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# A position paper of the EFLM Committee on Education and Training and Working Group on Distance Education Programmes/E-Learning: developing an e-learning platform for the education of stakeholders in laboratory medicine

## Abstract

The progress of information and communication technologies has strongly influenced changes in healthcare and laboratory medicine. E-learning, the learning or teaching through electronic means, contributes to the effective knowledge translation in medicine and healthcare, which is an essential element of a modern healthcare system and for the improvement of patient care. E-learning also represents a great vector for the transfer knowledge into laboratory practice, stimulate multidisciplinary interactions, enhance continuing professional development and promote laboratory medicine. The European Federation of Laboratory Medicine (EFLM) has initiated a distance learning program and the development of a collaborative network for e-learning. The EFLM dedicated working group encourages the organization of distance education programs and e-learning courses as well as critically evaluate information from courses, lectures and documents including electronic learning tools. The objectives of the present paper are to provide some specifications for distance learning and be compatible with laboratory medicine practices.

**Keywords:** distance learning; e-learning; European Federation of Laboratory Medicine (EFLM); laboratory medicine; multidisciplinary interactions.

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## I. Overview of e-learning

The progress of information and communication technologies (ICT) has strongly influenced changes in healthcare and laboratory medicine. The rise of ICT in science, healthcare and laboratory medicine is also stimulating a change in education with the incorporation of more e-learning in education, training and knowledge transfer. E-learning is related to learning or teaching through electronic means, such as internet, intranet, or other multimedia materials like audio or video tape, satellite television and CD-ROMs [1–3]. E-learning enables the transfer of knowledge and skills through web-based learning, computer-based learning, virtual education opportunities and digital collaborations [1–3]. E-learning is now frequently incorporated into conventional programs and several approaches have been

associated with this new way of learning such as problem-based learning, self-directed learning, case-based learning, just-in-time learning, e-journal club, e-courses and virtual patients [2–5]. The current emergence of e-learning is due to the progress of technologies with more capabilities, connectivity, learning tools and user friendly interfaces [2–5]. E-learning is a revolution in education but as our lives and professional environments rely more and more on ICT, e-learning is also able to respond to the requests of ICT consumers. E-learning is also able to support the effective knowledge translation in medicine and healthcare, which is an essential element of a modern healthcare system and can contribute to the improvement of patient care [4–7].

## II. The rational for e-learning

The positive potential of e-learning is undeniable. E-learning is particularly effective at engaging young people and might enable the improvement of inter-professional team interactions, life-long learning, practice performance, certificate programs and curriculum standardization [1–4]. E-learning presents several other advantages and might help to break barriers with more flexible learning opportunities. Indeed, e-learning enables learners' travel costs and times to be reduced, the selection of learning materials to meet a specific level of knowledge, an appropriate learning style to be chosen, the development of computer and internet skills, the stimulation of self-knowledge and self-confidence, the generation of useful supplementary materials to conventional programs and peer-reviewed electronic resources to be provided [1–4].

The efficiency and cost effectiveness of e-learning for education and teaching in the medical era have been documented by several reports (Table 1). In laboratory medicine, e-learning is offering several opportunities for the education and professional improvement of stakeholders, for the appropriate use of laboratory tests and for the improvement of patient care. More precisely, e-learning in laboratory medicine could help to reach several educational goals and curriculum needs in multiple fields (hematology, chemistry, forensic toxicology, clinical immunology, microbiology, blood gas laboratory, specialized care center laboratory...), fulfill some of the accreditation requirements for the management of competences and skills, disseminate evidence-based clinical practice guidelines, promote innovation, provide several learning resources, improve working conditions and efficiency and target outcomes oriented on patients

[6, 7, 15, 16]. E-learning is also representing a great vector for the transfer of knowledge into laboratory practice, to stimulate multidisciplinary interactions, to enhance continuing professional development and to promote laboratory medicine.

Several challenges are, however, paving the way of e-learning such as access to the appropriate computer and technology, the need of efficient virtual teaching supports, and standardization of contents and guidance for both learners and teachers [1–4]. Some important issues are also related to the ability to develop multidisciplinary peer-review processes of e-learning materials and the building of efficient e-learning programs able to support the credited continuing professional development of stakeholders in laboratory medicine [4, 16].

