Grant Agreement N° 215483

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|---|---|
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| *Identifier:* | *PO-SOE-1.1.1* |
| *Type:* | *Deliverable* |
| *Version:* | *1* |
| *Date:* | *22 September, 2008* |
| *Status:* | *Final* |
| *Class:* | *External* |

**Management Summary**

This report forms the deliverable PO-SoE 1.1.1, the analysis of current (educational) programmes and is part of SoE 1.1.1, the virtual campus, itself part of SoE 1 (Spread of Excellence) under the S-Cube project. The purpose of this report is to be used as a foundation for the design of the virtual campus.

We have analysed courses currently available within each of the partner institutions within the context of e-learning. The analysis has revealed both commonalities and levels of diversity between partner institutions. Furthermore, we have examined old and new teaching paradigms, and proposed that, for the development of the S-Cube campus, S-Cube partners should examine the requirements of modern teaching for the development of effective e-learning courses. In doing this however, there is much to be learned from traditional teaching, and this should not be eliminated without prior discussion and thought. We reviewed educational literature, and have also examined e-learning courses being offered by two of the S-Cube partners. We have also proposed a set of key performance indicators which can be used to measure the effectiveness of the virtual campus.



*The research leading to these results has received funding from the European Community's Seventh Framework Programme [FP7/2007-2013] under grant agreement n° 215483 (S-Cube).*

Software Services and Systems Network

## Members of the S-CUBE consortium:

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## Published S-CUBE documents

These documents are all available from the project website located at http://www.s-cube-network.eu/

PO-JRA-1.1.1: State of the art report on software engineering design knowledge and Survey of HCI and contextual Knowledge

PO-JRA-1.2.1: State-of-the-Art report, gap analysis of knowledge on principles, techniques and methodologies for monitoring and adaptation of SBAs

PO-JRA-1.3.1: Survey of quality related aspects relevant for SBAs

PO-JRA-2.1.1: State-of-the-art survey on Business Process Modelling and Management

PO-JRA-2.2.1: Overview of the state of the art in composition and coordination of services

**The S-CUBE Deliverable Series**

**Vision and Objectives of S-CUBE**

The Software Services and Systems Network (S-Cube) will establish a unified, multidisciplinary, vibrant research community which will enable Europe to lead the software-services revolution, helping shape the software-service based Internet which is the backbone of our future interactive society.

By integrating diverse research communities, S-Cube intends to achieve world-wide scientific excellence in a field that is critical for European competitiveness. S-Cube will accomplish its aims by meeting the following objectives:

- Re-aligning, re-shaping and integrating research agendas of key European players from diverse research areas and by synthesizing and integrating diversified knowledge, thereby establishing a long-lasting foundation for steering research and for achieving innovation at the highest level.
- Inaugurating a Europe-wide common program of education and training for researchers and industry thereby creating a common culture that will have a profound impact on the future of the field.
- Establishing a pro-active mobility plan to enable cross-fertilisation and thereby fostering the integration of research communities and the establishment of a common software services research culture.
- Establishing trust relationships with industry via European Technology Platforms (specifically NESSI) to achieve a catalytic effect in shaping European research, strengthening industrial competitiveness and addressing main societal challenges.
- Defining a broader research vision and perspective that will shape the software-service based Internet of the future and will accelerate economic growth and improve the living conditions of European citizens.

S-Cube will produce an integrated research community of international reputation and acclaim that will help define the future shape of the field of software services which is of critical for European competitiveness. S-Cube will provide service engineering methodologies which facilitate the development, deployment and adjustment of sophisticated hybrid service-based systems that cannot be addressed with today's limited software engineering approaches. S-Cube will further introduce an advanced training program for researchers and practitioners. Finally, S-Cube intends to bring strategic added value to European industry by using industry best-practice models and by implementing research results into pilot business cases and prototype systems.

S-CUBE materials are available from URL: http://www.s-cube-network.eu/

## Acknowledgements

We wish to thank Prof. Marco Ronchetti from DISI, University of Trento, Prof. Patrizia Ghislandi, University of Trento and Prof Alberto Colorini, the director of METID Centre, PoliMI for their contributions.

# Table of Contents

# 1 Introduction

Within S-Cube, we plan to set up a virtual campus between the partners. This campus proposes to:

- Develop a Europe-wide training and education programme, including a dedicated European PhD programme on Software Services and Systems.
- Provide an operational virtual community network through which researchers can communicate and have discussion forums, and, be informed of new research, methodologies and development activities, including business cases and training opportunities.
- Provide exposure to different academic approaches to Software Services and Systems research;
- Collect and consolidate course material on Software Services and Systems research and applications.
- Provide an infrastructure for creating a distributed learning centre for open learning content to support training for academic and industrial research.
- To set up Software Services and Systems competence centres which will provide specific user communities with access to advance technologies, test-beds, expertise and knowledge, which allow them to take-up these technologies and services.

This report has been written for the purposes of collating S-Cube partner institution information with a view to setting up this virtual campus. It presents e-learning[1] and how it has been implemented within the partner institutions to date. It then discusses Key Performance Indicators which can be used as a basis for measuring the success of the S-Cube virtual campus.

## e-Learning

The use of e-learning allows students to benefit from the Information and Communications Technology (ICT) infrastructures which have been developed in recent years, particularly since the advent of the Internet. While e-learning is mainly used to support full-time students in top educational institutions, the development of e-learning allows 'non-traditional' students, such as adult learners and those not living close to a physical campus, to benefit from educational opportunities that were previously not available to them. Globally, many Universities are including distance learning, and within this, e-learning, in their portfolios of course offerings.

However, e-learning is not just about the use of ICT within the traditional teaching environment. It is paramount that those teaching through the medium of e-learning look at new paradigms, and change the traditional way of teaching. This is not an easy task for those working within more traditional structures.

Therefore, it is important that, within S-Cube, and in supporting the development of a virtual campus for the teaching of Services, that we examine not only ICT which S-Cube partners use, but also the teaching paradigms which are in place. Using this, we can develop key performance indicators against which we can measure the development and success of the S-Cube virtual campus.

To compile this report, partners of S-Cube have reported on their e-learning capabilities, based on a questionnaire distributed by the editors (see Appendix 1). In addition, they have reported on existing Services courses, whether through e-learning or not, within their institutions. The editors have compiled information received and used this to comparatively analyse partners' capabilities

[1] E-learning can mean both electronic learning support e.g. on-line teaching material etc., or can mean a partial or complete replacement for face-to-face "traditional" teaching.

(Section 2). In Section 3, the focus is on e-learning paradigms, which have been compiled based on research into the discipline of Education. This is broadened into discussion on each of the factors required for 'modern' teaching, where e-learning fits. Based on this discussion, we present a set of key performance indicators which can be used as a basis to establish measures for the success of the S-Cube virtual campus. Working with partners from Politecnico di Milano and University of Crete, we present where their current e-learning programs fit into this paradigm. This is detailed in Section 4. Section 5 contains the conclusions of this report, with Sections 6 and 7 presenting Appendices and References respectively.

# 2 E-learning provision by S-Cube partners

This section summarises e-learning provision by S-Cube partner institutions. This information was collected from answers to a questionnaire distributed by the editors (see Appendix 1). In addition, use was made of available web sites listed at the end of this document (PLS RAMBOLL report[1], InnoUniLearning[2], UvT website[3]). Details received from each partner are summarised in Appendix 2.

