THE MULTIMEDIA OPEN LEARNING ENVIRONMENT (MOLE)

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Introduction

The MOLE (Multimedia Open Learning Environment – http://www.moleportal.eu/) is a multilingual multimedia management system for managing courses and supporting learning processes and learning communities through the Web. It was developed by the Laboratory of Distributed Multimedia Information Systems and Applications (TUC/MUSIC) of the Technical University of Crete. The MOLE fosters distance learning by enabling communication between tutors/trainers and students, cooperation among students and access to coursework information and learning resources. In doing this, the MOLE platform also supports the combination of traditional classroom-based lessons and practical sessions, with self-study and eLearning. This, so called, "hybrid" or "blended" approach provides a significant learning opportunity as it combines the immediacy of communication among the instructor and the learners and the irreplaceable practical training in laboratories and the convenience, flexibility and self-regulation of education without the time and space constraints. This hybrid organization aims to exploit the strengths of both approaches (traditional and tele-education).

In this paper we present the services offered by MOLE and how they can be exploited to establish and continuously support Communities of Practice (CoP). According to Wikipedia, a CoP is *"a group of people who share an interest, a craft, and/or a profession. The group can evolve naturally because of the members' common interest in a particular domain or area, or it can be created specifically with the goal of gaining knowledge related to their field. It is through the process of sharing information and experiences with the group that the members learn from each other, and have an opportunity to develop themselves personally and professionally (Lave & Wenger 1991). CoPs can exist online, such as within discussion boards and newsgroups, or in real life, such as in a lunch room at work, in a field setting, on a factory floor, or elsewhere in the environment."*

CoP benefit both individual practitioners and organisations by enabling them to manage change, offering access new knowledge, foster trust and a sense of common purpose and add value to their professional lives. As a mechanism for knowledge creation and sharing and capability building, CoP can significantly contribute to Vocational Education and Training by establishing effective training frameworks offering initial training to newcomers and continuous support to community members in exchanging experiences and best practices.

We present the establishment of two such training frameworks for establishing and supporting distributed communities of practice across European countries: The first one consists of computer science teachers in secondary education from European countries. The aim is to exploit modern Educational Programming Languages to make computer science courses in secondary education more attractive and creative in a learner-centred pedagogical setting. The second one consists of agricultural professionals from European countries. The aim is to transfer innovative training practices and eLearning content in Organic Agriculture in the case of vocational education of (young and unemployed) agricultural professionals in new EU members.

The MOLE multi-tenant architecture and services

An important characteristic of MOLE is its multi-tenant architecture that can support multiple instances of it using the same core to serve the needs of different projects or communities (Figure 1). The MOLE platform offers a complete set of services that reflect eLearning common practices supporting:

- the organization and management of digital educational content (e.g. lectures, notes, exercises, technical lab material, literature, FAQs etc.)
- course attendance (e.g. announcements, email messages, course calendar, personal rating, automatic track of exercises and deadlines, content update messages, course syllabus etc)

- learning communities (e.g. mailing lists, live chat rooms, forums, personal messaging, instant messaging, annotation tools, video conferencing and collaboration etc.)
- educational activities (e.g. courses registration, lab teams formation, exercise uploads and deadline management, assessment tests, resource scheduling and reservations, multimedia presentations etc.)
- course monitoring (course usage statistics, class performance indicators)

Each course allows can activate only a subset of course services depending on the course requirements.

