

Supporting Learning Communities and Communities of Practice with Coursevo

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Abstract—Coursevo (<http://coursevo.com/>) is a multilingual multimedia information system for managing courses, supporting learning processes and learning communities through the Web. Its multi-tenant architecture supports multiple instances of the underlying server infrastructure using the same core to serve the needs of multiple communities. An advantage of Coursevo in comparison with other eLearning systems 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. Coursevo is used in several vocational training and life-long-learning initiatives targeting engineers to establish and continuously support Communities of Practice (CoP). 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. We present the establishment of four training frameworks for establishing and supporting distributed CoP across European countries: (1) Computer Science teachers using Python in their courses; (2) Teachers using Arts in teaching all school subjects; (3) Civil protection Communities of Practice; and (4) Communities of Practice in Mechatronics.

Keywords—*Communities of Practice; blended learning; life-long learning; eLearning infrastructures; eLearning interoperability*

I. INTRODUCTION

The global competitiveness in economy the last years confirmed the need for an investment in knowledge development, to ensure not only basic literacies but also to secure research development and growth for a sustainable future. To address this need the traditional model of education is not enough. We should underline, though, that traditional education, mainly relying on the so called “industrial model” of organization and management was an important innovation in itself as it brought education to the masses of people in the western countries, initially, and then to the whole world. For many years this model has prevailed, producing a sustainable education model and ensuring a steady flow of individuals to the tertiary sector. With the advent of the computer and the possibility of technology for the masses a belief was affirmed amongst governments and educationalists that technology would take education forward and there would be even greater benefits. This belief led to huge investments in the purchase of various types of hardware and software systems that would

render the organization a solution that would not only meet their needs but surpass their expectations.

The prevailing mentality coupled with the “industrial model” of teaching is that the introduction of digital technology is the critical factor to modernize teaching and reap the benefits of ICT. This mentality is promoted by technology vendors that seek a way to increase their sales as well as governments that want an easy way to advertise their willingness to put forward “educational reforms”. However, this prevailing mentality and resulting policies, fail to follow the practice of people when it comes to the use of technology for learning, especially outside the walls of classrooms. With the proliferation of ubiquitous computing technologies (especially mobile technologies) and the wide use of social networks to promote new personal learning opportunities, many people worldwide pursue a personalized approach to technology use and learning [1]. This personalized mode of learning, which flourishes outside official educational systems and their “industrial mode” of teaching presents many challenges and opportunities for effective integration into mainstream education and professional training. This new way of learning is ideal for addressing life-long learning settings, especially when it comes to the need to continuously update and extend the technical knowledge of engineers, technologists and teachers in related disciplines.

To adequately address this need of recognizing and promoting the personalized use of technology to meet individual learning and training needs, there is a clear need to design and develop appropriate learning platforms and use them within appropriate learning and training frameworks for diverse learning modes ranging from face-to-face teaching and training to distant-learning. Pedagogical approaches that are focusing explicitly in the integration of technology to enable the set-up of learning environments that promote personalization are directly or indirectly related to the theory of constructivism [2] a paradigm for teaching and learning that promotes personalization and rich interactions to offer opportunities for knowledge construction in a personally meaningful manner.

This paper presents first the core features of such a platform, namely Coursevo, which was initially developed in the Technical University of Crete to support the courses offered by the Electrical and Computer Engineering School employing a rich set of services (Fig. 1). Furthermore the paper showcases four distinct uses of this platform within training frameworks targeting engineering professionals and teachers in computer science and technical education.

