

*Strokovni članek*

## EXPERIMENTAL E-LEARNING COURSE FOR HUNGARIAN RADIOGRAPHERS

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### ABSTRACT

**Introduction:** The growth in digital media technology within the past decade has strengthened e-Learning's position in education. The change of traditional teaching methods are apparent as teachers become moderators and passive learners become active learners. The implementation of e-Learning for the further education of Hungarian healthcare workers is still in its early stages. A pilot e-Learning course in MR Angiography (MRA) had been undertaken with Hungarian radiographer as participants. The aim of the study is to demonstrate the use of new educational technologies for the continuing professional development (CPD) of Hungarian radiographers.

**Methods:** Use of the virtual learning environment (VLE) e-Learning platform of the University of Hull supported the initiative of implementing the first e-Learning based training for Hungarian radiographers. The focus of the e-Learning course was MR angiography. The four week long mini-course had seven participants led by one e-Moderator. The learning objectives of the course were met through numerous activities e.g.: compilation of reference database, moderated discussion forums and submission of a project.

The course consisted of three phases covering basic MRA physics, technical aspects, advanced MRA techniques and ended with an assessment.

**Results:** Learning in a new digital environment in English as well as engaging in novel applications was seen as a big challenge by the radiographers. An active member of the learning curve was the e-Moderator who himself designed and set up the whole mini-course. The active participation, submitted assignments and positive feedback emphasize the success and acceptance of the e-Learning approach by all participants.

**Conclusion:** Changes in the Hungarian healthcare system have strengthened the position of radiographers within all healthcare professionals and within a radiology department. E-Learning has been demonstrated to be a feasible method of CPD and lifelong learning of Hungarian radiographers. Through a pilot electronic mini-course, we were able to implement the first e-Learning course for the continuing education of radiographers in Hungary. The promising results suggest that e-Learning may be a feasible method for training Hungarian radiographers living and working abroad.

**Keywords:** e-Learning, MR angiography, radiographer, Continuing Professional Development (CPD)

### INTRODUCTION

The practice of Lifelong learning (LLL) may be observed in the works of the Chinese philosopher, Confucius (B.C. 551-479) who emphasized the practice of self-educating and continuous development. Although the roots of LLL go back for centuries, it is still seen by many as being a contemporary practice today. 1996 can be considered as a milestone when it was officially designated to be the year of LLL1. It has become one of the main pillars of the educational strategies of western countries. Professional training and regular courses, i.e. Continuing Professional Development (CPD) have become a major element of LLL2. These are seen by many as being purely active learning. The elements of CPD are structured according to the personal professional needs while keeping in line with the requirements of the employer or the changes experienced in the profession. One of the main arguments for CPD is that the implementation of newly acquired knowledge leads to improvement of quality at work.

CPD is adamant for healthcare workers and clinicians actively involved with patient care. Its aim is the improvement of the quality, safety and efficiency of patient care through individual role development. There are many different formats of CPD e.g. conferences, courses, literature review, etc.

The role of e-Learning in the CPD of healthcare professionals is growing. It is an electronic learning approach which integrates distance learning and electronic media (internet) for educating purposes<sup>3</sup>. E-Learning is seen as becoming an important factor in the professional development of radiologists and radiographers, furthermore, it is expected to play a major role in their training<sup>4</sup>.

Among the countless advantages of e-Learning, its flexibility, cessation of barriers like time and travel as well as reduction of cost is viewed as paramount in the rise of e-Learning. Advantages like these are the driving force behind the strengthening of e-Learning in the training of healthcare workers. The use of e-Learning in the further training of

Hungarian healthcare workers is still not standard practice. It has not yet been implemented in any courses or trainings of Hungarian radiographers nor radiologists.

## Description

### Participants of the e-Learning course

The theme of the experimental e-Learning course for Hungarian radiographers was extracranial MR angiography (MRA). The structure and design of the course was created by the e-Moderator (tutor). The seven participants of the course were all Hungarian professionals who were selected based on their professional expertise in MR imaging and English language skills. The course was undertaken in English language and not Hungarian language (Table 1). Based on their current place of work, the seven students represented three different countries (Hungary, Ireland, Northern Ireland).

### Technical background of the course

The virtual course was run using the virtual learning environment (VLE) of the University of Hull (UK) named eBridge. Their VLE is based on the online learning platform developed by Sakai Community using internet services like chat, email, ftp, http, etc. to provide a robust flexible teaching/learning environment. The web based teaching and learning platform, eBridge, uses different electronic tools for the collaborative work of students, teachers and researchers (Image 1).