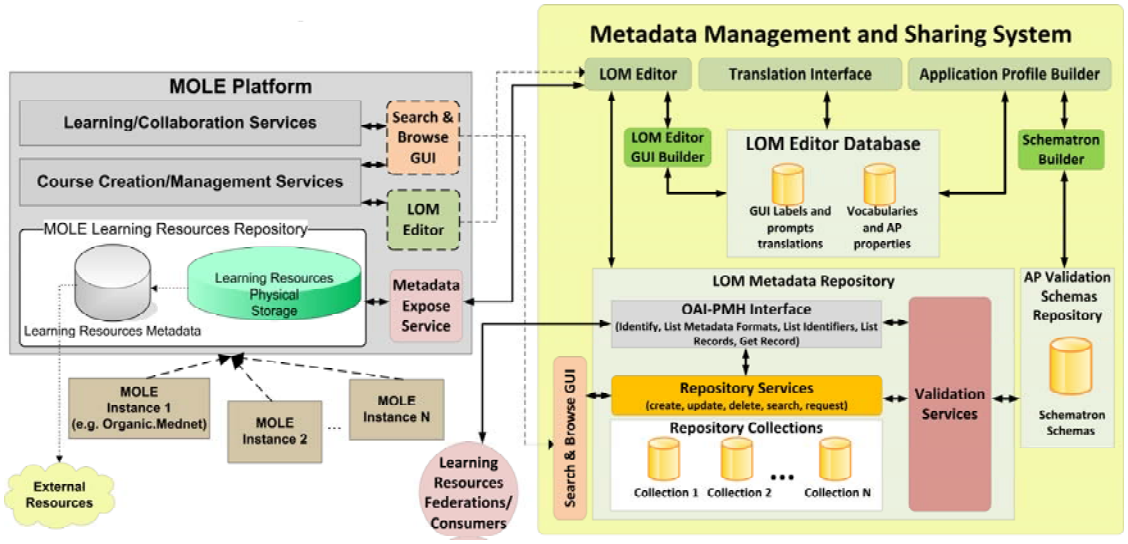

Figure 1 The MOLE multi-tenant architecture able to support different communities and projects

The MOLE platform offers instructors tools for easy content creation and web publishing. They have the ability to use common office applications for document creation. These documents are being processed by MOLE for indexing purposes and are published to MOLE in the desirable web based presentation format.

The platform provides also a framework for dynamic statistics graphical presentations such as real-time user action statistics, learning services usage, course traffic, and learner's performance statistics.

Finally, the MOLE platform maintains a Learning Resources Repository for the storage of the learning resources (locally or by reference) and their metadata. In order to support effective learning resource management and sharing, a framework and an architecture has been developed in MOLE, aiming at facilitating the implementation of such functionality on top of existing Learning Management Systems (Mylonakis et al., 2011). This generic component, illustrated in the right part of Figure 1, is the Metadata Management and Sharing System and is described later in this paper. MOLE also offers a service for exporting a course and its resources to SCORM format, supporting this way interoperability with other SCORM compliant eLearning systems.

An advantage of MOLE in comparison with other eLearning systems (e.g. Moodle, Sakai etc.) is the emphasis that is given in the use of multimedia as a powerful learning means. Learning activities using multiple media can be more effective than doing it through a single medium (such as text), but what is important is combining media effectively; Effective multimedia for learning requires carefully combining media in well reasoned ways that take advantage of each medium's unique characteristics. The most effective multimedia provides learning experiences that mirror real-world experiences and let learners apply the content in various contexts.

In the following sections some of the more interesting services of MOLE are presented: the multimedia support and the corresponding services (e.g. multimedia presentations, virtual conference and collaboration, multimedia annotations), the Metadata Management and Sharing System and the intuitive multilingual interfaces support.

Multimedia Support

Special emphasis in MOLE system is given in the use of multimedia as a powerful learning means. In order to support learning applications, the platform was developed to meet the following technological requirements:

- Effective management of multimedia and video/audio data streams. Mechanisms for synchronizing multiple media in presentations
- Support of synchronous and asynchronous learning activities
- Support of live synchronized multimedia transmission through the system, and access to recorded multimedia content
- Screencasts for demonstrations and presentations of software with concurrent recording of the speaker and presentation of slides
- Educational multimedia content creation and editing in dual mode: a) via a web based interface without the need for specialized software installations, and b) via an autonomous desktop application (MOLE Studio) for the creation of high quality video presentations for offline multimedia content creation and publishing
- Communication tools to support eLearning communities (Live chat with video and audio and text in real time, Video Conferencing Services with dynamic loading of shared presentations, Asynchronous multimedia communication messages)
- Advanced multimedia collaborative annotation tools on educational material using multimedia

