. A low number of accesses on Friday is comprehensible considering that a lot of students are commuters returning home on the weekend. The variety in access times has confirmed the third hypothesis that E-learning has allowed the medical students to study anytime. This finding also supports previous proclamations on E-learning as possible way of teaching postgraduate medical students or hospital staff in IL competencies. In the Czech Republic, as in the United Kingdom, giving staff in different locations 24-h access to the study materials and information sources 365 days per year is necessary.(Childs et al., 2005) Several studies about health profession education show time and space flexibility of E-learning as an advantage have also been found by health professionals across different countries.(DeBourgh, 2003; Morris, 2005; Van de Vord, 2010; Wilkinson et al., 2004, 2009)

Although several studies have pointed out the possible risks of E-learning, especially a requirement of students' ability to work in the online environment and have available intuitive and understandable study materials(Dewald et al., 2000; Masters and Ellaway, 2008; Weston et al., 1999) or the need to support learners during their study without physical contact with other students or a teacher(Conole, 2004; Moisey and Hughes, 2008), the results showed and confirmed the fourth hypothesis that most of the medical students were satisfied with the E-learning. A satisfaction of almost all students with the time and space flexibility and a low dissatisfaction from self-studying without any contact with the students and the librarian display the main advantages of the E-learning. Only 7% of the students dissatisfied with the online study materials show the librarians from MUCL and the Faculty of Science have

created intuitive and understandable tutorials which were evaluated as an advantage by almost two third of the medical students. A higher number of students missing the printed materials (12%) in autumn 2011 is very surprising considering the existence of a workbook(Kratochvíl and Sejk, 2011) for PhD medical students including instructions on most of the topics taught in the E-learning. This dissatisfaction is inexplicable because the students were informed of the workbook a few copies of which have always been available to loan at the MUCL or for sale in the campus bookshop. Although only an average of 55% of the students were satisfied with studying at their own pace, the results for year 2011 show a rapid increase of 85-88%. This increase relates to the changes in the E-learning which the librarian made according to the students' commentaries from the surveys prior to 2011. A lengthy animation was criticized in favor of an option to control the pace of reading using a Continue button, and they admitted feeling fear of the final exam or forgetting to study or do the tasks. The librarian reduced animations in the study materials to make them more simple, clear and above all brief, cancelled an obligation to pass the final exam after spring 2010 which reduced pressure on the students, and improved his assistance by sending a reminder about newly available topics and upcoming task deadlines to them each week. The results and described changes show tutoring E-learning is an unending developing process and confirm previous notices about the need of tutor's pedagogical, social, managerial and motivation strategy.(Díaz and Entonado, 2009; Ellaway and Masters, 2008; Eskola, 2007; Heinze and Schnurr, 2008; Kilic-Çakmak, 2010; McPherson and Nunes, 2004; Solimeno et al., 2008) However, the results showed most of the medical students were satisfied with the main aspects of the E-learning and the fourth hypothesis can be effectively deemed to be confirmed.

One of the most discussed problems of E-learning is its ability to enable the student to gain practical skills in a taught topic. Ellaway and Masters as well as Watkins or Holmes and Gardner note an analogous conversion of in class activities into E-learning activities may not always be possible.(Ellaway and Masters, 2008; Holmes and Gardner, 2006, pp. 105–110; Watkins, 2005, pp. 3–4, 85–89) However, the IL is specialized in the topics related to working within the online environment (catalogues, online databases, reference managers etc.) and therefore no significant difference between in class activities and the E-learning exists. The results of medical students' ability to gain the practical skills showed that almost all students were able to complete the tasks correctly on the first attempt. More significant problems with searching in Metalib, creating a list of references in EndNoteWeb and detecting signs of plagiarism in a text were found in a group of autumn 2011. As the librarian found while checking the tasks, the main cause of these problems was the students' inattention with reading assignments and study materials: while searching in Metalib they chose a group of multidisciplinary databases instead of assigned medical databases, some of them did the task without previous reading of the material about using boolean operators, wildcards etc., bibliographic references from EndNoteWeb were incorrect due to the conversion of the references into a text file which lost the formatting, they didn't detect one English sentence in a Czech written text as a quotation etc. However, almost all these students successfully repaired the tasks on the second attempt which shows they were also able to gain the practical skills and the above problems really related to their inattention rather than the inability to gain practical skills. Therefore the fifth hypothesis that most of the students were able to use acquired knowledge in practice can be also deemed to be confirmed.