## III. Developing an effective e-learning platform for stakeholders in laboratory medicine

In 2010, EFLM initiated a distance learning program and began the development of a collaborative network for e-learning. The EFLM dedicated working group encourages the organization of distance education programs and e-learning courses as well as critically evaluate information from courses, lectures and documents including electronic learning tools.

Therefore, the objectives of the present paper are to provide some specifications for distance learning, compatible with laboratory medicine and inspired by the Kirkpatrick model based on learner satisfaction, learning outcome, performance improvement and patient and health outcomes [17–24].

### 1. Determine the needs and educational objectives

- a) Establish the best way to catch the needs and educational preferences of the learners
- b) Collect the needs and potential pre-determined desired themes
- c) Identify and analyze the educational needs and preferences of the learners
- d) State the aim(s) and educational objectives of the course/training
- e) Identify the best way to reach the audience

Author/year	Focus of study	Main results	References
Bandla et al., 2012	<ul style="list-style-type: none"> <li>– Compare the efficiency of a single 2.5-h face-to-face workshop to a 4 asynchronous e-learning for training of medical students modules.</li> <li>– The immediate learning outcomes were assessed in a subsequent clerkship using a multiple-choice examination and standardized patient station.</li> </ul>	<ul style="list-style-type: none"> <li>– The design, delivery, and learner-assessment costs by format were equivalent at the end of 1 year.</li> <li>– The learner performance outcomes were roughly equivalent, based on delivery method.</li> <li>– The cost effectiveness of online learning is an economically and educationally viable instruction platform for clinical clerkships.</li> </ul>	[8]
Gordon et al., 2011	<ul style="list-style-type: none"> <li>– To develop a short, educationally sound, low cost e-learning resource for pediatric prescribing to improve junior doctors' prescribing skills and to evaluate its effectiveness.</li> </ul>	<ul style="list-style-type: none"> <li>– This short e-learning resource significantly improved the pediatric prescribing skills of junior doctors.</li> <li>– Outcomes were maintained at 3 months, suggesting the utility of low cost, low fidelity, educationally sound e-learning interventions.</li> </ul>	[9]
Hadley et al., 2010	<ul style="list-style-type: none"> <li>– To evaluate the educational effectiveness of a clinically integrated e-learning course for teaching basic evidence-based medicine (EBM) among postgraduate medical trainees compared to a traditional lecture-based course of equivalent content</li> </ul>	<ul style="list-style-type: none"> <li>– After adjusting for baseline knowledge, there was no difference in the amount of improvement in knowledge of EBM between the two groups.</li> <li>– The benefits of an e-learning approach need to be considered when planning EBM curricula as it allows standardization of teaching materials and is a potential cost-effective alternative to standard lecture-based teaching.</li> </ul>	[10]
Abdelhai et al., 2012	<ul style="list-style-type: none"> <li>– To evaluate students' learning outcomes as measured by improved knowledge acquisition and opinions of redesigning the Reproductive Health (RH) section of the PH course into e-learning and assessing e-course utilization.</li> </ul>	<ul style="list-style-type: none"> <li>– The students participating in the e-learning course showed significantly better results, than those receiving traditional tutoring.</li> <li>– The students who originally shunned the e-course expressed eagerness to access the course before the end of the academic year.</li> <li>– Overall, the students using the redesigned e-course reported better learning experiences.</li> </ul>	[11]
Mehrdad et al., 2011	<ul style="list-style-type: none"> <li>– To evaluate the efficiency of an e-learning course in 32 students which were in third semester of nursing bachelor program and were passing Maternal Child nursing course.</li> </ul>	<ul style="list-style-type: none"> <li>– The students reported better 'capability' and 'independency' in e-learning method while lecture was obtained higher scores in 'effectiveness on learning' and 'motivation' characteristics.</li> </ul>	[12]
Schroter et al., 2011	<ul style="list-style-type: none"> <li>– A randomized controlled trial was to evaluate the effectiveness of an interactive online Diabetes Needs Assessment Tool (which constructs an e-learning curriculum based on individually identified knowledge gaps), compared with self-directed e-learning of diabetes guidelines</li> </ul>	<ul style="list-style-type: none"> <li>– Both groups experienced a similar and significant improvement in knowledge.</li> <li>– The learning materials were acceptable and participants incorporated the acquired knowledge into practice.</li> </ul>	[13]
Woelber et al., 2012	<ul style="list-style-type: none"> <li>– To evaluate the overall efficiency and student's perception of two case-based e-learning programs that were produced with either easy-to-use or complex software.</li> </ul>	<ul style="list-style-type: none"> <li>– The students were showing a high acceptance and ability in using both e-learning environments.</li> <li>– The e-learning programs for case-based learning do not have to be overly laborious to program to be useful.</li> <li>– The production of case-based e-learning tools with easy-to-use software should be encouraged.</li> </ul>	[14]