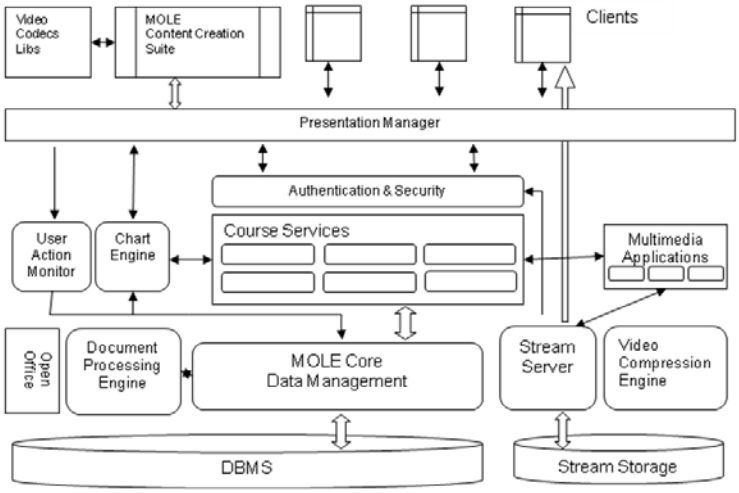

Figure 2 The MOLE internal components

As it is shown in Figure 2, the MOLE platform comprises core components that include the Document Processing Engine, the Data Manager, the Stream Server and the Video Engine. The stream server takes over the stream management and the delay sensitive data delivery to platform users. The Video Engine provides a rich set of codecs and video editing functionality and supports the content editing tools and platform's stream transcoding needs for supporting heterogeneous stream clients.

The Multimedia Presentation Service

The platform supports live broadcasting of a presentation given by an instructor using video and audio synchronized with presentation slides (Figure 2a). It is also possible to record the presentation and store it on the platform to be accessed by the learners at different times. The learner is able to navigate to the different parts of the presentation by selecting the preferred section from the list, while the slides and the video/audio of the presentation are synchronized accordingly.

The Video Conferencing and Collaboration Service

This service makes possible for groups of learners to meet in virtual space and to communicate with video, audio and text (Figure 2b). It also provides the opportunity for dynamic processing and uploading of presentation slides, where presentation is synchronized among the members of the conference call. Any registered member in the course can create a video conference room to start collaborating with other users on a specific topic.