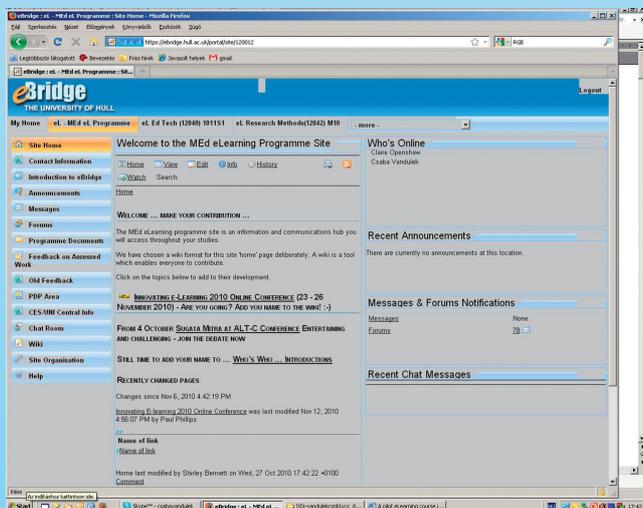


Image 1: Web based teaching and learning platform (eBridge)

### Course structure

The MR angiography course was structured into three main phases (Image 2). The length of the course was four weeks which was preceded by a one week induction phase. During the induction phase the participants (students) familiarized themselves with the new electronic learning platform, the structure of the program, and through simple activities gained basic experience using eBridge. The three main phases of the course were:

1. Review of basic MRA principles and techniques
2. Study of methodology of advanced types of extracranial MRA techniques
3. Design and submission of a working protocol focusing on an extracranial MRA

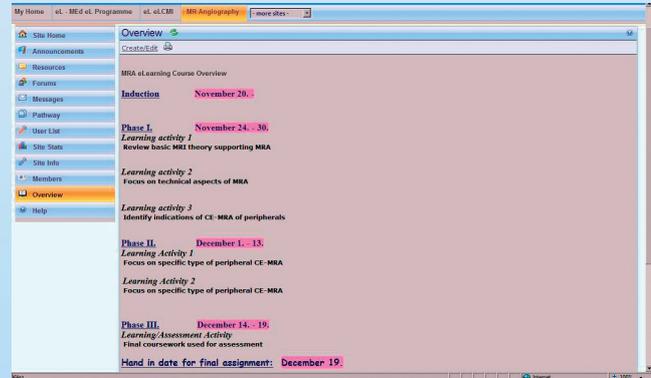


Image 2: Structure of MR Angiography eLearning course

The course design was done using a web based learning design program Phoebe Pedagogic Planner (Image 3).



Image 3: Implementation of web based learning design program

## Phase I. MRA building blocks: Review of MRA basics (1 week)

This phase aimed to review and analyze the basic elements forming the foundation of MR Angiography which then will allow progression on to Phase II and Phase III. Study focused on three learning activities:

1. Review basic MRI theory supporting MRA
  2. Focus on technical aspects of MRA
  3. Identify and analyze clinical indications of peripheral CE-MRA
- The activities involved participation in forums, individual reading, development of a resource bank and presentation of a case study for peer evaluation. During the forums, the students had the opportunity to discuss issues and questions not only with the e-Moderator but with their peers.

## Phase II. Methodology of advanced extracranial MRA techniques (2 weeks)

This phase concentrated on the methodology of currently used peripheral CE-MRA. The students were divided into four groups, each group focusing on a specific technique. In the first half of this phase, each group working in pairs deepened their knowledge of their designated technique, reviewed current publications on their topic; during the second half of the phase they presented the theory and practical applications of their technique through a PowerPoint presentation to the rest of the groups for peer evaluation and critical analysis. The presentation was expected to contain reference to the theoretical and technical background, K-space filling technique, pulse sequences, clinical indications of the MRA technique as well as a case study. Concurrently, the resource bank was further developed by the groups and discussion forums were used for communication between the peers and the e-Moderator.

The following MRA techniques were the focus of the four groups:

1. Peripheral CE-MRA with 3T MRI
2. Time Resolved Imaging (TRICKS)
3. Blood Pool CM CE-MRA
4. Contrast-Free (Time-SLIP) MRA

## Phase III. Design of an extracranial MRA protocol (1 week)

In the last phase, the four groups continued their work focusing on their specific MRA technique. This phase strongly built on the activities and results of the previous two phases. The groups had to present a working protocol centering on their designated technique. The protocol had to be supplemented with advantages and disadvantages of the methodology presented. Furthermore, identification of the clinical indications, contraindications and evaluation methods were expected. The submitted PowerPoint presentation was used for assessment and made available to the rest of the groups.

The learning outcomes of the e-Learning course were the following:

- A. Knowledge and Understanding: After finishing the course,

the participants will be able to demonstrate knowledge and understanding of theoretical background and current professional practice in the application, explanation and evaluation of MR Angiography.

