

E-LEARNING COURSE: BASIS OF HARVEST AND PRESERVATION OF TISSUES – DESIGN AND INITIAL EXPERIENCE

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ABSTRACT — **Background:** The design and initial experience with the e-learning course “Basis of Harvest and Preservation of Tissues” used as a support of an elective subject is presented. The aim of the e-learning course was to enable the students to learn the theoretical principles of the subject individually and to present the gained knowledge at the final seminar.

Methods: All functions of the course were operated in Moodle, local application of the Charles University in Prague, Faculty of Medicine in Hradec Králové. The course was divided into 3 main topics corresponding with topics of lectures: 1. Principles of tissue and organ donation, 2. Low temperature preservation of cells, tissues and organs, 3. Quality and safety assurance in practice of tissue and procurement establishments. A test consisting of 5 questions selected randomly from the bank of questions followed each topic. If the student answers correctly at least 3 questions he is allowed to pass to the next topic. The fourth topic “Basic processes in the tissue establishment and principles of their validation” was added into the electronic version as a tool for repeating and improving of knowledge. The fifth topic was represented by a database for uploading theses presented by students at the final seminar. The final test consisted of 15 questions (5 ones from each basic topic). It was necessary to answer correctly at least 10 questions to receive a certificate of completing the course.

Results: The course was put into operation during the summer term of the academic year 2012/2013. To the date 15 of September the total of 23 students enrolled (17, i.e., all students of the elective subject in the Czech version, 2 students of this subject in the English version, 2 postgraduate students and 2 medical doctors). All enrolled students used the course for on-line learning, downloading, or printing course study materials. All undergraduate students were obliged to use it for preparation, consultation and presentation of seminar theses, i.e., 10 minute Power Point presentations followed by 5 minute discussion. Verification of the course was planned during the summer term of the academic year 2013/2014.

Conclusions: The first experience showed that the presented e-learning course could serve as a useful support of the elective subject “Basis of Harvest and Preservation of Tissues”. It substantially enlarged the choice of study materials that can be regularly updated, so that the students receive the newest information. It can be also attractive for students that are not enrolled in the elective subject because of its limited capacity (not more than 20 persons) The efficiency of such form of education is being a subject of further verification.

INTRODUCTION

The elective subject “Basis of Harvest and Preservation of Tissues” was established at the Charles University in Prague Medical Faculty Hradec Králové by authors in the academic year 2001/2002 both in Czech and English versions as an extension of teaching

activities of the Tissue Bank University Hospital Hradec Králové existing before [1,2]. The schedule of this subject was traditionally divided to lectures, practicals and a final seminar. To complete this face to face course the students were obliged to pass through a final knowledge test consisting of 30 questions and to present seminar theses on a topic selected from 5 to

6 ones. The totals of 12 to 18 under-graduate students have been enrolled annually, mostly in the third year of their studies. The maximum capacity of the course was 20 persons. The study materials were represented predominantly by Power-Point presentations elaborated by authors as the published textbook “Transplantology for Medical Students” [3] covered this special area only marginally. The aim of the construction of the presented e-learning course was to fill in the existing gap and to offer the students a complex multimedia supported study material covering all aspects of the elective subject and to enable them to learn individually its theoretical principles as well as to facilitate preparation, presentation and archivation of seminar theses. In construction of the course the authors used their previous experience with programmed instructions [4] and combined it with the new technical support available in the framework of the project: “Innovation and development of the study programme of general medicine at the Charles University in Prague, Medical Faculty Hradec Králové by means of information technologies (IT Medik)”. The authors have also expected simplification of the agenda connected with evaluation of the knowledge tests.

METHODS

E-learning course prerequisites, its design and comparison with the standard face to face learning programme

An introduction to the e-learning course informs the students on the course prerequisites, content, available study materials and methods of assessment the gained knowledge and skill. Knowledge of medical physics, medical biology, anatomy and physiology is regarded as a general prerequisite for entering the course. A special knowledge of basis of tissue transplantation is required as well. For this reason study of selected chapters of the textbook “Transplantology for Medical Students” [3] is recommended.

