

Post degree online course in Haematopathology and e-Learning: description of an innovative curriculum in e-Learning

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Abstract: The paper describes a post degree course organized together by the Haematopathology Unit of Bologna University and Macerata University e-learning centre. The course structure consists in the analysis of seven study cases, explored thanks to innovative technical solutions. The descriptions of the course main innovations and tools are reported. All students are already working in hospitals, so that the course flexible structure allows them to take part to the activities at the best.

Introduction

As already stated by Sir William Osler at the end of the XIX Century, there is a cogent need of continuous education in medicine that reflects the translation of new knowledge from the scientific research arena to the daily practice. This assumption has become even more evident during the last two decades due to the development and application of innovative advanced technologies that have allowed the deep analysis of disease mechanisms as well as the design of modern therapies.

Such situation has prompted to the institution of CEM (continuous education in medicine) programmes that have been officialised by the Italian Government since ten years. In particular, each physician is officially requested to take part in these programmes in order to obtain the institutional credits that satisfy his duty in terms of update aiming to keep his professional skills and credibility. So far, CEM has mainly been based on the organisation of meetings, conferences, workshops, round-tables, etc. However, all these approaches stand on the passive transmission of knowledge from a speaker to the participant, who is often only scarcely involved in the process. Studies carried out at the international level show that learning is much more effective if participants are gathered in small groups and directly take part in the process by a problem-solving methodology (1). In fact, they face to novel information in a just-in time frame that simulates their daily work conditions.

Undoubtedly, within this setting, e-learning represents an innovative and productive didactic approach. In particular, it has the following advantages over the traditional forms of teaching:

- 1) no need of travelling for participants;
- 2) higher flexibility as to what the access to teaching facilities is concerned;
- 3) possible cost reduction;
- 4) expected higher learning efficacy;
- 5) more practical result control;
- 6) productive application of the Internet technologies.

At the time being, different forms of e-learning are available:

- 1) didactic: with no interaction and individual management (e.g. video-streaming);
- 2) interactive: with handling by the single participant (e.g. interactive patient case simulator);

- 3) collaborative, asynchronous: with asynchronous interaction of different pupils (e.g. chat, e-mail, newsgroup);
- 4) collaborative, synchronous: with synchronous interaction of several participants (e.g. video-conference, virtual class).

Given that, the teacher acts like a tutor who guides and supports the participant through the learning activities. One possible limit of the above described process lays in the costs of the platform needed to provide the service. The latter can be minimised by allowing access to the service to as many users as possible.

Having this in mind, we decided to carry an e-learning experiment in the field of Haematopathology. We were prompted to such decision also by the publication of the Fourth Edition of the WHO Classification of Tumours of the Haematopoietic and Lymphoid Tissues at the end of 2008 – the beginning of 2009, which one of the authors (SAP) is co-editor of (2). The Classification introduces many new concepts by comparison with the previous edition, which the pathologists should become familiar with, if they aim to fulfil the present diagnostic standards. In particular, the latter are based on the amalgamation of morphology, phenotype, cytogenetics, molecular biology and clinical data. The availability of an Olympus Bliss platform for histological slide digitalization – that was in use for research purposes – certainly facilitated the project design.

The initiative implies the offer to the participants of the gratuitous download of a visualisation programme that allows them to transform their working station into a virtual microscope.

The Courseware

Each month, a case is uploaded on the on line learning environment, including text files with the clinical history and laboratory data, imaging technique files if available, virtual slides corresponding to all the histological, immunohistochemical, *in situ* hybridization, and molecular biology preparations produced by the Haematopathology Unit of Bologna University to allow the correct interpretation of the case. Each participant has 15 days to look at the material and one week to expose his/her diagnosis on a discussion forum by having the opportunity to compare his/her own opinion with that of the other class members. The diagnosis should be supported by reasons and references to the studied materials. After that, the tutor publishes the diagnosis, comments on the ones proposed by the panellists, and provides the pertinent references with link to PubMed. After that, a plenary video-conference is finally held for group discussion and insights on the specific topic. The format chosen satisfies all the different forms of e-learning above described.

Infrastructure Setup

Technically speaking, the e-Learning platform for Haematopathology online course is based upon a three servers infrastructure, one of which is virtual. To have a well designed efficient course, we chose one of the best learning platforms, and we merged a virtual slide server into it, so that students can analyze the microscopic images, necessary to give the correct diagnosis. A videoconference server has been dedicated to the course, as each learning unit ends with the above mentioned online meeting among teachers, students and tutor.