In general, partner institutions offer both undergraduate and postgraduate courses in relevant disciplines such as engineering, science, information management and other disciplines such as humanities and business. Interdisciplinary courses are also taught. Partners within the consortium may be either Universities or Research Centres. The Research Centres generally are either within a University or have a close association with a University. For example, Lero@UL is a research institution which is part of the University of Limerick; University of Trento has a close association with the nearby FBK (Fondazione Bruno Kessler), which promotes research in the areas of science, technology, and humanities. In these cases, information for the relevant University is discussed. However, both CNR and MTA SZTAKI are both Research Centres who do not have a close collaboration with a University, therefore, they do not have an involvement in e-learning or service courses. There are also Universities who do not do have courses on services but who, because of the S-Cube initiative, expect to commence implementing such courses in the near future.

Physical facilities vary between Universities. In some cases, such as the Vienna University of Technology, are located on a single campus. Others have distributed campuses – for example, Université Claude Bernard Lyon has 14 faculties located in 10 campuses spread over the city of Lyon. Partners have networking and information communications technology available to them which include wireless networks, library services, audio-visual services and communication links to other institutions. In the majority of cases IT services are supported by centrally within their institutions.

Partner's involvement in e-learning is varied. Some institutions are well-advanced – for example Politecnico di Milano, where the METID unit (Metodi E Tecnologie Innovative per la Didattica) is responsible not only for ICT in education, but also for the development and delivery of e-learning courses. In contrast, other partners have personal rather than institutionalized e-learning in place. Some institutions provide guidance on e-learning to their teaching staff; others have individuals involved, but no central support is provided. In UCBL, teacher support includes training and relief from teaching duties to develop e-content, which is seen as vital to encouraging update of e-learning and overcoming possible resistance. In addition, for some courses e-learning facilitates access to simulations of otherwise less accessible equipment. There are plans within some institutions for increasing involvement in e-learning (e.g. UPM Madrid) and in USTUTT there is a publicly available ICT strategy which supports a growing e-learning community. The University of Trento has a system where university lectures are regularly recorded and made available through asynchronous high quality video-streaming (LODE –Lectures On DEmand). In UvT, Tilburg, each student has a personal Electronic Study Guide (ESG) which includes the lecture schedule and examination details. In some partner Universities, there is a group specifically focusing on e-learning. An example is USTUTT (where ILIAS provides teaching and learning materials to students, individually and in work groups). E-Learning platforms used vary across partner institutions and include Moodle, eFront (SCORM compliant), SPIRAL, Blackboard, h323, Isabel, Centra, Breeze, e-Col and Joomla.

Funding for S-Cube partners involvement in e-learning projects comes from a variety of sources. In some cases, funding comes directly from central University funding. Other partners have established partnerships with industry and / or research institutions. Government funding has been made available, and partners have been involved in EU projects which have provided funding for e-learning. In addition, Universities co-operate with others to develop joint courses – these include UVT, Tilburg and University of Crete. In addition, the Politecnico di Milano has set up public-private partnerships for the purpose of developing e-learning.

The extent of e-learning implementation varies across the partners. In USTUTT, for example, a complete distance e-learning is currently available for two masters programmes, in UL, e-learning facilities are used by individual lecturers within modules, and Politecnico di Milano has been operating distance learning programmes since 1992 and was the first Italian university to provide a fully online degree course. In the Politecnico di Milano, e-learning initiatives are mostly project based and current projects include: Laurea OnLine (http://www.laureaonline.it/), Corsi On-Line (http://corsi.metid.polimi.it/) and Math OnLine (http://www.mathonline.it). Some 30 projects are in progress, including some international projects. In this case, the teaching policy, and in particular the e-learning process, is based on a clear educational model, applied uniformly across multiple projects; this involves a multi-disciplinary approach, with an emphasis on design with the e-learning experience influencing traditional teaching methods as teachers have been forced to structure their material better in an e-learning environment. In most of the partner institutions, e-learning has been used as a supplement and support for traditional teaching rather than to replace it.

Within some universities, such as TUW, the importance of part-time students is recognized, and therefore, e-learning facilities are invaluable. In partner institutions were feedback has been collected, the student experience has been recorded as positive. In the University of Limerick, e-learning is being used to support the recent introduction of problem-based learning traditional teaching.

Partner's implementation of e-learning varies. In some cases there are complete courses run in an e-learning format, while in others, e-learning is used in particular modules. In addition, there is a wide variety of services education provided (see Appendix 3). In some institutions, Masters programs are offered, in others, services courses are taught as part of Bachelors degrees.

# Partners' Key Features

### Table 1: ICT and E-learning summary

| Institution | Trento | USTUT St'gart | Polimi Milan | UOC Crete | TUW Vienna | UCBL Lyon | Madrid | UvT Tilburg | UL (Lero-UL) |
|---|---|---|---|---|---|---|---|---|---|
| Central ICT management | + | + | + | - | + | + | + | + | + |
| Wireless network access | + | + | + | + | + | + | + | + | + |
| Course material e-access | + | + | + | + | + | + | + | + | + |
| Digitally recorded lectures | + | + | + | + | - | - | + | - | - |
| Distance learning experiments | + | + | + | - | + | - | + | + | + |
| Distance learning projects | ~ | ~ | + | + | - | ~ | - | - | + |

## Table 2: Co-operation and Funding

| Institution | Trento | USTUT St'gart | Polimi Milan | UOC Crete | TUW Vienna | UCBL Lyon | Madrid | UvT Tilburg | UL (Lero-UL) |
|---|---|---|---|---|---|---|---|---|---|
| Co-operation: other universities | - | + | + | + | - | - | + | + | + |
| Co-operation: research institutes | + | + | + | + | - | | - | - | + |
| Co-operation: private enterprise | + | + | + | + | + | | - | + | + |
| Significant external funding | + | + | + | ~ | ~ | ~ | - | ~ | + |

Legend: + exists; - does not exist; ~ partially exists; blank: information was not available.

### Trento

- The University of Trento has a well-developed ICT / e-learning strategy, driving a process of increasing support of traditional teaching, which is gaining importance and acceptance
- A key component of the delivery of e-learning is digital videos of the lectures
- The University of Trento has developed collaborations both internally, between departments and with many other research institutions and commercial organisations

### USTUTT, Stuttgart

- The University of Stuttgart is committed to an innovative, interdisciplinary and collaborative approach
- Links have been developed within the university, with other universities and research organizations and with various external partners; this raises significant revenue
- The ICT and e-learning infrastructure is well-developed, so many students experience "blended" learning, a combination of traditional teaching supported by extensive e-learning support; distance e-learning is available for two masters programmes

### Politecnico di Milano

- Politecnico di Milano has used e-learning successfully since 1992; a key driver for this process is the distributed nature of the campus, spread over seven different locations
- ICT and comprehensive e-learning support for both students and teachers is offered by METID, which is also responsible for the development and delivery of the e-learning policy
- There has been co-operation with private partners, partly to help defray the high cost of e-learning programmes; this has been largely successful and is seen as a key requirement for further development of e-learning; various other co-operations have been used; but not with other Italian Universities, possibly due to competition
- The introduction of e-learning has required re-thinking of the educational context; it has been found that e-learning leads to much more teacher-student interaction and that teaching material has had to become more structured and of better quality; this is also affecting traditional teaching at the University

### UOC, Crete

- UOC has a good ICT infrastructure and plans for further development. ICT is handled internally, including the design, development and support.
- The e-learning platform is based on Moodle, and it is used as an enhancement for the traditional approach. Many of the courses are available in digital format as well.