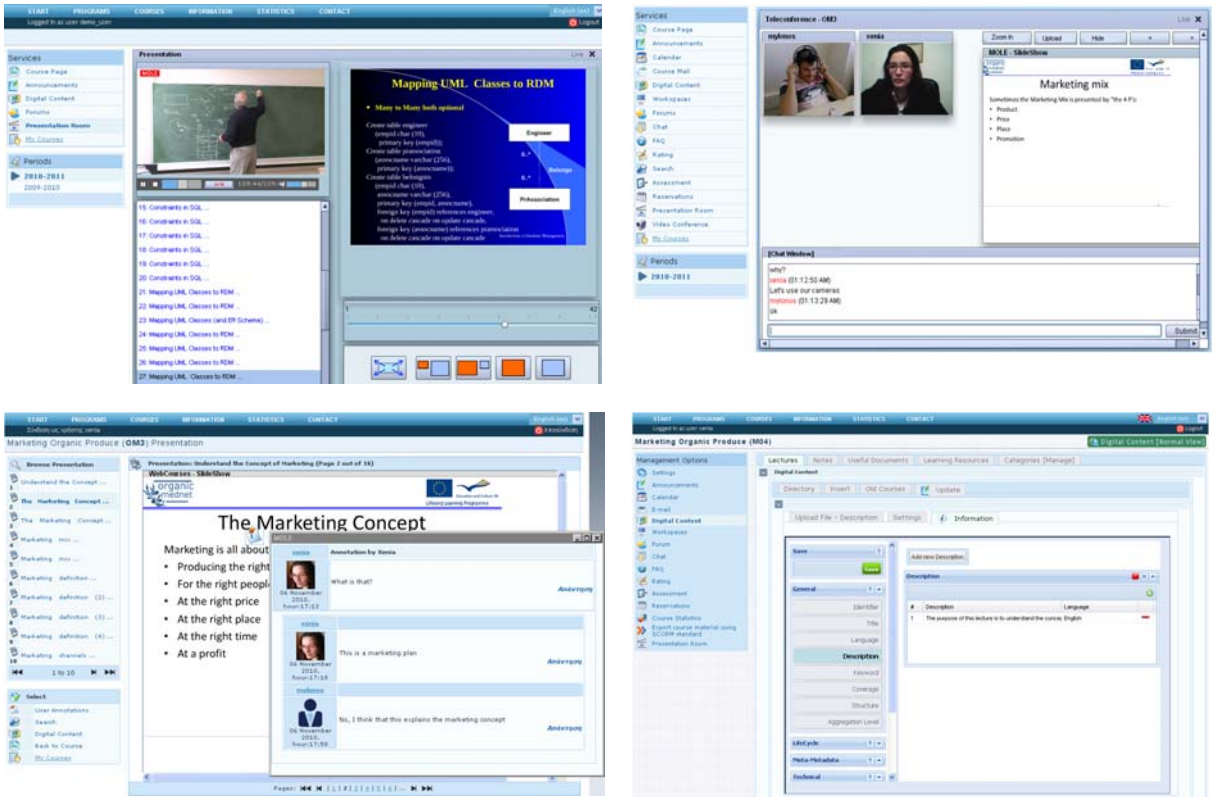

Figure 3 a) Multimedia presentations (top left), b) Video Conference and Collaboration Service (top right), c) Multimedia Annotations (bottom left), d) LOM Editor (bottom right)

The Multimedia Annotation Service

The multimedia annotations feature (Figure 2c) allows users to navigate in the course lectures or notes, which have been previously processed and presented on the system and leave comments, notes or upload/record audio/video data at several points on the presentation. These comments can be seen by other users and the instructor. It is also possible to create a comment or note in response to a previous comment of a user. This way the educational process is enhanced, since the opportunity of asynchronous communication between learners and instructor via comments or questions on specific points of the presentation of lectures or notes is provided.

The Metadata Management and Sharing System (MMSS)

Educational resource sharing is emerging as a viable means to improve the quality of and access to education (Elearnspace, 2003). The use of learning metadata standards for the description of learning resources, as well as the implementation of harvesting protocols that will make them available to large repositories/federations are technical issues that should be addressed in eLearning infrastructures. The approach followed in MOLE (Mylonakis et al., 2011) addresses the requirements set by the eLearning community and reflected in the work in progress from the LODE group of the IMS Global Consortium - http://www.imsglobal.org/lode.html. This approach is generic and enables an LMS to share and exchange learning content with other systems leveraging the advances in related standards and ensuring the widest possible exploitation of learning content and related investment made by learning organizations today.

The MMSS (Figure 1) allows for the creation of LOM metadata descriptions based on different Application Profiles (AP), supporting the needs of different communities in different educational contexts. The technical experts can take advantage of the system, in order to develop an appropriate AP by using the AP Builder that the users can later use in order to create the corresponding LOM metadata descriptions through the LOM editor (Figure 2d). The LOM XML documents that are produced can be searched and edited through appropriate user interfaces. Moreover, the OAI-PMH Interface implementing the OAI-PMH protocol on top of the LOM Metadata Repository allows for the exposure of the metadata to Learning Resources Federations/Consumers.