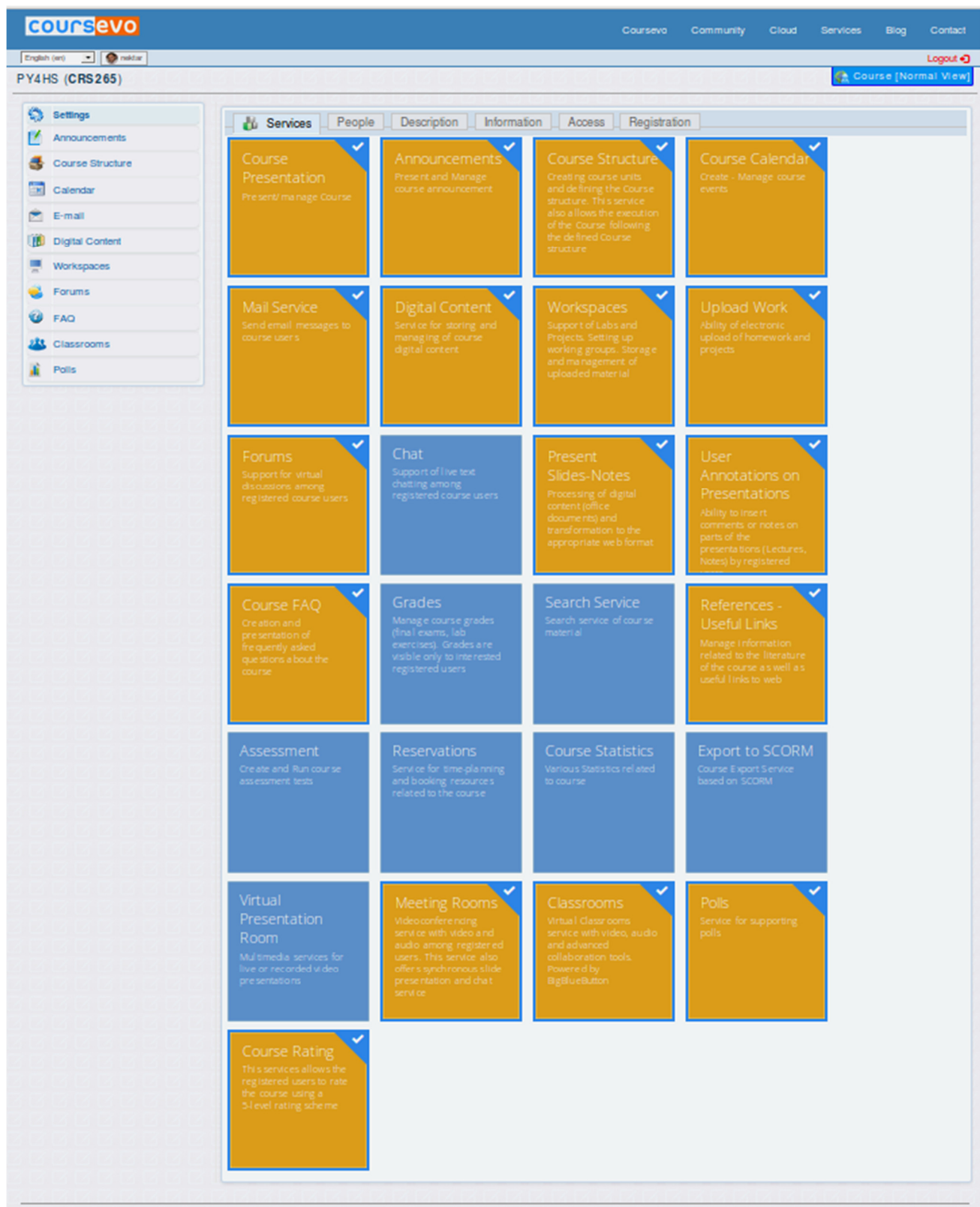


Fig. 1. The Coursevo course administration panel to select the services that will be available in a certain course. The panel shows the full range of available services and tools that are available to course administrators.

The overarching approach to address all these distinct training settings is based on the notion of *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. 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 organizations by enabling them to manage change, offering access to 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 how Coursevo is used to set up four 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 addressing the educational use of the Python programming language. The second one addresses primary and secondary teachers from all disciplines that target artful thinking and teaching, i.e. how they could adopt and use the arts for teaching all school subjects. The third community of practice refers to civil protection volunteers and local authorities addressing issues related to floods, forest fires, earthquakes and European civil protection policies. The fourth community of practice consists of managers and employees in Small and Medium-sized Enterprises (SMEs) and university students and teachers in the field of Mechatronics.

II. MAIN FEATURES AND ARCHITECTURE OF COURSEVO

Coursevo (<http://coursevo.com/>) is a multilingual multimedia educational platform for managing courses and supporting learning processes and learning communities through the Web. Coursevo fosters distance learning by enabling communication between tutors/trainers and students, cooperation among students and access to coursework information and learning resources. It can combine 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 between educators and learners with the irreplaceable practical training in laboratories and the convenience, flexibility and self-regulation of personal study without time/space constraints.

Coursevo platform as an online e-learning solution hides the complexity and frees the trainers from tedious system maintenance tasks, since a course or even a full functional learning site can be created in a few steps following the SaaS (Software as a Service) paradigm. In the main site, there are links

to Coursevo Community Portal and to Coursevo Cloud, a directory of available e-learning site instances and course programs. In order to use the Community Portal or an independent e-Learning instance, one may sign-in to create a local account or may benefit from the popular social networks authentication mechanisms (Facebook, Google+) that have been integrated in Coursevo platform (Fig. 2).



Fig. 2. Coursevo Community Portal front page.

After log in, the user may browse the available programs or categories or search for and register in particular courses (Fig. 3).

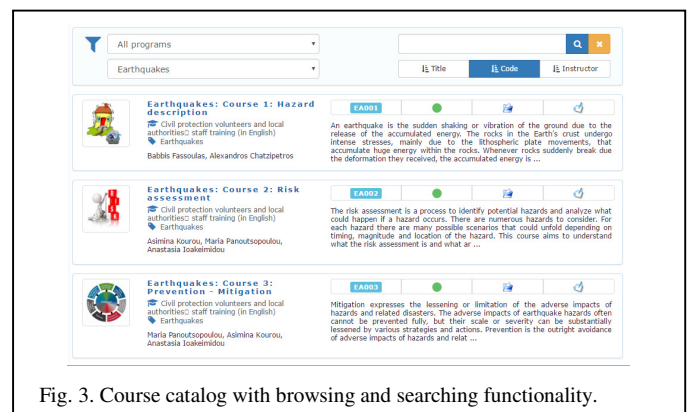


Fig. 3. Course catalog with browsing and searching functionality.

Each user has access to a personal dashboard (Fig. 4) where it is possible to have quick access to all the courses he/she attends/manages. Furthermore, through the dashboard, the user is informed for various updates in courses via the available platform notifications.