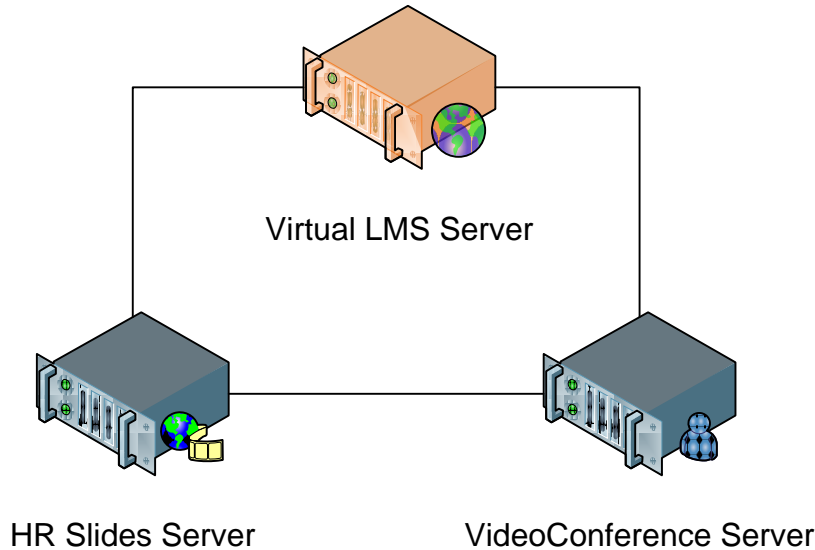


Figure 1: server infrastructure layout

Virtual LMS Server

This server, based on VMWare Virtualization products, is a Virtual Machine with SUSE Linux Enterprise Server operating system; the LMS chosen for the platform is OLAT (Open Learning And Training), a Java Open Source web application developed by University Of Zurich (UZH), that has proven to be very reliable and rich in functionality; we are using the 6.1 version, that also won the IMS Learning Impact 'Leadership Award' 2009 for best open source learning platform. University Of Macerata (UniMC) improved this platform, adding some personalized e-Learning tools. Macerata University e-learning centre is using OLAT since 2008 for post graduate courses (about 300 students) while in 2009 the platform will be used also for undergraduate courses (more that 1000 students). Thanks to the course authoring approach of the platform, creating a sequential tree structure has been possible, subdividing the course in different time phases, and scheduling their activation, so that the course elements are automatically and correctly activated during the course.

The identified phases are the following ones:

1. Case report: this is a study phase: the student has a set of documents and other materials derived from patient interview and laboratory analysis, e.g. molecular investigations and on-line slides consultation thanks to the interaction with a High Resolution Slide Server (described in the following paragraph) transforming the student workstation in a powerful virtual microscope;
2. Diagnosis: in the course this function is implemented as a forum, that allows students and teacher discussion and interaction, becoming subsequently a repository of all students' diagnosis;
3. Diagnosis discussion: this phase begins with the publication of the correct diagnosis, developed by course teachers, followed by a videoconference session with Prof. Pileri for the necessary explanations on the diagnostic method.

Thanks to OLAT, once the course materials are created, converted and organized, the automatic time publication has offered to teachers the advantage of reducing the time needed for course management.



Figure 2: The OLAT learning management system

High Resolution Slides Server

A network slide server has been installed in an IBM Blade server, with Windows Server 2003 x64 operating system. As the Bologna partner already had an Olympus digital Microscope, with scanning function, the choice naturally fell onto the dotSlide Net Image Server by Olympus.

This software has two main functions:

- Slide database with search functions, a web application, based upon Microsoft .NET Framework ;
- Rich slide navigation interface, based on Adobe Flash technology.

Thanks to the high browser compatibility of the Flash plugin, the web slide navigation application brings a simple and complete interface to Windows, Mac and Linux desktops; the application has pan, zoom functionality, and, thanks to the high resolution of the scanning microscope, every zoom rate is clear and detailed until maximum zoom is reached.