All functions of the course were operated by Moodle, local application of the Medical Faculty Hradec Králové supervised by the IT management team of the Department of Medical Physics. The e-learning course design is presented in the Figure 1. It preserved the three main topics corresponding with topics of lectures: 1) Tissue and organ donation; 2) Low temperature preservation of cells, tissues and organs; 3) Quality and safety assurance in the practice of tissue and procurement establishments. A short intermediate knowledge test consisting of five questions followed each topic. If the student passed successfully through this test, i.e., answered correctly at least three questions, he/she was allowed to continue with the next topic. If not, he/she was returned to the beginning of the particular topic and had to study again all obligatory materials. The fourth topic “Basic processes in the tissue establishments and principles of

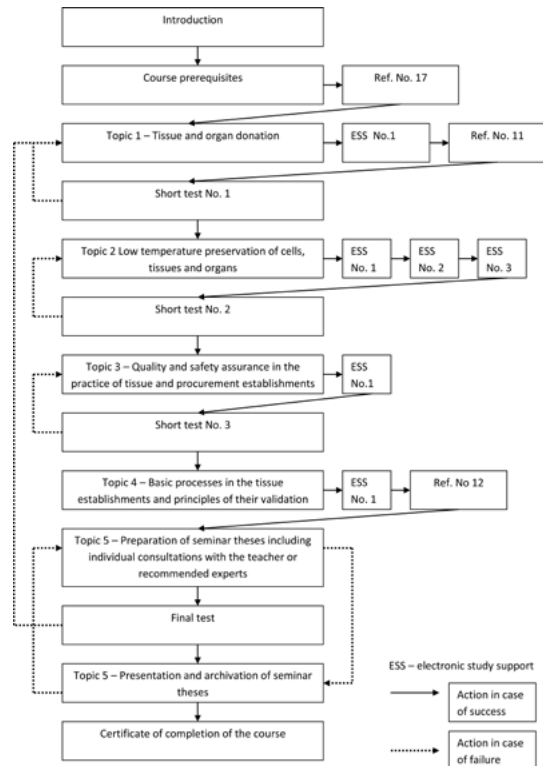


Figure 1: Basic schedule of the e-learning course

their validation” was added in the electronic version as a tool to repeating and enlargement of knowledge.

The fifth topic was represented by a database for uploading seminar theses. The number of topics usually used in the standard learning process was preserved as well. In the academic year 2012/2013 the students had the following choice of themes: 1) Principles of tissue and organ donation in the European Union member states; 2) Mazur’s two factor hypothesis and its practical applications; 3) Main mechanisms of cryoprotection; 4) Methods of preservation of musculoskeletal tissues; 5) Methods of preservation of haematopoietic tissue, 6) Methods of preservation of cardiovascular tissue.

To complete the e-learning course the students had to pass successfully through three short intermediate knowledge tests (each consisting of five questions) and through the final knowledge test consisting of fifteen questions. In the case of failure in the final test (less than ten correct answers) he/she was allowed to repeat the test maximally twice. The minimal interval between two consecutive attempts was adjusted to 48 hours. A certificate of attendance of the course was issued automatically and immediately after its completion. The course was ready for use after being reviewed by Jaroslav Špatenka, M.D., Ph.D., Head of the Transplantation Centre, University Hospital Motol, Prague and was put on the website: <http://moodle.lfhk.cuni.cz/moodle2/course/index.php?categoryid=43>.

Table 1: Overview of obligatory study materials

Topic number	Electronic study supports	Chapters in monographs [references]
1	1	1 [8]
2	3	0
3	1	0
4	1	1 [9]
Total	6	2

Table 2: Content of obligatory electronic study supports

Total number of slides with text	242
Total number of slides with static pictures	84
Total number of references	34

Course aim qualification and quantification

The aim of the course was to enable the students to learn individually theoretical principles of the subject and to give them the skill in preparation, presentation and discussing seminar theses.

The effectiveness of the learning process was assessed by the final knowledge test in which the student had to answer correctly at least 10 from 15 questions (5 from each basic topic) selected randomly from the bank of questions.

The tools used to achieve the aim

These tools were represented by study materials, bank of questions and means of communication with the teacher and with other students.

Study materials

The multimedia supported study materials were divided to obligatory and recommended. Without studying obligatory materials the student was not allowed to pass to the short intermediate test. The study materials consisted of: 1) Electronic study supports; 2) Published full texts in Czech and English; 3) Audio and video presentations; 4) Important website addresses. The overview of obligatory study materials covering individual topics is presented in the Table 1. The content of electronic study supports is summarized in the Table 2. The recommended study materials are presented in the Table 3. All obligatory study materials are written in the Czech language, the recommended materials include also texts and audio presentation in English. All used and published full texts included in the course were written by authors themselves [2,5,6,8,9]. All obligatory study materials and the majority of the recommended ones could be studied on-line or after downloading or printing.