Multilingual Interfaces Support

In order to be able for various communities residing in different geographical places to use MOLE, the platform supports multilinguality in a generic and effective manner. An intuitive form based interface was developed in order to be able to provide translations for each MOLE element from a selected language (reference language) to another (translation language). If asked to, the system is able to suggest a translation for the target sentence. When the translation to a specific language is completed, MOLE interfaces in any MOLE instance can be switched to the user preferred language.

Currently, ten languages are supported (Greek, English, German, Italian, Spanish, Estonian, Turkish, Czech, Bulgarian, Romanian), while French translation is in progress.

Using MOLE in pSkills to build a CoP of Secondary Education Computer Science teachers

The pSkills project (http://pskills.ced.tuc.gr) provides the foundation for a future integration of the national educational systems from the perspective of Information Technology (IT) Fluency (Committee on Information Technology Literacy, National Research Council, 1999). IT Fluency is considered an important aspect towards the development of an inclusive and competitive Information Society. This trend is illustrated by current technological advancements, such as the provision of a graphical programming interface based on MIT's OpenBlocks technology (Open Blocks, 2011) and the Android operating system of mobile devices from Google (App Inventor for Android, 2011) that extends the Web 2.0 philosophy in the domain of software development. Such interfaces that exploit the experience derived from using modern Educational Programming Languages (EPLs) are expected to be functional in other domains and provide the possibility of easily creating applications that can be shared with other people thereby promoting a new digital culture that transcends the model of passive consumers of software products. Modern society perceives that the mastery of computer programming (Eric Allen et al., 2008) is a key competence, as well as delivering a number of critiques (The Economist, 2010) on the current focus on the so called computer literacy without addressing concepts and core skills (Kellner, 2000; Tapscott, 2009) that are technology independent and do not change in time.

The pSkills project addresses the needs of computer science teachers to master advanced technological studies, modern EPLs and employ novel pedagogical approaches designed to make programming courses in schools more effective and motivating. It offers suggestions for exploiting the flexibility of computer science courses in European countries to put in place appropriate elements of a suggested Common European Curriculum. The European Curriculum is complemented with learning scenarios that teachers can adapt to their specific needs as well as training material to implement those scenarios.

To ensure appropriate support for teachers, the project establishes a CoP based on a training network infrastructure (the pSkills Affiliate Network) managed by a dedicated Training Support Group that builds and maintains a repository of tools and training material and provides in-service training services through face-to-face workshops, a dedicated Summer School, and services offered by MOLE.

Using MOLE in Organic.Mednet to build a CoP of agricultural professionals

Organic Agriculture (OA) is an increasingly important part of the food and agriculture industries in the traditional member states. Public awareness on environmental issues, as well as food safety and quality, have brought forward OA as an agricultural approach that can not only produce safer products but is environmentally sound too. Due to the particularities of the agricultural sector, it is difficult to promote the new culture of sustainable agricultural production to its stakeholders. In countries such as Turkey and Spain the uptake of OA practices and techniques is still developing. Among others, the reasons for these countries lagging behind can be found in the slow introduction of OA topics as a priority of academic and vocational educational systems of all levels that contribute to the education of agricultural professionals. On the other hand, large international organizations (Food and Agriculture Organization of the United Nations, International Federation of Organic Agriculture Movements), as well as non-profit associations such as the Soil Association in UK, drive their own awareness and education initiatives for the promotion of OA in countries around the world. In addition, there have been during the past few years, several pilot actions/projects that have increased the production of eLearning content on OA theory, methods and practices (e.g. EcoJob-AP, BIOAGRO eContent, Organic.Edunet).