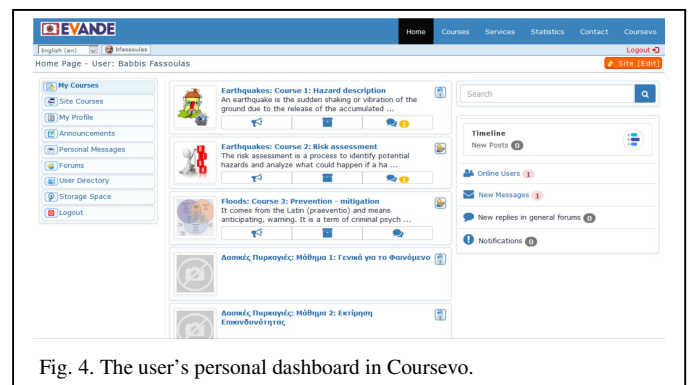


Fig. 4. The user's personal dashboard in Coursevo.

Coursevo users are able to view the learning community that is shaped around each instance of the platform. Furthermore each user holds a personal profile. This personal profile can be enriched with the desired personal information like full/short CV, personal photo etc. (Fig. 5). The platform allows users to browse community directory, exchange personal messages, keep personal message boards and follow other members, enabling communication and formation of learning teams and sub-communities regardless specific course attendance.



Fig. 5. Public view of a Coursevo member profile

Trainers are able to configure an e-learning instance to automatically issue certificates of successful attendance for specific training programs. A training program consists of one or more courses from multiple study programs or subject categories. The successful attendance is tracked by the learners' performance on specific obligatory self-assessment tests. Each learner is able to view the available certificates (Fig. 6) that can be issued based on course registrations as well as the personal progress and remaining assessments needed to be completed in order to earn the appropriate certificate.

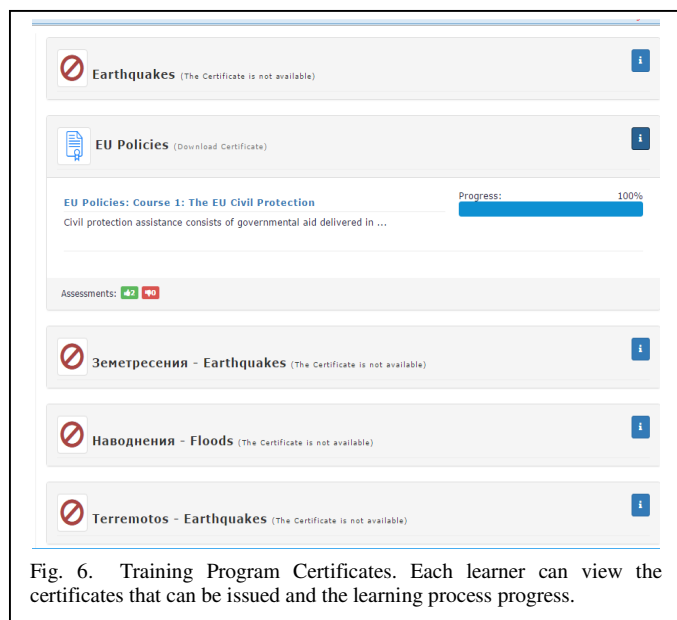


Fig. 6. Training Program Certificates. Each learner can view the certificates that can be issued and the learning process progress.

The Coursevo platform has full multilingual support. New languages can be added dynamically and easily by authorized

users, using the appropriate form-based translation service. The translation process is performed in the context of the provided system and course services and is assisted by a mechanism for automatic translation suggestions (Fig. 7).

All the above features are built within a flexible architecture that enables customizable course services and multimedia features to promote effective personalized learning paths that can be packaged as needed to support diverse communities of practice. The following subsections give more details on:

- The offered services pertaining to effective course management.
- The features related to the use of multimedia for effective learning support.
- The core components of the platform and its multi-tenant architecture.

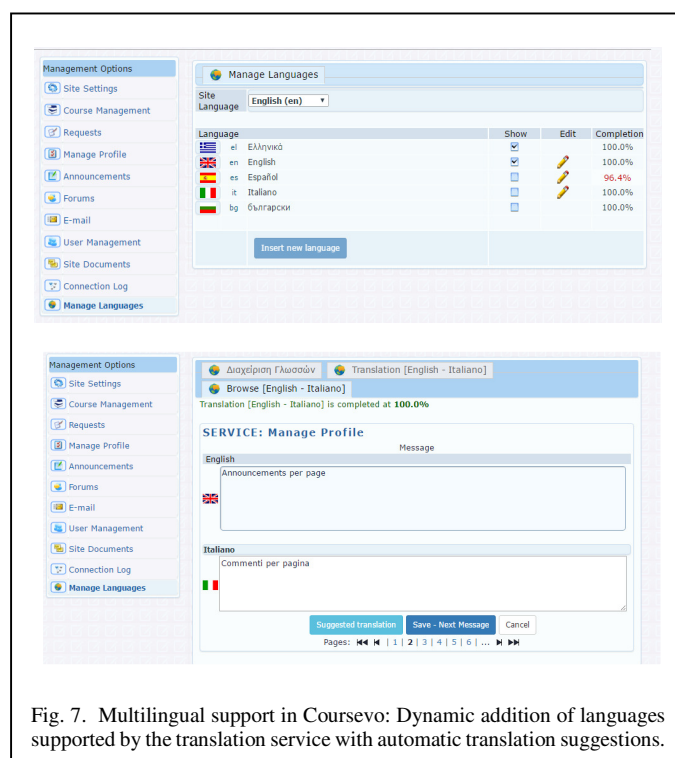


Fig. 7. Multilingual support in Coursevo: Dynamic addition of languages supported by the translation service with automatic translation suggestions.