The bank of questions

The final test consisting of 30 questions used in the standard face to face learning was replaced by three short intermediate tests and the final test as described in the section one. The questions were selected randomly from the bank consisting of more

than 100 questions. In order to prevent selection of more than 1 question dealing with similar issue, each topic was divided into 5 categories, so that only one question could have been selected from each category. In the majority of questions only one answer of 4 options was correct. In some questions dealing with the topic 3 selections from 2 alternatives were used. An overview of knowledge tests and the structure of the bank of questions are presented in the Table 4.

The means of communication

The technical support of the project “IT Medik” – Moodle, made it possible that the course participants communicate individually with their teacher by e-mail. The communication among the participants using the function “Chat”, was possible as well. The students, who completed the course can use standard questionnaire consisting of seven questions as a feedback. As the replies are automatically analyzed by Moodle, the teacher has immediate information on the level of the students’ satisfaction with the course.

RESULTS

Some functions of the course were put into operation during the summer term of the academic year 2012/2013, i.e., before official completion in June 2013. Till now, the course was used exclusively as a support of the standard face to face learning process. The number of students enrolled to the date of 15th of September 2013 is presented in the Table 5.

All enrolled students of the elective subject used the course for on-line learning or downloading study materials. They were also obliged to use it for preparation, consultation and presentation seminar theses, i.e., 10-minute Power Point presentations followed by 5-minute discussion. The final versions of these theses were stored in the course database. Only three students (1 under-graduate, 2 post-graduate) tried to pass through the first intermediate short test and only 1 post-graduate student tried to complete the course. All these attempts were successful. No negative feedback was recorded.

DISCUSSION

E-learning courses have become standard part of the medical and nursing education [10–12]. Although the authors were acquainted with the principles

Table 3: Overview of recommended study materials

Topic number	Published full texts [references]	Audio and video presentation	Website addresses
1	0	1 (E)	1
2	2 (1C, 1E) [5]	1 (C)	0
3	0	0	0
4	2 (1C, 1E) [2,6]	0	5
Total	4	2	6

C - in Czech, E - in English

Table 4: Overview of knowledge tests and structure of the bank of questions

	Number of questions asked	Number of correct answers required	Number of categories	Number of questions available in the bank
Short test No. 1	5	3	5	52
Short test No. 2	5	3	5	35
Short test No. 3	5	3	5	27
Final test	15	10	15	114

Table 5: Number of students enrolled in academic year 2012/2013

Student group	Number of students
Students of an elective subjects in Czech	17
Other undergraduate students in Czech	1
Students of an elective subject in English	2
Post-graduate students (Pharmacy)	2
Medical doctors (Neurosurgery and vascular surgery)	2
Total	24

of programmed instructions already 40 years ago [4,13,14], they were not able to use it in the practice until the necessary technical background comparable with the current trends [15-17,19] was available at their workplaces. The presented course is oriented primarily on pre-graduate medical students which is a feature that differs from other courses available abroad that are aimed mostly on post-graduate training of the staff of tissue and procurement establishments [18]. As the course also attracted attention of under-graduate students studying in English (Table 5) the authors are ready to prepare its English version. It was also documented (Table 5), that attention of post-graduate students or even of medical doctors was attracted. Our course is aimed exclusively on support of theoretical parts of the elective subject and on preparation of seminar theses. In this form it does not support the practical part of the subject, e.g., electronic study supports include only static pictures. In order to achieve this, the course should be supplemented with a higher number of video presentations of individual processes used in the tissue and procurement establishments. In this paper the authors present the pre-verification stage of the construction of the course, its verification was performed in the academic year 2013/2014. The results of this verification are being analyzed now and will be published later. On its basis

some modifications of the course are planned, such as enlargement of number of questions in the bank for use in the tests no. 2 and 3 (Table 4) to achieve the number of at least 50 questions for each intermediate short test. Enlargement of number of video presentations or of published full text dealing with the topics still uncovered by published study materials (Table 1) is planned as well. The effectiveness of the learning process is being assessed at this stage on results of the final knowledge tests only. Pre-test is not included in this version of the e-learning course.

CONCLUSION

The first experience showed that the presented e-learning course could serve as a useful support of the elective subject „Basis of Harvest and Preservation of Tissues“. It substantially enlarged the choice of study materials that could be regularly updated, so that the students receive the newest information. It could be also attractive for students that were not enrolled in the elective subject because of its limited capacity. The efficiency of such form of learning is being a subject of further verification.

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