### TUW, Vienna

- TUW has a well-developed ICT infrastructure, with full e-access to course administrative information and teaching material. The ICT support is handled centrally
- A number of e-learning related systems are in place, with overlapping functionality and not all entirely satisfactory or widely accepted; these include the Moodle based system TUWEL
- Distance e-learning has not been developed, except experimentally; TUWEL could in theory be developed for e-learning, but there are no immediate plans to do so

### UCBL, Lyon

- A particular feature of UCBL is that is a large university with a very diverse student body
- The success of the e-learning initiatives appears to have depended in particular on a strong leadership and professionalism of the e-learning unit PRACTICE; considered and effective teacher support also seems to have been crucial
- The use of a customised LMS, SPIRAL, seems to have been an appropriate compromise between expensive commercial systems and insufficiently featured open-source offerings

### UvT, Tilburg

- UvT has a high-quality ICT infrastructure and plans are in place for a completely integrated service to meet future demands
- Distance e-learning has not been implemented, but a comprehensive Blackboard implementation supports full e-access to course material, and many other features; there is also an electronic study guide, personalised for each student

### UPM, Madrid

- UPM Madrid is a relatively young university, open to new technology and collaboration in the e-learning area.
- The distance learning system is well established, many courses being already taught online.
- UPM is also part of the Open Course Ware virtual campus initiative. Here, different universities make study material freely available.

### University of Limerick (Lero@UL)

- UL has central ICT support, and an infrastructure which allows access to administrative and teaching material as required.
- E-Learning is not controlled centrally at any level, and the development of e-learning is left to the individual faculty member.
- Some e-learning has been carried out through the use of Moodle and Blackboard.

# Partner comparison

- The Politecnico di Milano stands out as the prime partner for the development of successful e-learning; while geography may have been a key driver, success has probably depended more on a clear and coherent pedagogical vision and a willingness to engage in co-operative ventures
- The University of Stuttgart has a systematic approach to e-learning, a central e-learning platform and numerous support facilities, including recorded lectures and online surveys; there are two fully on-line masters programmes; collaboration is a strong feature of the university
- The Université Claude Bernard Lyon is a large university, catering for a diverse student population. The university has relatively recently introduced a successful e-learning strategy; this is based on a single e-learning platform that has become a key aspect of both the teacher and the student experience
- The University of Trento also has a strong e-learning policy; although it has not developed distance learning as such, it has a successful model for the flexible and personalised blending of a whole variety of e-learning facilities, as well as a range of external co-operative projects
- UPM, Madrid is a young university, open to new technologies and ready to experiment with different approaches to education provision. It has an overall strategy defined and many of its courses are taught online. The lack of collaboration with other companies and organisation could be seen as its weak point.
- Tilburg University runs a number of high-profile business oriented courses, in particular a Masters programme in Information Management. Almost all courses are supported by the Blackboard e-learning programme and there is a personalised study guide for each student
- UoC, Crete has a good ICT infrastructure and a very good collaborative network. Many of their courses are available in digital format. But for them e-learning is only an enhancement for the traditional approach. Their weakness is the lack of experimentation.
- TUW, Vienna is a good example of a university that have good ICT support, but relatively limited e-learning facilities. They do not feel the pressure to change. Current issues e.g. a rather diverse set of e-learning tools and some pressure on ICT resources, could be addressed without significantly improving e-learning.
- The University of Limerick is also a good example of a university ICT support. In their case, support for e-learning has recently become centralised within the Centre of Teaching and Learning. New teaching techniques, such as Problem-Based Learning, means that there is a growing pressure to develop this teaching support.

# 3 E-learning Strategy Analysis

The development of e-learning strategies, and in the case of S-Cube, the virtual campus, means that academics need to examine their teaching paradigms. This is likely to require a change away from traditional methods.

When compiling this report, we examined educational literature. New and Old Paradigms of Teaching were presented by Johnson et al. [4] (see Table 3). Furthermore, the documentation submitted by Politecnico di Milano (PoliMI) demonstrates that they are successful users of e-learning. Their success stems from such requirements as:

- Students and teachers having a precise responsibility in the learning process.
- Collaborative learning.
- Attention to roles in the learning process with a focus on user learning.
- Ad hoc design of courses is based on the user and their needs.
- Material, but also (and more important) services with specific attention to teacher-student communication channels.
- Learning agenda with time, flexibility and constant learning rhythm.
- Learning by doing to build student motivation.
- Constant feedback and monitoring which includes synchronous and asynchronous methods.
- Indicator system which allows control over the process.
- Partnership – Collaboration with external companies and organisations.

**Table 3: New and Old Paradigms of Teaching**

| | **OLD** | **NEW** |
|---|---|---|
| Knowledge is | Transferred from Teacher to Students | Jointly Constructed by Students and Teachers |
| Students are | Passive - waiting to receive information | Active, Discoverers, Constructors |
| Faculty | Classify and sort students | Develop students' competencies |
| Relationships between teacher and student | Impersonal | Personal |
| Context | Competitive, individualistic | Cooperative, emphasized Teamwork |
| Assumption | Any expert can teach | Teaching is Complex, requires training |

Based on input from this research and other partners, we have identified factors which we should consider when developing and using modules within the S-Cube virtual campus. These are:

- Responsibility
- Collaborative learning
- Roles
- Learning by doing
- User-centred design
- Services and materials
- Learning agenda
- Feedback and monitoring

- System indicators
- Partnership

We need, however, to be careful that we do not 'swing' totally away from the traditional methods. There are times when a face-to-face discussion group may work better than a web-based group, and we, as experienced academics, need to ensure that the S-Cube virtual campus is set up in a way that allows us to do this if needed.

In the remainder of this section, we discuss each of these factors, and have proposed key performance indicators (KPIs) for each of them which can be used as an initial starting point for the virtual campus management when setting up the measurement structures for its success. Some of the KPIs will be measured on a three-point scale (No, Partial, Yes), others will require other metrics as indicated. The KPIs have been used to assess current programmes delivered by both PoliMI and the University of Crete (see Appendix 4). Each course presented will need to be bound by criteria – for example, too many references for a course could be equally as bad as too few references for a course.

## Responsibility

Education is an interactive or transactional process. In an educational transaction, issues of responsibility and control apply to both teaching and learning [1]. Therefore, the teacher has the responsibility to define a syllabus[2] and design educational activities. However, students need to have opportunities for dialogue regarding outcome expectations, learning activities, and means of assessment for individual courses. Students have to assume responsibility for their own learning.

The transactional perspective on teaching and learning reflects a dynamic balance of responsibility and control issues congruent with the educational purpose and the capabilities of the students.

KPIs:

1. Are the learning objectives clearly defined at the start of the course?
2. Is the syllabus defined before the start of the course?
3. Is the lecturer knowledgeable about his/her subject area?
4. Does the student have the opportunity to express his/her opinion about the learning activities and outcomes?
5. Do the educational activities undergo regular revision?
6. Does the teacher/faculty take into account the feed-back from students when carrying out revision of course syllabus?

## Collaborative learning

Collaborative learning refers to methodologies and environments in which learners engage in a common task where each individual depends on and is accountable to each other. Groups of students work together in searching for understanding, meaning or solutions or in creating an artifact of their learning such as a product. Collaborative learning activities can include collaborative writing, group projects, and other activities. [5]

[2] Course refers to a subject taken over a short period of time (may be within one semester for example); Syllabus refers to the topics covered within individual courses.