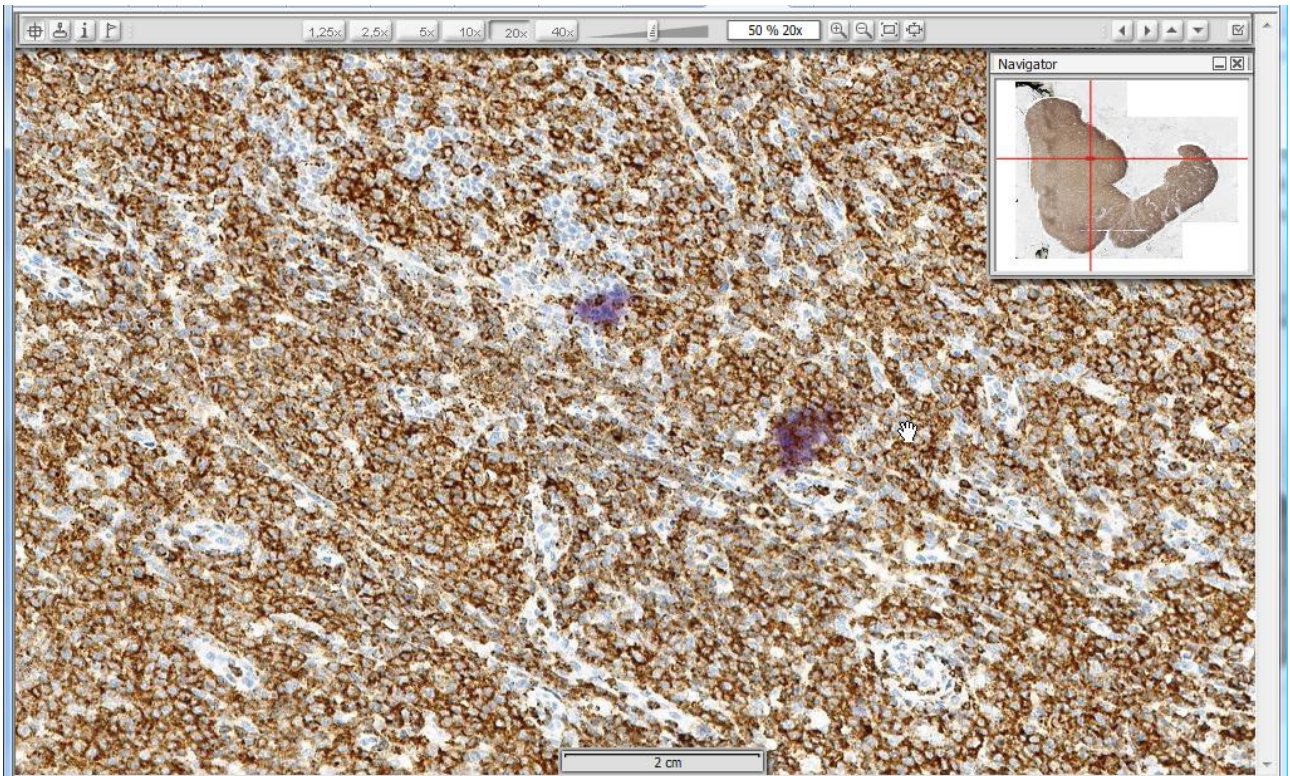


Figure 3: the Slide Navigation Interface

Even if the amount of data for a single slide is elevate (several GigaBytes of disk load) the slide navigation is smooth and fast, because the Net Image Server sends the data via a streaming method only for the visible part, optimizing the data transfer and lowering the bandwidth for the high resolution image download.

This software provide a great advantage in e-learning to formulate the correct diagnosis and more students can navigate the slides simultaneously.

Video Conference Server

In another dedicated IBM Blade server with Windows Server 2003 x64 as operating system, we placed the Videoconference service .The Videoconference facility is provided by Adobe Acrobat Connect Professional software.This software is the leading video conference server on the market and provides a high quality video conference experience, with a simple interface, entirely based on Flash player, the most popular RIA (Rich Internet Application) plugin, that, as above stated for the Slide server, brings a cross platform application compatibility.

This server allows to create, organize, manage and schedule virtual rooms for any kind of meetings.

The above mentioned virtual rooms can be seen as a structured set of multiuser collaboration and interaction tools, as:

- Audio/video conference;
- Text chat;
- Desktop, application and document sharing;
- File transfer;
- User management;
- Survey and FAQs;
- Meeting recording and offline replaying;
- Synchronous web browsing (web safari);
- Collaborative note writing.