A. Coursevo services and course management

Coursevo offers a set of services for:

- **Organization and management of digital educational content:** Lectures' presentations and recordings, notes, exercises, technical lab material, literature, FAQs etc.
- **Course attendance:** Announcements, email messages, course calendar, personal rating, automatic track of exercises and deadlines, content update messages, course syllabus, learning path, assessment tests, and generation of course certificates.
- **Learning communities' communication and collaboration:** Course and group mailing lists, live chat rooms, forums, polls, personal messaging, instant

messaging, annotation tools, file sharing, video conferencing and collaboration.

- **Educational activities:** Courses registration, lab teams' formation, exercise uploads and deadline management, assessment tests, multimedia presentations, resource scheduling and reservations.
- **Course monitoring:** Course usage statistics and class performance indicators.
- **Interoperability with other educational platforms** via SCORM [3] packages.

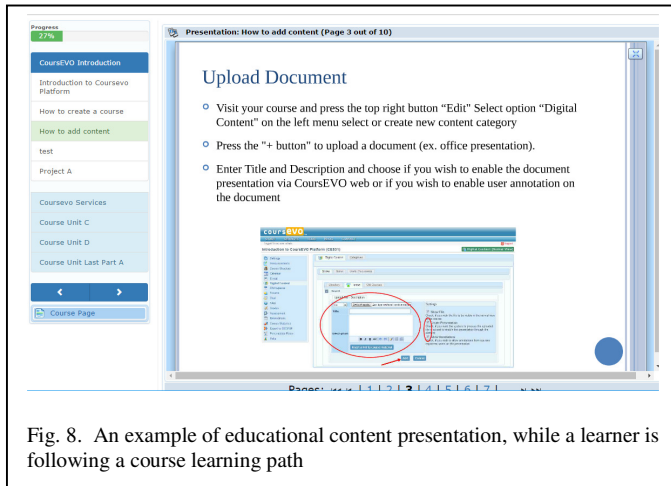


Fig. 8. An example of educational content presentation, while a learner is following a course learning path

Each course can be configured to follow specific registration and content access policies. The educators are able to activate the proper subset of course services depending on the course needs depicted in Fig. 1. They can use services and tools that allow for easy content creation and web publishing. They have the ability to use common office applications for document creation. These documents can be processed by Coursevo for indexing purposes and then published in a web friendly presentation format (Fig. 8).

Besides office documents, educators are able to upload images, videos and SCORM Sharable Content Objects (SCOs) or quickly and simply re-use existing content in the web that is accessible in popular web platforms like YouTube, Slideshare and Wikipedia. All the above course content can be combined with other Coursevo services like video-lectures, forums, assessments etc. and organized in different learning paths in order to meet diverse educational needs.

B. Coursevo features for efficient use of multimedia

Coursevo provides an integrated educational environment for synchronous and asynchronous learning that offers significant advantages in comparison with other eLearning systems: It gives emphasis in the use of multimedia as a powerful learning means.

Indeed, 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.

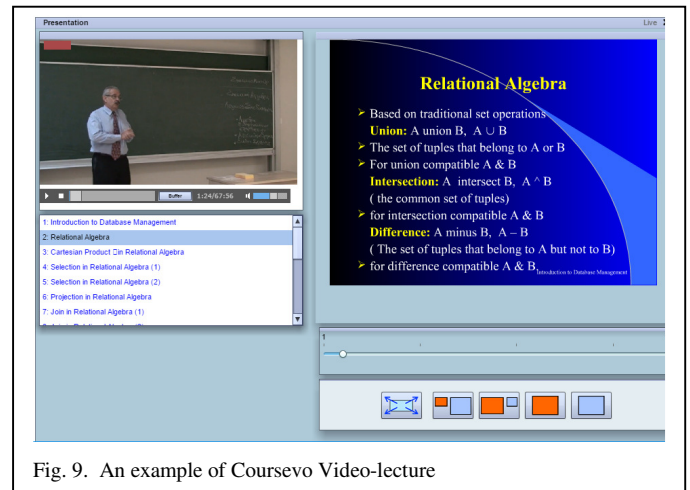


Fig. 9. An example of Coursevo Video-lecture

In particular, the features offered by Coursevo regarding the efficient educational use of multimedia are the following:

- Effective support of multimedia and video/audio data streams management.
- Mechanisms for the synchronization of multimedia presentations.
- Support of synchronous and asynchronous learning activities.
- Support of live synchronized multimedia transmission through the system, and access to the recorded multimedia content.
- Support of learners' intervention in live sessions.
- Multimedia educational content creation in two ways:
 - Through the Web-based interface without the need for specialized software installations.
 - Through an autonomous desktop application (Coursevo Studio) for the offline creation of high-quality video presentations with automatic slide synchronization (Fig. 9) that can be easily exported and published at a later time. The Coursevo Studio supports also the generation of demonstrations and presentations of software by capturing the screen, recording the speaker and the presentation of slides.
- Communication tools to support educational communities:
 - Live video chat between online users.
 - Video Conferencing Services (Fig. 10) with collaboration tools employing BigBlueButton (<http://bigbluebutton.org/>).
 - Asynchronous multimedia communication messages.
- Advanced multimedia collaborative annotation tools on educational materials using multimedia.