B. Practical Skills: In relation to the study of MR Angiography the participants will be able to demonstrate the practical skills and knowledge by designing their own MRA protocol

## RESULTS

The selection of the participants of the e-Learning course was based on meeting a set criterion. They had to be actively involved in MRI imaging, have minimum 3 years experience in cross-sectional imaging, have basic English knowledge and have at least a BSc degree. The student cohort brought in diversity to the group as they represented 3 different countries and altogether 6 different hospitals. This diversity brought in various aspects, views and approaches used in MR angiography in general. The exchange of local protocols and techniques was seen as an additional benefit of the course.

During the course, the students had the opportunity to study and deepen their knowledge in extracranial MRA techniques which are currently not performed in Hungary. Contrast Free MRA is not available in Hungary, therefore an extensive review of the different pulse sequences was key to the understanding of the specific MRA physics involved. The group work covered Fresh Blood Imaging (FBI), Contrast-Free Improved Angiography (CIA) and Time Spatial Labeling Inversion Pulse (Time-SLIP). The study of the other techniques was just as successful. Blood pool contrast agents are rarely used in the diagnostic centers of Hungary, therefore the discussion and sharing of the preliminary results was seen as a major step forward using this technique. The availability and use of Time Resolved MRA and extracranial MRA on 3T is limited in Hungary. The exchange of experiences and resources from other countries and institutions showed an increase in activity and discussion in the different forums on eBridge.

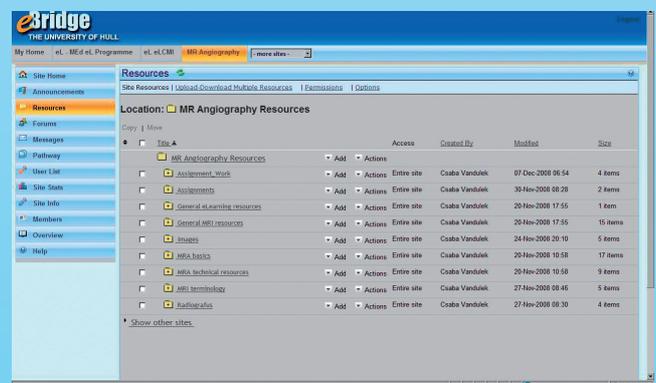


Image 4: Resource bank

The resource bank was quite popular among the students. In the first few weeks of the course a large volume of documents, files, protocols, presentations and videos were

submitted by the individual students (Image 4). Later on, the contribution of the various groups provided additional resources for the peers e.g. protocols and case studies.

The work and participation of the students was assessed based on formative assessment principles. The designated assessment work had to be handed in via eBridge meeting the deadline of each phase. Through the formative technique, the frequent interactive assessment aided the e-moderator to focus on the learning needs of the students and fine-tune the teaching method in order to meet the needs and expectations of the students<sup>5</sup>.

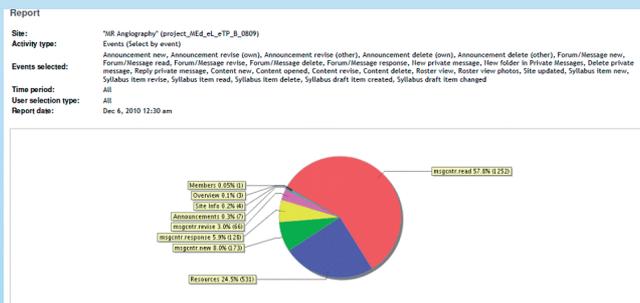


Image 5: Statistics of participants forum activity

The success of the e-Learning course was observed indirectly through the course activity of the different forums (Image 5). The highest number of postings from the students (60) was observed in the first phase which was a review of MRA basics. Interactivity, peer support, exchange of views and questions and answers amongst the peers supported the collaborative aim of the e-Learning course. A slight decrease of activity was observed in the second phase (48 postings) following the introduction of individual group work. An increase of activity followed the submission of the PowerPoint presentations where the groups critically reviewed and discussed each others work. Activity in the forums decreased quite dramatically in the last phase (11 postings). Individual work dominated this phase which ended with the submission of the final MRA working protocol to meet the requirements of the formative assessment.