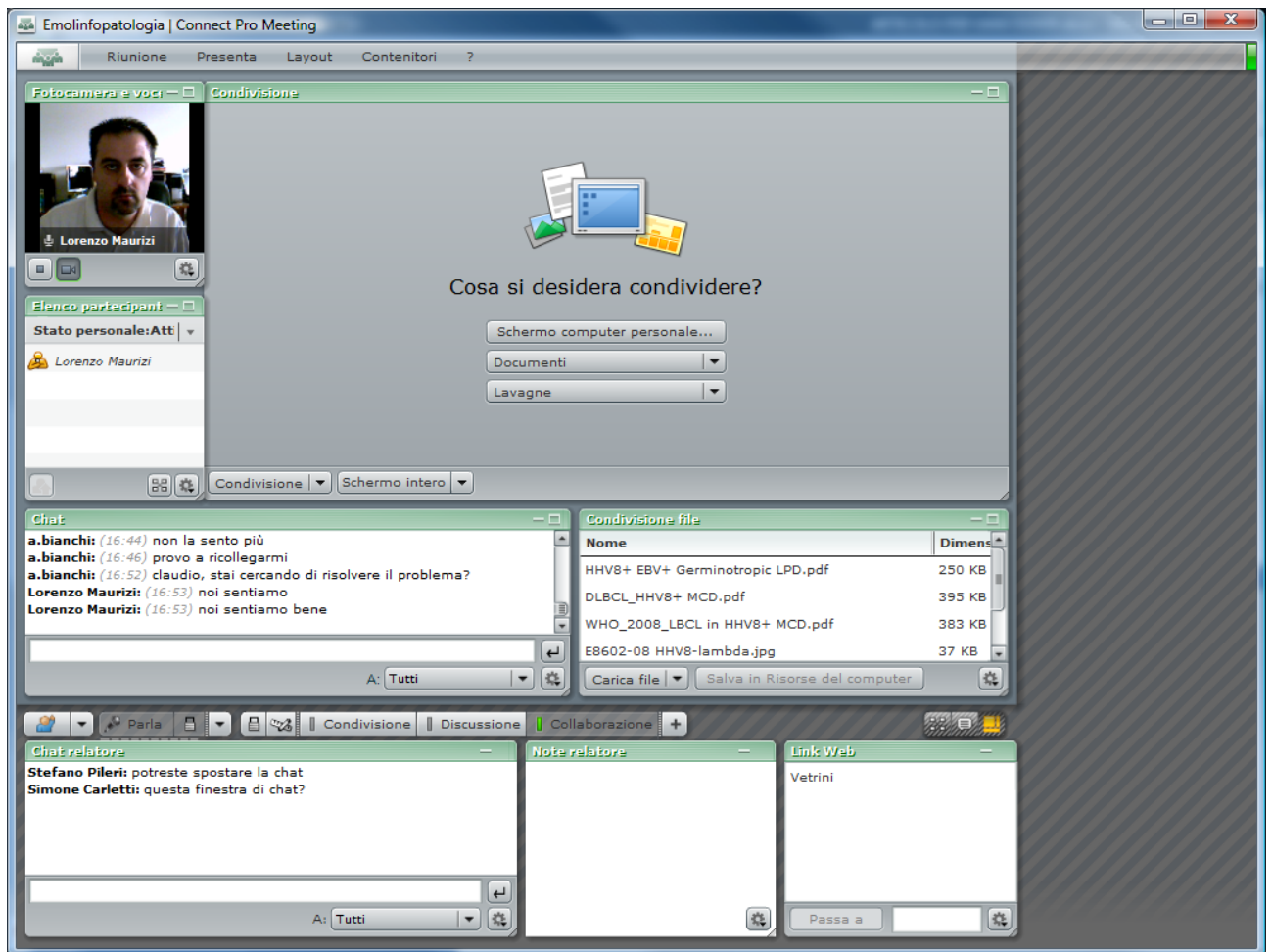


Figure 4: the Acrobat Connect Interface

In our implementation, the Videoconference software is used by teachers and students to discuss the final case diagnosis. In “presentation” mode, the teacher can show and discuss the course materials thanks to desktop and document sharing. Moreover, they can show how to achieve the correct diagnosis with the provided course materials, while students can speak, discuss and share docs. as if they were all at the same time in the same place.

Even if the course will end in 2009, December , both partners already agreed to start up a new edition in January, 2010. In the new edition, the courseware and tools will not be basically changed, as they have been working well, reaching the necessary technical results. The study case structure is also extremely functional for medical target. In order to involve more the class in tasks and group activities, a tutor, expert in e-learning and online courses, will support teachers and students during activities.

- 1) Norman G. Research in medical education: three decades of progress. Br Med J 2002, 324:1560-2.
- 2) Swerdlow SH, Campo E, Harris NL, Jaffe ES, Pileri SA, Stein H, Thiele J, Vardiman JW eds. WHO Classification of Tumours of Haematopoietic and Lymphoid Tissues. 4th Edition. IARC Press, Lyon, 2008.