In the context of Learning Management Systems (LMS), collaborative learning refers to a collection of tools which learners can use to assist, or be assisted by others. Such tools include Virtual Classrooms (i.e. geographically distributed classrooms linked by audio-visual network connections), chat, discussion threads, and application sharing. E-Learning has unique capabilities to support asynchronous, collaborative communication in a dynamic and adaptable educational context.

The technology of e-learning has the capability to support a learning environment that develops and encourages to develop the ability to think and learn both independently and collaboratively. The creation of knowledge in this educational context is an individual and, at the same time, collaborative process made possible by a community of learners.

However, e-learning is not inherently learner-centred. Its success depends on the ability of the educator to create learning environments that motivate students and facilitate meaningful and worthwhile learning activities and outcomes. The teacher needs to design the right balance and blend of collaborative and individual learning activities.

KPIs:

1. Are there any collaborative writing activities?
2. Are there any group project activities?
3. Is there a virtual classroom available for the students enrolled to the course?
4. Are there any chats and discussion threads?
5. Are there any application sharing facilities?

## Roles

The three main components of the teaching/learning system are the Learner, the Subject, and the Teacher. Ranking them in different orders leads to different models of the teaching/learning process [7].

In the traditional teaching model, the common ranking is Subject-Teacher-Learner. The Subject is non-negotiable (a body of knowledge that already exists), and the Teacher acquires authority from his or her access to that knowledge. The Teacher role is defined by the Subject, and mediates the knowledge to the Learner. The Learner is the one who is to be changed by exposure to the Subject.

However, newer approaches tend to give more importance to the Learner. If teaching is conceived as constructing a bridge between the subject and the learner, learner-centred teachers keep a constant eye on both edges of the bridge.

KPIs:

1. Does the teacher give students the opportunity to express their ideas?
2. Does the teacher give the students the opportunity to ask questions?
3. Does the teacher encourage the students to find out more about the subject?
4. How many questions on average does each student ask? (Number)
5. How many references does the teacher provide to the student? (Number)
6. How many references quoted by a student does the teacher add to their lecture materials? (Percentage)
7. Guided by the teacher, can students pursue different tracks of learning?

## Learning by doing

It has been suggested that students who actively engage with the material, are more likely to recall information [3], and we have seen that traditional education is changing from the model where academics once stood in front of a class and imparted information to a scenario where students are expected to become more actively involved in the learning process. In, for example, problem based learning, students are expected to find relevant information and apply this, either individually or in groups to the problem they are required to solve. In doing this, we should not neglect the knowledge about how students learn – through abstract conceptualization, reflection, experimentation with practical application and doing things. Therefore, in any e-learning education, students should have the ability to carry out all of these.

KPIs:

1. How many interactive activities are students involved in e.g. role playing, debates, class discussions? (Number)
2. How many group activities are students involved in e.g. cooperative learning, case studies? (Number)
3. How many individual activities are students involved in e.g. short written exercises, information seeking? (Number)
4. Is there a forum where discussion is primarily initiated by students?
5. Do students get an opportunity to learn through different modes?
6. Is experimentation followed by assessments and reflection on results?
7. Is reflection on experimentation followed by relating it to a theoretical framework?
8. Are approaches other than those applied in the group experiment discussed / used?

## User centred design

Learner-centred education places the student at the centre of education. It begins with understanding the educational context from which the student comes. It continues with the instructor evaluating the student's progress towards learning objectives. By helping the student to acquire the basic skills to learn, it ultimately provides a basis for learning throughout the life. It therefore places the responsibility for learning on the student, while the instructor assumes responsibility for facilitating the student's learning [6]. The approach strives to be individualistic, flexible, competency-based, varied in methodology and not always constrained by time or place.

KPIs:

1. Are the students' needs evaluated before the course is designed?
2. Is the course able to change based on the feed-back from the students
3. Is the course able to change based on the student's progress towards the learning objectives?

## Services and materials

The availability of services from the academic staff optimize the opportunity for quality student-faculty, student-teacher and peer interactions and communication in support of learning. Furthermore, students should be made aware of materials which support their learning. In doing this, open communication must exist between students and academics.

KPIs:

1. Are the course support materials available in advance?
2. Is there a good communication channel between student's and teacher/faculty?
3. Are there good facilities to enable communication between students, like chats, discussion threads, and virtual classes?

## Learning agenda

Interactive pacing of the educational experience operates from both a social perspective and serves to keep an educational group synchronized or acting together, and in an individual perspective, serving to define a speed for progressing through the lesson such that the educational objectives are completed in a reasonable and pedagogically effective span of time.[1]

Allowing individual student control of pacing and at the same time facilitating group pacing such that collaborative learning activities are possible, is a challenge to interactive forms of e-learning. It requires careful balance and planning during the instructional design.

KPIs:

1. Is the learning environment flexible?
2. Does the learning environment support multiple resource tools?
3. Can the learning route be personalised based on learner's needs?
4. Are there different levels of guidance available?
5. Are there different delivery modes available?

## Feedback and monitoring

Assessment has five major uses[1]:

- Communicate the achievement status for students.
- Provide self-evaluation information to the learner.
- Student placement for educational paths or programmes (accreditation).
- Motivate the learner.
- Evaluate the effectiveness of instructional programmes.

KPIs:

1. How soon after the evaluation are the results made available to the students? (Number)
2. Is the rank of the student calculated, and communicated to the student after each evaluation?
3. How frequently is a student assessed? (Number)
4. Is there a variety of assessment instruments used?

## System indicator

Concurrent with adopting e-learning, institutional policy and strategic plan must be developed to provide direction and to focus sufficient resources to facilitate the transformations.[1]

In defining the policy benchmarking has an important role. It gives a direction and also enables control over the process. Establishing success criteria, assessing progress and communicating direction and accomplishments are all parts of it.

KPIs:

1. Is there a policy document and a strategy plan that describe the direction and the approach of the educational system?
2. Are success criteria established?
3. How often is the progress assessed? (Number)

## Partnership

To ensure that student learning is kept up to date, it imperative that, within any academic institution, students are exposed to relevant 'new thinking' both through research and industry. Therefore, these should be closely aligned with the material from which courses are being taught.

KPIs:

1. Is the institution open to external collaborations?
2. How many concurrent collaboration research and industry projects are running at the same time?
3. Are research results and industry examples incorporated with the course materials?

## Key Performance Indicators within S-Cube

When setting up the virtual campus, it is imperative that we, within the S-Cube project, are prepared to measure our success. Given the research carried out for this report, we have suggested KPIs which can be used for measurement. The academic committee from the virtual campus will need to define exactly how and when these measures will be used, and whether they will be collected centrally by the virtual campus management.

Regardless, each course developed for use within the virtual campus should be measured as the campus develops, and where courses are not demonstrating success in each of the factors listed, they should be reviewed. We also expect that the KPIs suggested will be modified as the campus develops.

# 4 Evaluation of existing e-learning programs: Politenico di Milano (PoliMI) and University of Crete (UOC)

## Introduction

In evaluating existing e-learning programs, we chose two partners who are at different stages in e-learning development. Politecnico di Milano has a mature e-learning program. On the other hand, the University of Crete is developing its name in this area, and is working towards increasing its offering of e-learning courses.