Salmon (2000) developed the 5 Stage e-Learning Model which describes the individual students learning process (experience) in contrast with the e-Moderator's role and activities. This model demonstrates the relationship between the learning and moderating process, the dynamics of activity and the acquisition of new knowledge<sup>6</sup> (Image 6). The first stage aims to assist the students in the familiarization of the VLE, the implemented tools and pathway of the course. An important factor is the e-Moderator's role in strengthening the motivation of the students and providing help and encouragement in this new environment. Online socialization and interaction begins in the second phase. The e-Moderator facilitates this process using icebreakers and other e-tivities. An important aspect is the review of the ground rules and netiquette which is expected to be adhered to by all participants. This

is followed by the third stage where information exchange and co-operative tasks raise the activity profile of the course. Interaction between the peers and interaction between the course content are facilitated by the e-Moderator. Knowledge construction is key to the fourth stage. Here focused online collaboration with respect to the relevant tasks is demonstrated. The students become aware of their role in sustaining growth of knowledge, newly discovered facts while implementing critical thinking within their studies. The e-Moderator is equally as active by guiding the group and individual e-tivities, encouraging self-reflection and feedback sustaining the whole learning process both on an individual and on a group level. The last stage reflects independent work and study. Building on the new ideas acquired during the previous phases, they not only broaden their knowledge but critically review the new perspectives applying them to their context. The support of the e-Moderator is apparent when and where needed by the students, yet on a whole, reduction of the activity of the e-moderator may be observed.

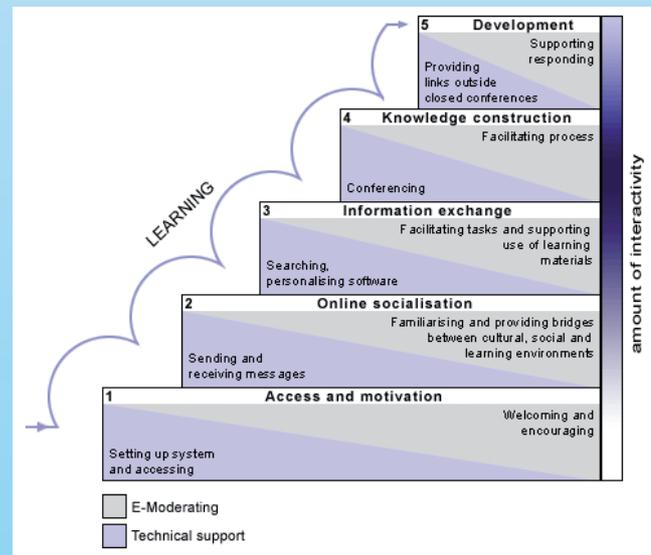


Image 6: 5 Stage e-Learning Model

The students need to acquire a certain level of skills needed to efficiently support their individual learning process. On the other hand, the facilitating skills and intuitivism of the e-Moderator is apparent during the whole course. The bar on the right side shows the intensity and dynamics of interactivity among the peers. The gradual increase, plateau and decrease follow the learning process which ends with self-reflection and conclusion of the newly acquired facts and skills. By being aware of the tendency of these dynamics, the e-Moderator can adapt the teaching process and exchange of knowledge to help facilitate the students meet the learning outcomes determined at the beginning of the e-Learning course.

## CONCLUSION

The dramatic changes in medical imaging and radiotherapy allow for complex treatment using multi-modalities; these changes prove to have a major impact on the radiographers role in Hungary<sup>7</sup>. The emergence of teleradiology increase the responsibility radiographers have in their daily routine at hospitals and other healthcare institutions where the availability of radiologists have become severely limited. The broadening of competencies and skill matrix can only be achieved through continuous professional development<sup>8,9</sup>. One of the possible methods of CPD is through e-Learning based courses which are not available for Hungarian radiographers yet. A university based virtual learning environment was used to host an experimental e-Learning course focusing on MR angiography. The preliminary results and feedback have showed that electronic methods can be efficiently used in the further training of Hungarian radiographers.

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Table 1 . Details of course participants.

<i>Students/Moderator*</i>	<i>Residence</i>	<i>Specialisation</i>	<i>Qualification</i>
<i>LT</i>	<i>Hungary</i>	<i>fMRI, DTI</i>	<i>biologist</i>
<i>TD</i>	<i>Hungary</i>	<i>Cross-sectional imaging in animal breeding</i>	<i>agricultural engineer</i>
<i>GP</i>	<i>Hungary</i>	<i>MR angiography</i>	<i>radiographer</i>
<i>MB</i>	<i>Hungary</i>	<i>MR contrast media</i>	<i>radiographer</i>
<i>AB</i>	<i>Northern Ireland</i>	<i>Routine clinical examinations</i>	<i>radiographer</i>
<i>NA</i>	<i>Ireland</i>	<i>Routine clinical examinations</i>	<i>radiographer</i>
<i>AT</i>	<i>Ireland</i>	<i>3T research</i>	<i>radiographer</i>
<i>CV</i>	<i>Hungary</i>	<i>DWI, intervention, research</i>	<i>radiographer</i>