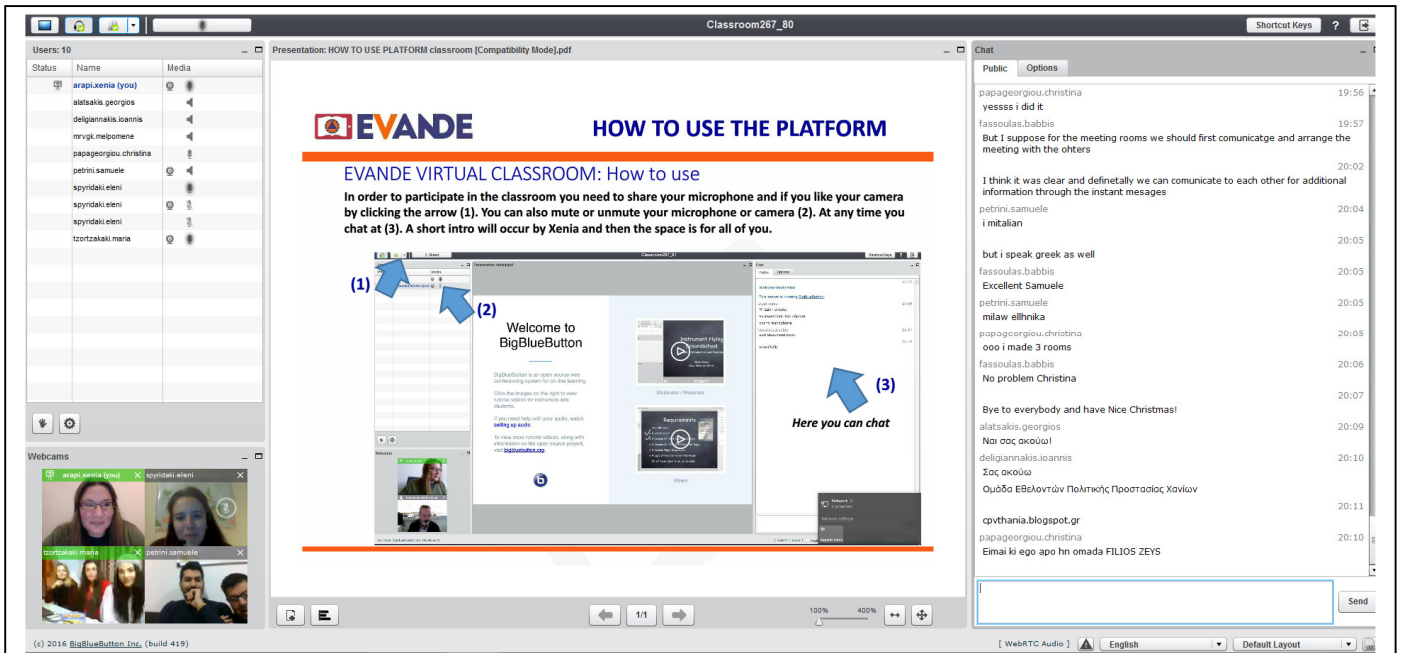


Fig 10. BigBlueButton is used in Coursevo to support video conferencing services.

C. Coursevo core components and multi-tenant architecture

An important characteristic of Coursevo is its multi-tenant architecture (Fig. 11) that can support multiple instances of it using the same core to serve the needs of different projects or communities. This is an important aspect when establishing and sustaining a Community of Practice that needs its digital identity in terms of web space (each “tenant” or “instance” of Coursevo has its own URL in the form <http://community-name.coursevo.com>), its particular repository of digital materials, communication services and courses’ structure and supported services. Furthermore, each community could use

external resources of digital materials and export selected content to external systems. All these are supported by Coursevo by employing interoperability standards (IEEE LOM) and communication protocols (OAI-PMH).

As it is shown in Fig. 12, the Coursevo 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 the platform’s stream