No significant differences between knowledge of the students gained in class or from the online environment have been found by the several studies. (Grant and Brettle, 2006; Joint, 2003; Lindsay et al., 2006; Mulherrin and Abdul-Hamid, 2009; Nichols et al., 2003; Salisbury and Ellis, 2003; Wilkinson et al., 2009) Similar findings have been gained by the librarian when the students from the E-learning had more correct answers in some areas (library

catalogues and terminology, plagiarism) than the students from the classrooms who in turn were more successful in answering the questions in others (scientometry, bibliographic references and electronic information resources). The first difference can be explained by the quality of study materials as the students from the E-learning group had interactive tutorials including practical examinations (e.g. determining the type of document or an aspect of plagiarism) while the students from the classrooms got only theoretical printed materials without any practice. This explanation can be supported by previously published experiences. An information skills tutorial at the University of Salford, United Kingdom, has been found a useful and effective tool for teaching due to its enabling active learning.(Grant and Brettle, 2006) Similar findings have been found at the State University of New York at Oswego.(Nichols et al., 2003) The second difference relates to a high number of incorrect answers to the questions on the structure of bibliographic references in a book, a conference paper or an article and on determining the type of databases (if Web of Science or Scopus is bibliographic or full-text database). These faults were caused by differences in the content of the course between the first years of its teaching and the present. While the students from the classrooms were taught manual creation of the bibliographic references and sequential searching in the different databases, while in accordance with an expansion of the electronic resources accessible at Masaryk University and an implementation of linking services the students from the E-learning group were taught to generate the references via EndNoteWeb and to search the full-texts of articles using the SFX linking service. Therefore the students from the E-learning group weren't as familiar with recognizing the structure of references and differences between the bibliographic and full-text databases. According to above noted studies and confirmed medical students' ability to gain the practical skills in the E-learning the described theoretical faults may not be considered as a significant problem.

Conclusion

As was described in the introduction several studies have noted various requirements on the E-learning environment, teaching methods etc. The limitations of this study should be noted because as mentioned above Masaryk University has developed its own LMS complying to described requirements and another libraries may not have similar conditions. However, this LMS is very similar to LMS Moodle (http://moodle.org) which could provide a relevant variant of the E-learning environment for other libraries. Although the preparation of the E-learning course is time consuming and requires facilities for creating interactive and attractive study materials(Heinze and Schnurr, 2008; Masters and Ellaway, 2008), there are several studies describing the design and development of tutorials which can allow other libraries to avoid mistakes.(Grant and Brettle, 2006; Mages and Garson, 2010; Su and Kuo, 2010) Furthermore it is possible to use tutorials created by other libraries.(Stubbings et al., 2012) The results presented in this paper show an effort made in the preparation of study materials saves the librarian's time which he can spend on other IL activities such as single lessons on a concrete topic for the academic staff and the students who aren't familiar with E-learning. Finally the librarian also increased his independence in preparing the study materials which he has learned to create in Adobe Captivate, Photoshop etc. The librarian, along with his colleagues, have also enhanced their prestige at the university and beyond in making the study materials available at the library website(Knihovna univerzitního kampusu MU, 2012) and compiling them to e-book such as Methodology of Bibliographic References Creation(Kratochvíl et al., 2011) which was awarded the INFORUM 2011 Award.(Albertina icome Praha, 2011)

The results discussed in this paper, showing E-learning as aplicable to the teaching of IL at the Faculty of Medicine, coupled with the possible use of LMS Moodle, give other medical

libraries as well as other disciplined libraries have an adequate reason to consider offering their IL activities in an E-learning environment. Research at the Washington State University, USA, showed a general satisfaction of students from various scientific disciplines with the E-learning(Van de Vord, 2010) as well as satisfaction with an online citation tutorial on APA style created by the Harvard Graduate School of Education, USA.(Mages and Garson, 2010) At San Diego University, USA, an increase has been found in the ability to avoid plagiarism by students of humanities, business, engineering, natural and social sciences with their learning in online tutorial has been found.(Jackson, 2006) Similar findings have also been found at several other libraries across different disciplines.(Jeon et al., 2011; Lindsay et al., 2006; Partridge and Edwards, 2005; Salisbury and Ellis, 2003) The results of MUCL also confirm the possibility of using E-learning in IL teaching: the librarian has spent 50% less time in tutoring E-learning than F2F teaching and the number of students in the course has increased because of E-learning. Time and space flexibility has been confirmed by observing the times when the medical students studied online study materials and also the lack of significant difference between the average number of hours a week spent by the students learning in the F2F courses and E-learning. Finally most of the medical students have been satisfied with the E-learning and have been able to gain theoretical and practical skills. In accordance with the above mentioned studies the results presented in this paper show that E-learning can really be a relevant variant of teaching IL if the essential requirements for LMS described in the introduction and suitable pedagogical strategies are provided.

These results prompted the librarian to prepare separate PDF documents with instructions on the theoretical topics (research strategy, evaluating the quality of websites, plagiarism, references and scientometry), even though the medical students can also study from the printed workbook for the PhD medical students. The librarian has also decided to ask the Masaryk University technical support to make video records of his single lessons for the academic staff and the students who aren't familiar with E-learning as a video included in the interactive website of the course. These additions should improve delivery method of the study materials to students preferring printed or audiovisual materials. Due to the additions the librarian acknowledges the need to monitor whether the documents and videos will be more accessed than the interactive tutorials and if the correct answers to the described topics will increase. He also recognizes that even if the knowledge and practical skills of the medical students from the E-learning and the class are similar the specific impact of the E-learning must be measured through pre-testing and post-testing. Finally, in accordance with the need to evaluate the role of the teacher in E-learning(Wallace, 2003) the librarian has decided to prepare a questionnaire and arrange an interview on a students' satisfaction with their method of tutoring. All these further evaluations will provide a more detailed analysis of the efficiency of E-learning in an IL activities.

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