The Politecnico di Milano, Italy, have been offering distance learning programs since 1992, and was the first Italian university to provide a fully online degree course. Because of this, within the S-Cube partnership, PoliMI's ICT structure and educational set-up is particularly mature. They have a distributed campus, and therefore their ICT infrastructure is key. The university has a unit (METID - Metodi E Tecnologie Innovative per la Didattica) which is responsible for the development and delivery of e-learning courses Within PoliMI, they use a variety of technologies including Centra (version 7.5), Breeze (version 5), e-Col. They also use open source platforms, such as Moodle and Joomla.

The courses offered at the University of Crete can be supported by an e-learning management system. The system is developed and supported by the University's Communications and Networking Center, based on Moodle. Courses or seminars, at undergraduate or postgraduate level which follow the University academic regulations can be run from this centre. eFront™ (http://www.efrontlearning.net) is an alternative educational platform used in the Transformation Services Laboratory at the Computer Science Department that can deliver the needed infrastructure for courses. It also acts as a complimentary communication, training and testing tool. Moreover, it is used to distribute digital content to students, as a communication medium between students and professors and as a file-management solution for its content library.

## Responsibility

Within both PoliMI and the University of Crete, the instructor is responsible for defining the objectives and curriculum of the course, for adding material relevant to the course and for organizing the learning process. They can manage his/her class with several tools through which he/she can view statistics, create student groups, assign grades, post notices, etc. They also design the assessment criteria. Students are responsible for being aware of and attending assigned activities in a course. It is also their responsibility to be aware of announcements, news and forthcoming events, and do carry out the assignments and other relevant activities.

In the PoliMI model, as responsibility in the learning process is very important, instructors are additionally responsible for taking advantage of ICT infrastructure, such as multimedia and for the design and management of new modes of relationships with students. In addition to the instructor, there is a strong support by a tutor, They are experts in the field (usually researchers or also professors from Politecnico) coordinating, in collaboration with the instructor, a virtual classroom. They manage the educational activities provided for in the course (projects, exercises) and most of the communication with students such as clarifications and in-depth discussions. Tutors have a range of expertise ranging from preparing content to relational capacity. In addition, there is a

general tutor, who is normally a PoliMI professor. In cooperation with other professors and staff they follow the general progress of students, evaluating general teaching problems, and managing specific difficult situations which students experience, for example, dissatisfaction with grades, difficulty with following course materials.

## Collaborative learning

In the PoliMI model the collective dimension of university studies is exploited online. In their case, they implement the unique capabilities of e-learning to support asynchronous, collaborative communication in a dynamic and adaptable educational context. In addition to asynchronous communication, there are synchronous sessions which are held between student and tutor (the live sessions). These are important for the students (learning) and for the instructor and tutor (teaching / monitoring). Teamwork is emphasised, and collaboration between students is encouraged and takes place. When assignments are given, the number of group projects is limited, particularly because many of the students are in full-time employment and therefore do not have occasion to work together. Consequently, it is important that the students can perform many activities on an individual basis allowing them to customise their studies around their availability.

The e-learning system at UOC is designed to support an interactive style of learning. There are activities through which students interact with each other, such as forum, chat, the making of a glossary or a wiki page. Moodle supports collaborative writing activities and a teacher assigning a group project can give students a place to work by creating a wiki with the group mode enabled. This gives each group their own space to record research, to develop outlines and to create the final product. The teacher may create a submission date on which to turn off editing capabilities for students so that he or she can grade the final projects. Afterwards, the teacher may enable visible groups so that everyone can see each other's work.

## Roles

Within PoliMI, the instructor's role is focused more on student's learning than on teaching techniques and instructors recognize the importance of building on the conceptual and cultural knowledge that students bring with them to the classroom. Another feature is that, compared with courses run in the classroom, there is a greater heterogeneity of students (mostly workers, often working in the field of computing). Because of the collaborative tools used and co-operation and interactivity between students, this translates into greater knowledge. Oftentimes there are interesting discussions because students pose questions or respond on the forum and chat on the basis of their work experience. This ultimately means that students have a very active role in the construction of knowledge.

The e-learning system at UOC recognizes two types of users: the instructor and the student. The administrator of the system creates a new course and defines the teacher of this course. The teacher is allowed to add material and activities in his course. Students have the opportunity to express their ideas through synchronous-tools such as 'Chats' or asynchronous through 'Forums'. Instructors and students communicate with each other by the traditional way.

## Learning by doing

In both PoliMI and UOC, the student is encouraged to become involved in an active learning process. The e-learning systems encourage students to play an active role in the learning procedure

by undertaking assignments that are complementary to the course curriculum (e.g surveys), and by taking part in discussions and cooperative learning.

### User centred design

In both Universities, the user and his/her needs are very much considered of every step in the production of the distance learning projects. The main structure of individual courses is designed before they commence. However, the teacher interacts with students to make relevant changes. Feedback from the students is used in order to improve the course for the next time period that it will be given to students.

### Services and materials

Fundamental to the PoliMI model is the design of efficient teacher-student communication channels. In addition, course materials are usable both on-line and off-line. This allows students to review the lessons more than once and they can also hear the live sessions more than once.

In the University of Crete, communication between students and teachers is facilitated through mailing lists, chats, and virtual classes.

### Learning agenda

At PoliMI the learning agenda guarantees both time flexibility and constant learning rhythm.

### Feedback and monitoring

At PoliMI constant feedback and monitoring is considered an absolute necessity to make the online education distance transparent to the students, tutors and instructors. For feedback, both synchronous and asynchronous methods are used. In particular, feedback is given through forums and especially during live sessions. Both these instruments are used by tutors and instructors to check if students are studying and whether they understand materials and assignments. The synchronous / asynchronous communications, in addition to supporting collaboration, are used for monitoring.

In UoC, students are evaluated in each activity in which they participate. They also have the opportunity to obtain self-evaluation information.

### System indicator

PoliMI uses an indicator system to allow control over the process, from design to provision.

### Partnership

At PoliMI, collaboration with external companies and organisations is considered a value, not only from the economic perspective, but also in terms of organisational, management and customer care terms.

UOC has established partnerships with other universities in the past and is open to joint PhD and masters programs.

# 5 Findings

## E-learning Classification

This survey of the e-learning facilities of S-Cube's partners has revealed a significant diversity. The analysis identified that all partners have a significant ICT infrastructure, which is probably now a basic requirement of any modern university. As well as access to computers with web browsers, e-mail and file storage, all partners provide on-line access to teaching material – which could be of varying quality. The second level, achieved by most partners, includes: more advanced e-learning support, electronic course management, audio-visual material such as streamed or recorded lectures, on-line forums or other collaborative facilities, tools and support for teachers to develop e-material. The third level is for full support for distance learning i.e. where students can study largely off campus. This has been achieved on a project basis and for some specific courses in a few cases only. The distinction between the second and third levels identified above is essentially between e-learning as a *support* for traditional learning, and e-learning as a *replacement* of traditional learning.

## E-learning: Pre-requisites and Issues

In practice, this classification is mostly a matter of degree, rather than absolute distinction and reflects the progress made by partners over time seeking to improve ICT infrastructure and introduce e-learning. While small improvements can be made informally, major changes and the introduction of new facilities can only be made under leadership strong enough to build the necessary consensus and overcome the inevitable resistance. Another driver seems to be the use of technology to overcome geographical spread, where a university is not based around a traditional campus. This may be one of the reasons why some partners have gone further down the e-learning road than others.