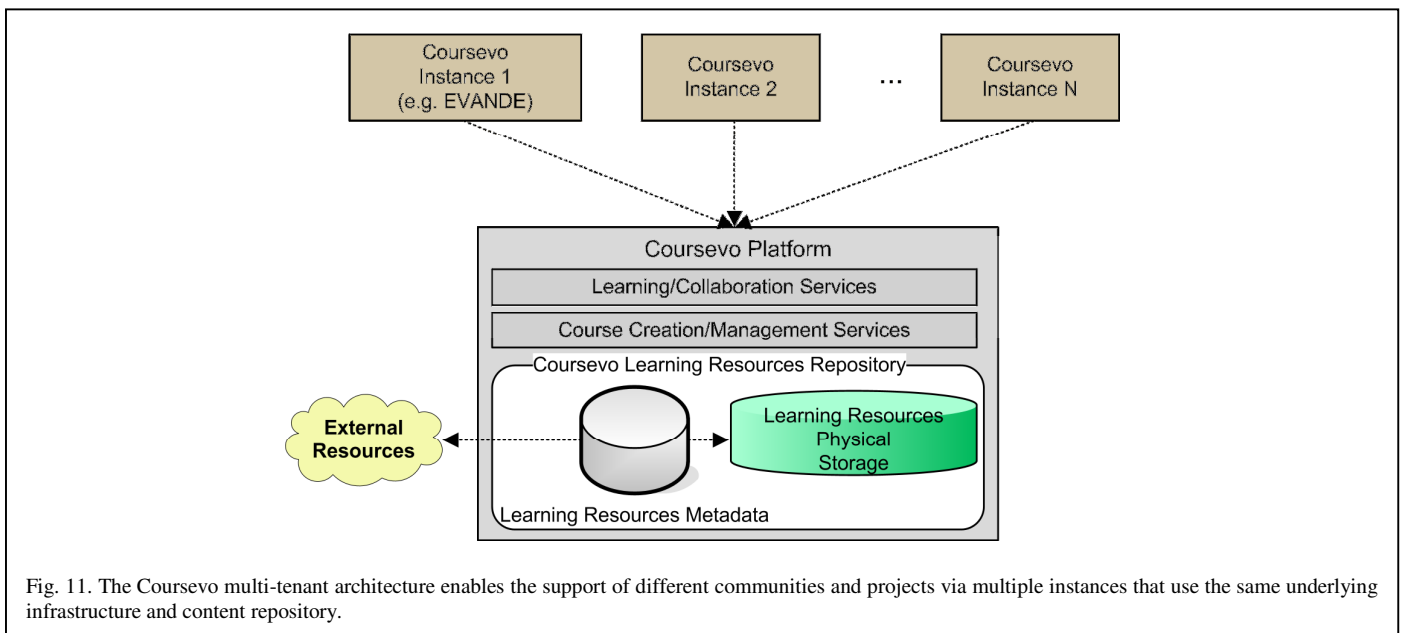


Fig. 11. The Coursevo multi-tenant architecture enables the support of different communities and projects via multiple instances that use the same underlying infrastructure and content repository.

transcoding needs for supporting heterogeneous stream clients. Some of the more interesting multimedia services of Coursevo are the following:

- **The Multimedia Presentation Service:** The platform supports live broadcasting of a presentation given by an instructor using video and audio synchronized with presentation slides. 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. 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. Educators and trainers have also the option to exploit advanced web conference services using the open source BigBlueButton system that has been integrated in the Coursevo platform (Fig. 10).
- **The Multimedia Annotation Service:** The multimedia annotations feature allows users to navigate in the course lectures or notes, which have been previously processed and presented on the system. During the navigation they can 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.

III. INITIAL AND CURRENT VERSION OF COURSEVO IN THE SERVICE OF ENGINEERING EDUCATION - ESTABLISHING AND MAINTAINING DIVERSE COMMUNITIES OF PRACTICE

The first version of Coursevo (called WebCourses) has been developed and used for more than ten years to support the learning activities in the School of Electrical and Computer Engineering (ECE) at the Technical University of Crete. This initial platform was widely accepted by the academic community and has become the core educational tool of the School. Hundreds of students are using it on a daily basis to keep track of their courses, access course material, participate to learning processes and collaborate to deliver lab projects.

Coursevo is the “WebCourses evolution” supporting several vocational training and life-long-learning initiatives targeting professionals to establish and continuously support Communities of Practice (CoP). A CoP, as already presented is a community of people who share an interest, a craft, and/or a profession. It 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 sharing knowledge and experience. It is through this sharing process that the members learn from each other and have an opportunity to develop themselves personally and professionally [4]. 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 etc.

CoP benefit both individual practitioners and organizations by enabling them to manage change, offering access to new knowledge, foster trust, promote a sense of common purpose and add value to their professional lives. As a mechanism for

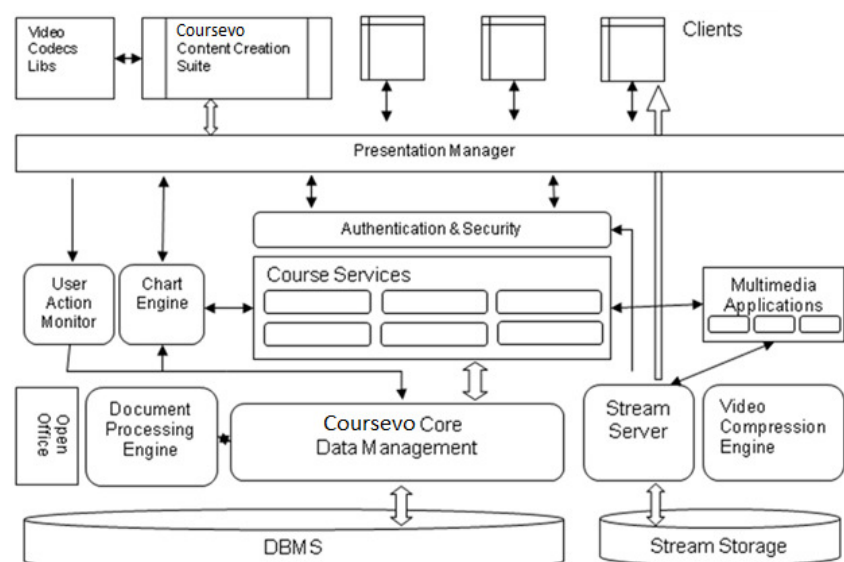


Fig. 12. The Coursevo core components following a 3-tier architecture.

knowledge sharing and capability building, CoP can 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. The following sections present four such training frameworks using Coursevo to establish and support distributed CoP, either nation- or European-wide.