Such initiatives have various goals and are implemented in different socio-cultural and linguistic contexts. In several occasions they have been proven successful, and they could be appropriate candidates for transfer in new contexts and/or new countries. In this direction, the Organic.Mednet project (http://www.organic-mednet.eu) uses existing results as a basis so that it appropriately adapts, transfers and validates them for training new user groups. Specifically, Organic.Mednet facilitates the transfer of innovative training practices and eLearning content to the case of vocational education of young and unemployed agricultural professionals, as well as to agricultural professionals in new EU members, by establishing a CoP, using face-to-face training sessions, as well as services provided by MOLE.

Conclusions

Communities of Practice (CoP) provide a rich conceptual framework for organizing the interactions among people that share a concern or a passion for something they do and learn how to do it better as they interact regularly. The concept has turned out to provide a useful perspective on knowing and learning. A growing number of people and organizations in various sectors are now focusing on communities of practice as a key to improving their performance.

The approach discussed in this paper addresses the need to establish and maintain CoP among people that may be geographically distributed through the support of a rich set of communication and learning services offered by MOLE, a multimedia learning support platform. MOLE was initially developed to serve the academic CoP (teachers and students) of the department of Electronic & Computer Engineering at the Technical University of Crete. The system has been extended to support multi-lingual communities, rich multimedia communication services and content management to address the knowledge management and learning needs of professional communities. Moreover, MOLE supports two other types of CoP, secondary education teachers and organic farming professionals, established in the context of four EU Projects (pSkills - http://pskills.ced.tuc.gr, Organic.Mednet - http://www.organic-mednet.eu, CerOrganic - http://www.cerorganic.eu, and Organic.Balkanet - http://www.organic-balkanet.eu). Their MOLE instances are available from http://pskills.moleportal.eu/, http://om.moleportal.eu, http://cerorganic.moleportal.eu, and http://ob.moleportal.eu respectively.

References

1. ALLEN, E.; BODIK, R.; BRUCE, K.; FISHER, K.; et.al. (2008). *SIGPLAN programming language curriculum workshop: Discussion Summaries and recommendations* SIGPLAN Not. 43, 11 (November 2008) (pp. 6-29)
2. *App Inventor for Android* [Internet]. [cited 2011 Sep 14]; Available from: http://www.appinventorbeta.com/about/
3. COMMITTEE ON INFORMATION TECHNOLOGY LITERACY, NATIONAL RESEARCH COUNCIL (1999). *Being Fluent with Information Technology* Washington, D.C.: The National Academies Press.
4. ELEARNSPACE (2003). *Why We Should Share Learning Resources* Retrieved on May 29, 2003, http://www.elearnspace.org/Articles/why_we_should_share.htm
5. KELLNER, D. (2000). *Globalisation and new social movements: lessons for critical theory and pedagogy* In N. Barbules and C. Torres (eds). Globalisation and Education: Critical Perspectives. London: Routledge
6. LAVE, J.; WENGER, E. (1991). *Situated Learning: Legitimate Peripheral Participation* Cambridge: Cambridge University Press. ISBN 0521423740
7. MYLONAKIS, M.; ARAPI, P.; PAPPAS, N.; MOUMOUTZIS, N.; CHRISTODOULAKIS, S. (2011). *Metadata Management and Sharing in Multimedia Open Learning Environment (MOLE)* In Proceedings of Metadata Semantics and Research Conference 2011 (MTSR2011) - Special track on Metadata & Semantics for Learning Infrastructures, October 2011, Izmir, Turkey
8. OPEN BLOCKS (2011). *Scheller Teacher Education Program* [Internet]. [cited 2011 Sep 14]; Available from: http://education.mit.edu/openblocks
9. TAPSCOTT, D. (2009). *Grown Up Digital* NY: McGraw Hill
10. THE ECONOMIST (2010). *Computing in schools: Teach computing, not Word* August 26th, 2010 [Internet]. [cited 2011 Sep 14]; Available from: http://www.economist.com/blogs/babbage/2010/08/computing_schools