**Table 1** Efficiency of e-learning in healthcare.

- f) Define the format use for the content and a protocol able to face the needs and educational objectives
- g) Define the target audience
- h) Consider the potential barriers for the release of the course

## 2. Prepare the content according to the needs and educational objectives

- a) Define the educational objectives and expected outcomes
- b) The content should be defined and prepared according to the educational objectives and expected outcomes
- c) The content should be adequate, relevant, realistic and well organized
- d) The content should be evidence-based and pedagogical
- e) The content should be prepared according to relevant ethical, medico-legal and legal requirements
- f) The content should be interactive and provide links to further relevant information
- g) The likely duration of the course should be stated
- h) The content/course should be available as needed and when needed
- i) The content should be flexible and responsive to learners
- j) The date of preparation of the content and related materials should be mentioned
- k) The content should meet national and international standards
- l) The content should be balanced, free of bias and potential conflicts of interest should be stated
- m) The content and related materials should be copyright authorized
- n) The content should be peer-reviewed and ideally include multidisciplinary peer reviewing process
- o) A description and qualification of the teachers, speakers and producers should be provided

## 3. Specify the expected outcomes

- a) Describe the potential gain of knowledge
- b) Describe the potential acquired skills
- c) Describe the potential acquired competences
- d) Specify the potential transfer to work situations
- e) Define the potential improvement of curriculum content
- f) State the certificate that can be reached after the course through quizzes and examination

## 4. Determine the technical needs and resources

- a) Identify and evaluate the available relevant software(s) and equipment
- b) The selected technical solution should be usable according to the criteria for web-based materials
- c) The teachers, speakers and producers should be trained to the selected solution
- d) The selected technical solution should fit the expected number of participants
- e) The technical solution should allow effective means for the learner to provide feedback on the materials
- f) The selected technical solution should allow the creation of a portfolio of acquired skills and knowledge
- g) The selected technical solution should facilitate an intuitive management of records
- h) The selected technical solution should provide a confidential treatment of records and learner profiles
- i) The selected technical solution should facilitate the registration procedures
- j) The selected technical solution should engage and support learners
- k) The selected technical solution should meet national and international standards

## 5. Encourage active learning

- a) Stimulate learner assessment through quizzes and examination
- b) Evaluate the learner with objectives questions related to the content and educational objectives
- c) Catch the learner feedback with online evaluation form
- d) Ensure a secured and confidential learner assessment and evaluation
- e) Ensure the appropriate authentication of the learner

## 6. Stimulate the use of credits for continuing professional development (CPD)

- a) Stimulate the building of an interactive online CPD platform that can support active learning and establish an additional stimulus for knowledge translation into daily medical practice
- b) Request CPD credits recognized by a relevant professional accreditation and by employers
- c) Respect the guidelines to obtain CPD credits

## 7. Identify the challenges prior to implementation

- a) Define the project management and its time line
- b) Learn about internet and computer skills
- c) Structure a business plan and a budget
- d) Work on an evolutive and interactive content
- e) Structure the peer-reviewing process of the content
- f) Schedule the maintenance of the software and equipment
- g) Request for continuing professional development credits
- h) Identify the online support group

## IV. Conclusions

E-learning is a revolution for the education of healthcare professionals and stakeholders in laboratory medicine. E-learning offers huge opportunities for learning and access to a vast amount of knowledge as well as providing

an additional stimulus for knowledge translation into daily medical practice. E-learning programs might also enhance the performance of the stakeholders in laboratory medicine, support the need of more managed competences and improve patient care and safety.

The role of EFLM and international societies of laboratory medicine is to develop e-learning programs for stakeholders in laboratory medicine, ensure the value of e-learning solutions and programs developed for stakeholders in laboratory medicine and establish core standards for e-learning in laboratory medicine.

## Conflict of interest statement

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