A. Computer Science teachers using Python in their courses

The first CoP supported by Coursevo is *py4hs – Python for High School*. It consists of computer science teachers in secondary education in Greece. The aim is to enable them use the Python programming language in both their school courses and in volunteer coding clubs that they can establish and run beyond school. This initiative is partially funded by Google CS4HS programme (<http://www.cs4hs.com/>). To support this CoP a special course space (Fig. 13) has been created in the Coursevo community portal [5].



Fig. 13. The Coursevo course page supporting the training needs of Greek Computer Science teachers that are adopting the Python programming language in the courses they offer in lower and upper secondary education.

In this course, the members of the CoP form local study groups that are supported using the *workspaces* feature of Coursevo (Fig. 14). The platform supports multiple workspaces per course. A workspace essentially organizes teams of course participants following specific patterns of interaction and collaboration. Furthermore it offers team discussions employing all the communication services of Coursevo (chat rooms, forums, video conferencing etc.). This way each team can work in a separate space while the CoP as a whole uses the central communication services of the course. *py4hs* effectively demonstrates the flexibility of Coursevo and its capability to support inner structure in a CoP via teams.

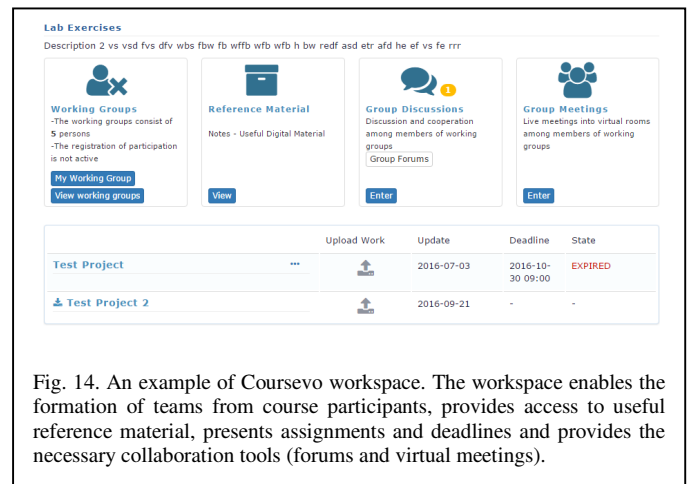


Fig. 14. An example of Coursevo workspace. The workspace enables the formation of teams from course participants, provides access to useful reference material, presents assignments and deadlines and provides the necessary collaboration tools (forums and virtual meetings).

B. Teachers using Arts in teaching all school subjects

Yet another CoP supported by Coursevo addresses the needs of teachers across EU countries to adopt and use the arts for teaching all school subjects within the Erasmus+ project *e-ARTinED – Arts in Education online: A new approach to education using the arts* [6]. *e-ARTinED* expands the research and the resources created in a previous successful initiative by providing a much awaited distance learning programme and establishing, starting from this programme, a CoP of educators that wish to employ arts in their teaching practices. It is coordinated by a Swedish organization that is currently working with the Ministry of Education of Sweden, regional and local authorities, on developing a school in Sweden based on the *e-ARTinED* methodology. The school would act as a catalyst for innovation through this CoP thus contributing to include new concepts and pedagogies in education across European Union countries.

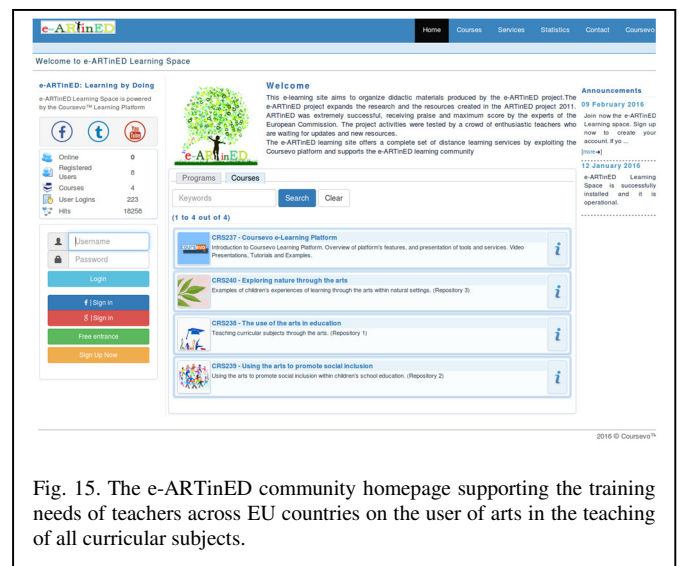


Fig. 15. The e-ARTinED community homepage supporting the training needs of teachers across EU countries on the user of arts in the teaching of all curricular subjects.