Two – related – key components for the development of e-learning can be identified: pedagogical vision and centralised support. The basis of pedagogical vision is the recognition that e-learning, especially distance learning is significantly different from traditional teaching. A strategy document to articulate this vision was produced by some partners. A centralised support unit has been introduced by all partners; initially such a unit was responsible for ICT support only, but in some cases, the unit also takes responsibility for e-learning, even the promulgation of the pedagogical vision.

Technology is obviously central to the delivery of e-learning. The basic tool for the delivery of e-learning is the e-learning platform. A number of such platforms are now available and partners have used a variety of them. A key choice is whether to go for a proprietary system or choose open-source. One solution, favoured by some partners, is to use an open-source system, which is obviously cheaper, and use in-house ICT expertise to customise it, perhaps incrementally. It would seem preferable to have just one platform, but some partners have used several, apparently successfully. It is worth mentioning that while technology is necessary, it is by no means sufficient to ensure success of an e-learning initiative.

An aspect of e-learning, quickly apparent to teachers, is that development of e-learning material is more work than traditional lesson preparation. For the university, development of e-learning can therefore be a significant expense. One way of overcoming this issue is to enter into partnerships with other departments or other institutions, which many partners have done, to a varying degree and perhaps for a variety of reasons. In some cases a business model was evolved that allowed the development of e-learning material, with the costs and benefits shared by the involved parties.

An aspect of the development of the centralised support unit is that it must offer appropriate support to its users: students and staff. Students have been reported as enthusiastic users of e-learning systems, and indeed also as drivers of the whole process of change involved in the uptake of e-learning. The staff require support not only in the use of systems, but in the development of e-learning material. Better e-learning platforms offer authoring tools to aid creation and re-use of e-learning material. It has been recognised in some cases that teachers need relief from regular teaching duties in order to develop e-learning, access to training and time off to attend related events, and conferences. It would appear that without such measures, teachers may resist rather than endorse e-learning initiatives.

## E-learning Benefits

The benefit to the university as a whole is presumably financial, as once the investment in e-learning has been made, the delivery of courses is less costly. The introduction of distance learning raises the possibility of enrolling students that were not traditionally part of the catchment area; by the same token it also means that catchment area students may be susceptible to "poaching" by other universities. This natural competitive pressure may account for an apparent lack of co-operation between universities in the development of e-learning.

A number of benefits of e-learning for students have been noted. Students appreciate the presentation of all e-learning facilities through a common portal, where this is available. More surprisingly – at first, students report a more personalised experience with e-learning, especially through on-line forums and chat sessions which can improve relations within and between students and staff. This is, however, in the context of face-to-face meetings, where the e-learning is seen as a supplement to traditional methods. Teachers have experienced similar benefits: a greater knowledge of their students and an opportunity to reach both the weakest and strongest students more easily. Staff also appreciate the ease of communication with students and being able to update teaching material conveniently.

## E-learning Risks

The current situation is that, with the exception of courses within Politecnico di Milano, partners in S-Cube have implemented e-learning as a support for traditional learning, and presenting courses in traditional mode has worked successfully for them. While S-Cube must be ambitious and look towards the future, the consortium must be careful that they do not lose the learning they have gained in developing traditional courses, and that the methods which are used to teach those courses may also be useful in the future development of a virtual campus.

A major risk involved in moving to a total e-learning situation is the training of faculty. Faculty must ensure that students gain from the e-learning experience. Making this shift that is not just a conversion from traditional to e-learning, but a new learning experience for faculty themselves. This training needs to be provided at some stage in the process. Furthermore, faculty should be aware that the implementation of e-learning may not result in greater learning – there are

responsibilities from the student side which must also exist, and again, we need to consider how we ensure that these are implemented.

Furthermore, individual partners will need to consider procedures for the regular review and modification of syllabi. Faculty will need to have procedures for version control, archiving and dissemination. The issue of quality will be important to ensure that the S-Cube campus can work successfully and inter-institutional interactions will need to be considered.

All partners have, to some degree, implemented e-learning and are all interested in extending e-learning within their institutions. They also have networking and information communications technology in place and run many courses which are similar. However, there are some differences between institutions which will lead to a variety of requirements which should be taken into account when developing the S-Cube virtual campus. These include:

- Teachers within partner institutions have different levels of training;
- Partner institutions use different application software;
- Current extent of implementation is varied;
- Academic regulations will differ between institutions;
- Funding comes from many different sources;
- Partners represent research centres as well as Universities.

While e-learning, in theory, is a new and useful means of distributing knowledge to students, S-Cube needs to ensure that the development of the virtual campus is carried out in an organised and controlled manner.

## Key Performance Indicators (KPI)

For the development of the S-Cube virtual campus, it is imperative that Key Performance Indicators are used for the measurement of its success. Those presented in Section 3 provide the basis for those which will be implemented by the academic council of the virtual campus. These KPIs are expected to help identify whether or not we, as educators who are developing courses through e-learning, are working towards the successful implementation of a virtual campus. The KPIs are also expected to help ensure that we develop a modern style of distance learning based on ICT infrastructure which will be successful, and therefore will be to the benefit of the student experience and learning within the European Community. S-Cube also needs to consider other factors when finalising the KPIs for the virtual campus. These include:

- Sources of the KPI assessment (evaluation forms, observed data, expert opinion, teacher's evaluation)
- Verification and / or auditing of the KPI assessment

## Conclusion

The overall partner experience reported is that e-learning has been a success in the context of e-learning as a support for traditional learning. As noted, e-learning as a replacement of traditional learning has been implemented in a few cases only, mostly as supplementary or Master level courses, with the notable exception of Laurea OnLine (Politecnico di Milano). Partners have reported a progressive evolution of e-learning facilities, involving not just technical development but also the building of consensus and changing the university culture. This latter process

necessarily takes time and S-Cube needs to be aware of this. In the case of Laruea OnLine, the students' experience seems to have been positive, and may be a good example of the use of technology to help break down isolation and build relationships. It is imperative that in setting up the virtual campus, that S-Cube project also creates a positive student learning experience, where faculty and students can benefit from the learning involved in such an initiative.

# 6 Appendices

## Appendix 1: Specification for PO-SoE 1.1

General input from partners was sought under the following headings:

### Background information

- Name and number of colleges / departments
- Location and geographical spread
- Number of students
- List of services courses taught, with brief syllabus (if available)

### ICT assessment

- Is there an overall ICT strategy? Is there a document describing it?
- What are the main functions of the current ICT infrastructure in relation to education?
- What are main problems with the existing ICT facilities?
- What are the future plans for ICT?

### E-learning

- Brief summary of existing e-learning facilities
- Identification of specific e-learning initiatives e.g. is e-learning specific to certain courses or types of course or is it used widely?
- Identification of technologies used

### Funding and Co-operation

- How are any existing e-learning initiatives funded?
- Is there any co-operation with other institutions such as private companies / public companies / government bodies / other universities
- Is there a coherent business model or models for any joint ventures?

### Educational issues

- What changes have been made to the teaching and learning experience in e-learning programmes?
- Has the experience of e-learning affected traditional teaching?
- What is the teacher experience?
- What is the student experience?
- What is the overall impact on education of e-learning?
- What are the future plans for e-learning?