e-ARTinED takes advantage of the Coursevo multi-tenant architecture to establish a dedicated learning portal that is adapted to the particular needs of the *e-ARTinED* CoP [7]. The learning portal exploits (Fig. 15) the flexibility of Coursevo, its digital content organization features in particular, to establish a number of distinct repositories of reusable training materials that

can be used either as standalone repositories or feed with material the courses organized by the project. Furthermore, these repositories are interoperable with external federations through exporting metadata records of the hosted educational materials. The e-ARTinED community develops and offers a number of training courses based on digital materials collected from many external sources as well as materials that are developed by the community itself with the responsibility of the partners of the e-ARTinED Erasmus+ project.

C. Civil protection Communities of Practice

Coursevo also supports the training of civil protection volunteers and local authorities' staff in the context of the project EVANDE [8]. *EVANDE – Enhancing Volunteer Awareness and education against Natural Disasters through E-learning* [9] is a European project co-funded by the European Union Civil Protection Mechanism. It promotes the training of civil protection volunteers and local authorities' staff on the topics of floods, forest fires, earthquakes and European civil protection policies. Additionally, the EVANDE project aims at the exchange of experiences in order to strengthen the cross-border collaboration and effectiveness of civil protection policies and activities among the participating countries and the involved target groups.



Fig. 16. The EVANDE community homepage supporting the training of civil protection volunteers and local authorities' staff on the topics of floods, forest fires, earthquakes and European civil protection policies. The courses are available in English, Greek, Spanish, Italian and Bulgarian.

Four web-seminars (educational programs) have been developed containing a series of courses on earthquakes, floods, forest fires and European civil protection policies. The web-seminars cover topics such as hazard description; risk assessment; prevention; preparedness and recovery. In addition, the web-seminars present indicative case studies and best practices on civil protection in Europe. The courses are available in English, Greek, Spanish, Italian and Bulgarian and are free of charge requiring only a simple registration thus demonstrating the multilingual features and openness of the Coursevo platform (Fig. 16).

D. Communities of Practice in Mechatronics

Coursevo has been selected to support training of managers and employees in Small and Medium-sized Enterprises (SMEs) and university students and teachers in the field of Mechatronics. This is done within the context of the project *MechMate – Strategic Partnership in the field of Mechatronics for innovative and smart growth of European manufacturing SMEs*, an Erasmus+ Strategic Partnerships project for vocational education and training. MechMate develops curricula and an educational approach supported by e-learning, so as to meet current industry needs and requirements and university standards. The training courses cover, among others, the following subjects:

- "Mechanics and machine elements";
- "Fundamentals of electrical engineering and electronics";
- "Signals, systems and control in mechatronics";
- "Digital Systems",
- "Embedded systems in mechatronics";
- "Communication interfaces and protocols";
- "PLC systems",
- "Measurement and data acquisition";
- "Sensors in mechatronics"; and (10) "Actuators in mechatronics".

IV. CONCLUDING REMARKS

As ICT advances, there are many research and development efforts focusing on the design of learning and training frameworks that take advantage of digital technologies to offer effective blended- and distant-learning opportunities for all kinds of students as well as for professionals during their vocational training and subsequent life-long learning paths during their career. In many cases, over emphasizing the technological means to build such frameworks leads to poor results and increases the disbelief in technology. The approach reported in this paper, tries to set en equilibrium between technology and pedagogy by offering a platform that is pedagogically informed and combined with an approach that explicitly focus on professional training and continuous learning support. The characteristics related to the people targeted by the initiatives reported in this paper are varied but a common variable is the wide range in skill and use level of technology. Consequently, the design of learning has as much importance as the technology selection and human interaction between trainers and trainees well as peer interaction is proving a necessary component in the learning stages.

The learning design for the training frameworks presented in this paper in the form of four dedicated Communities of Practice has taken particular attention to using a platform (Coursevo) that, in addition to supporting expected functions such as digital content repository, communication tools like personal messages, forums and teleconferences, it supports asynchronous and synchronous training sessions. The design has also taken particular care in integrating those features of Coursevo with an

effective learning approach, namely Communities of Practice, where trainees develop their knowledge through a variety of interactive sessions involving information provision, discussion, evaluation and practical exercises. Trainees have the possibility to access the training material in the form of guides, documents, templates and invited to develop their own material, whenever possible, with the opportunity to access mentorship at every stage of the process. The approach also promotes a mixture of virtual learning with face-to-face meetings in a blended-learning setting that tries to exploit the best practices of both modes of interaction.

Participants in the communities of practice reported in this paper demonstrate high motivation to continue the training and praise for the usability and learnability of the Coursevo platform. The material offered through the platform and the efficient combination of virtual-learning sessions with face-to-face meetings is considered important as well.

Further developments are currently under way in the context of other research and development activities that are just commencing: In the context of the Erasmus+ MultiLib project, teachers will be trained on the educational use of Children Literature and folk tales from 6 European countries and 6 countries with significant contribution to the immigrant flows towards Europe. In this new initiative the experience gained from the previous use and best practices presented in this paper will be exploited to make the design of training activities more informed and effective.

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