# Appendix 2: e-Learning in Partner Institutions

# University of Trento

## Background

- The University of Trento is a young university located in the city, organized in seven faculties with 15,000 students and over 500 academic staff; some 25 undergraduate courses and a similar number of postgraduate courses are offered
- The IT related courses are handled by DISI (Engineering and Information Science) department
- There is a close association with the nearby FBK (Fondazione Bruno Kessler), which promotes research in the areas of science, technology, and humanities; more than 350 researchers are employed
  - The Center for Information Technology (IRST) focuses research on key areas of information technology; research is organized in Research Units, in particular the Service-Oriented Applications Research Unit, which focuses on a set of research topics: distributed business processes, user-centric services, and service-level agreements
  - FBK collaborates with the University of Trento on shared projects and labs, also on shared educational programmes such as PhD's

## ICT Overview

- The provision of comprehensive ICT services is handled by the University Lab of Innovation in Didactics
- In collaboration with DISI, a multidisciplinary team continually reviews and develops the ICT strategy, using "Guidelines for the Organization of Online Academic Teaching"
- There is full ICT support for students, who are able to access resources and tools to supplement or replace traditional learning methods
- A wireless network covers the university, and the wider city, through the WILMA http://wilmanet.it/ network
- There is personalised ICT support for lecturers
- There are communication links with external institutions

## E-learning

- E-learning is coordinated through the Online Didactics project; there are four main platforms for the delivery of services, all available through a common portal:
  - Personal webpage and portal, where the lecturers provide and maintain the related materials and information on their own
  - A Moodle-based system, offering a wide range of facilities for the provision of e-learning materials and communications facilities
  - ESSE3, developed by KION and widely used and adopted in Italian universities; ESSE3 is used more for administrative functions, for which it is more powerful than Moodle, and offers: student enrolments, course management, syllabus management, exam management, organization and management of student career, certificates and personal data

- Online Community of the faculty of Economics, a proprietary LMS solution created and supported by the faculty in order to organize, manage, and facilitate the educational processes in the Faculty of Economics

- The University lectures are regularly recorded and made available through asynchronous high quality video-streaming (LODE –Lectures On DEmand); benefits include:
  - Students may "attend" lectures when convenient – or possible, rather than when they are delivered; this is particularly useful for students who are also working
  - Language support; lectures are given in both Italian and English, and there are both Italian and foreign students
  - The ability to review a lecture
  - There is also the ability to attach documents to the video stream e.g. the lecture slides
  - Over 2/3 of the students use the system, including, the students with special needs
- The main benefit of e-learning is seen the flexibility, of both time and place, and support for more routine tasks; negatives include unfamiliarity and lack of knowledge

## Funding and Co-operation

- DISI has initiated a number of collaborative centres with other departments in the university, particularly in life sciences
- A number of partnerships have been established with industrial and research bodies through the mechanism of joint laboratories; these include:
  - LEGO (Lab on Interoperability and e-Government)
  - TRITON (Trentino Research and Innovation in Tunnel mONitoring)
  - WOTBL (Wireless Optical Test Bed Laboratory)
  - Other co-operative ventures include:
  - FBK-IRST
  - CreateNet
  - GraphiTech
  - CNR-Laboratory for Applied Ontology

## Education

- There has been a widespread and enthusiastic adoption of the e-learning facilities offered, both by students and staff
- The overall approach is one of blended learning, where a combination, possibly personalised, of traditional and e-learning is used
- An investigation conducted in 2005 reported that e-learning was used mainly to support traditional teaching, and only very rarely to replace it

# USTUTT, Stuttgart

## Background

- The University of Stuttgart offers a wide range of courses, primarily in engineering, but also including natural, social and human sciences
- The university has a policy of fostering interdisciplinary studies, within and outside the university
- There are ten faculties and 150 institutes with 20,000 students and 4000 staff, largely based on campus
- University of Stuttgart Overview

http://www.uni-stuttgart.de/ueberblick/bilder_zahlen/Uni_IMAGE_english_RZ.pdf

## ICT Overview

- There is a publicly available ICT Strategy [de]

http://www.uni-stuttgart.de/ueberblick/bilder_zahlen/Uni_IMAGE_english_RZ.pdf

- The University of Stuttgart follows a three-pronged program, “campus-online”
  1. “100 online” is concerned with technical and teaching issues
  2. “self-study online” supports the implementation of e-learning modules
  3. the third component is the support of online training of the students
- RUS (Computing Centre of University of Stuttgart), through STUDserv, provides a wide range of ICT services including:
  - Student account management and information system
  - Internet, e-mail, printing, file storage and sharing
  - Software & tools for download
  - Remote secure access
  - Access to library catalog
  - Lecture recordings and a range of associated services are available, which have proved especially popular with students
- Online questionnaires are available for feedback on teaching and other purposes

## E-learning

- A complete distance e-learning is currently available for two masters programmes; a variety of e-learning facilities are available through a multiplicity of various projects
- E-learning support is provided by ILIAS, which provides teaching and learning materials to students, individually and in work groups, and an authoring tool for teaching staff
- ILIAS provides a wide range of facilities:
  - Individual Personal Desktop, Course Management, Group Management
  - Repository with Role Based Access Control
  - Learning Content, Learning Progress Management, Test and Assessment
  - Chat, Forums, Exercises, RSS Support, Podcasts
  - Authentication (LDAP, Shibboleth, CAS, Radius, SOAP)
  - Web Service Interface (SOAP)
- E-learning presentation http://www.ias.uni-stuttgart.de/vortraege/021010rus/sld001.htm

## Funding and Co-operation

- The University of Stuttgart has dedicated over €1.2 million of its budget for the funding of e-learning projects
- In addition, the Ministry of Science, Research and Art of Baden-Württemberg supported the programs within the program “Innovative Projects in the teachings of the Universities of Baden-Württemberg” (including a self-study-online program)
- Numerous e-learning projects of University of Stuttgart are also supported by the Federal Ministry of Education and Research
- E-learning is funded through the EU, for example, Candle, LeGE-WG
- Other organizations, such as the Association of Sponsors of German Science

## Education

- E-learning is considered a great support for staff and students and has become an indispensable part of teaching processes in USTUTT.
- The e-learning projects of University of Stuttgart are much appreciated. Until now 75% of the institutes participated in over 400 e-learning projects and over 500 lectures have been recorded.
- The main usage of e-learning facilities is to support the classical approach, which is still dominant.
- The e-learning evaluation in 2004 showed that e-learning facilities increased students’ motivation in 70% of the cases.

# Politecnico di Milano

Acknowledgement: Additional information on the Politecnico di Milano was gathered from the PLS RAMBOLL report[4]

## Background

- The Politecnico di Milano is spread over seven campuses centered in the Lombardy region of Northern Italy; there are nine colleges offering 27 courses and additional PhD programmes
- There are 38,000 students and over 1000 staff
- Courses are offered in engineering, including software services engineering, architecture and design

## ICT Overview

- The ICT infrastructure is well-established and has long been a key support for the distributed campus
- The METID unit (Metodi E Tecnologie Innovative per la Didattica) is responsible not only for ICT in education, but also for the development and delivery of e-learning courses

## E-learning

- The Politecnico di Milano has been operating distance learning programmes since 1992 and was the first Italian university to provide a fully online degree course
- E-learning initiatives are mostly project based; current projects include: Laurea OnLine (http://www.laureaonline.it/), Corsi On-Line (http://corsi.metid.polimi.it/) and Math OnLine (http://www.mathonline.it); some 30 projects are in progress, including some international
- A variety of technologies are used, these include Centra (version 7.5), Breeze (version 5), e-Col (the base of many projects of the Centre); also open source platforms, such as Moodle and Joomla, are used in their customized versions in several projects

## Funding and Co-operation

- Funding has two components: 1) Self-funding from the sale of services provided by METID 2) Public-private partnerships
- There has been co-operation both with other public partners and with private enterprise
- Current co-operation has been project oriented, based on differing business models. An increased level of cooperation is seen necessary for future larger scale e-learning projects.

### Education

- Teaching policy, and in particular the e-learning process, is based on a clear educational model, applied uniformly across multiple projects; this involves a multi-disciplinary approach, with an emphasis on design
- A key finding has been that e-learning has resulted in more student-teacher interaction than in "traditional" courses
- The e-learning experience is also influencing traditional teaching methods
- Teachers have been forced to structure their material better in an e-learning environment
- E-learning is used not only to replace "traditional" teaching methods (e.g. Laurea OnLine), but also as a supplement and support (e.g. Corsi On-Line and Math OnLine)

# UOC, Crete

## Background

- The University of Crete (UOC) is a leading, multi-disciplinary, research-oriented university of Greece.
- UOC has two campuses in two different cities, Heraklion and Rethymno. There are 5 faculties and 17 departments.
- UOC teaches about 15.000 students and employs about 800 researchers and organisational staff.

## ICT Overview

- ICT is handled internally by the Communications and Networking Centre (Ucnet) and the Computer Centre (CC).
- Ucnet is responsible for the design and development of the network, while CC's responsibility is the operation of the system and network infrastructure.

## E-learning

- A Moodle-based e-learning platform, partially supporting SCORM standard, is used at the university level. The main use includes material distribution, online assignments, and communication.
- The Computer Science Department uses an alternative e-learning platform, eFront, which is SCROM compliant. This platform is an experimental one, and it is used only for one course at the moment.

## Funding and Co-operation

- The majority of e-learning facilities at UOC are funded through European Commission or National projects.
- UOC co-operates with all universities of Greece in terms of joint lectures/courses and joint masters programs.

## Education

- Even though UOC uses E-Learning to enhance the traditional teaching approach, it is seen as an important part of the educational system.
- UOC intends to improve e-learning facilities as well as content. One important concern is also the creation of strategies for motivating the students and teachers to use e-learning more.

# TUW, Vienna

## Background

- The Vienna University of Technology (TU Vienna or TUW) is a long-established teaching and research institution situated in the centre of Vienna
- There are around 17,000 students and 2500 staff
- There are eight faculties: Architecture and Regional Planning, Chemistry, Civil Engineering, Computer Sciences, Electrical Engineering and Information Technology, Mathematics and Geo-Information, Mechanical and Industrial Engineering, and Physics

## ICT Overview

- ICT is handled internally by ZID (Zentraler Informatik Dienst)
- The ICT infrastructure includes wireless LAN access in most areas; many students have their own computers, but public computers are also available
- Facilities include Linux based computer labs, e-mail, Internet, online libraries etc.
- External access is also provided by a VPN
- Problems include lack of availability of computers at peak times and in some cases, poor performance

## E-learning

- Although there are extensive ICT facilities, distance e-learning facilities have not been implemented, except experimentally
- Current e-learning support includes:
  - Every faculty maintains its own web site / information system, which handle registration and examination and also provide teaching material
  - A university-wide system, TUWIS++ provides course management facilities; although use is mandatory, it lacks acceptance, so the independent faculty systems are used as well
  - An e-learning system, TUWEL has been introduced, initially intended as a replacement for TUWIS++
  - Additional systems are provided by external sponsors; these are partly used instead of faculty websites
- A variety of technologies are used: TUWEL is based on Moodle; this powerful and complex system currently lacks widespread acceptance
- A “grading robot” was also introductd to assess student IT exercises automatically, but technical and other difficulties led to the abandonment of the project

## Funding and Co-operation

- Most ICT is funded centrally by the university itself
- Some projects are funded by industrial partners; these include a successful blogging system

## Education

- Students and staff enjoy a good level of ICT support: course administration and teaching materials are available on-line; assignment submission is well supported electronically
- Many students enrolled on IT masters are also working, perhaps part-time, so reliable remote access to material is important, particularly if lectures are missed; staff also value remote access to teaching material, which can be updated conveniently
- Full e-learning has not yet made much progress, although some projects have been tried; it is recognised that e-learning would be a major change for both the staff and students. Such initiative will require more teacher support to reflect the significant change in the teaching practices
- It is expected that TUWEL may become more important in future, if it can find widespread acceptance; this would allow for more e-learning. However, no concrete plans for the expansion of e-learning are currently in place

# UCBL, Lyon

Acknowledgement: Additional information on UCBL was gathered from InnoUniLearning[5]

## Background

- Université Claude Bernard Lyon is one of the largest research and educational institutions in France; there are 14 faculties located in 10 campuses spread over the city of Lyon
- There are approximately 30,000 students and 5000 members of staff
- A whole range of scientific and technical courses are taught, including computer science
- The university follows a policy of non-selective undergraduate entry, resulting in a very heterogeneous student body

## ICT Overview

- UCBL has a comprehensive ICT infrastructure, which supports e-learning facilities for most of the students
- A wireless network covers (most of) the campus; e-learning facilities are also available off-campus

## E-learning

- E-learning has been introduced relatively recently (2003) and has grown significantly since then
- The development and delivery of e-learning is handled by PRACTICE, which employs more than 30 full-time staff
- Platforms available are:
  - An open-source e-learning platform SPIRAL has been customised to specific needs (http://spiral.univ-lyon1.fr/00-perso/index.asp), used mainly as a repository for teaching material, used by most students
  - An e-learning platform (http://emiage.univ-lyon1.fr/), which is used for distance learning
  - Every faculty or teaching group also has their own web page where teaching material can be maintained
- Teacher support includes training and relief from teaching duties to develop e-content, which is seen as vital to encouraging update of e-learning and overcoming possible resistance
- For some courses e-learning facilitates access to simulations of otherwise less accessible equipment

## Funding and Co-operation

- Funding comes both from central government and the Rhône-Alpes Region Council.
- Local industry also contributes financially to the support of e-learning

## Education

- The overall educational benefit of e-learning is difficult to assess; specific advantages include:
  - E-learning is popular among students, and appears to foster a sense of belonging
  - Democratisation of learning, by ensuring equality of access to teaching facilities
  - Feedback and surveys – built into SPIRAL – allow feedback, hence continuous improvement

- Greater student-teacher interaction through blogs / forums can help students overcome their reluctance to ask questions in front of their peers

- The intrinsically customisable nature of the e-learning experience seems to be particularly valuable for a large and diverse student population
- The success of e-learning at Université Claude Bernard Lyon has led to further SPIRAL implementation projects

# UvT, Tilburg

Acknowledgement: Additional information on UvT was gathered from the UvT website[6]

## Background

- Tilburg University is a leading provider of undergraduate and postgraduate courses in the Netherlands in Information Management with a strong focus on meeting business needs
- Courses are offered with both IS (Information Systems) and Business Management slants. The educational programme allows the selection of courses targeted at specific career opportunities

## ICT Overview

- The ICT infrastructure is currently well-developed. There are ICT services, library services and a media centre (audio-visual material)
- There are ambitious plans for a "joint services" department for the demand-led delivery of ICT services in the university

## E-learning

- Nearly all courses offered by UvT are implemented with Blackboard, which includes course registration, teaching material, assessment details, e-mail, and on-line discussion boards.
- Each student has a personal Electronic Study Guide (ESG); this includes the lecture schedule ad examination details.

## Funding and Co-operation

- There are plans for joint programme development with the universities of Cambridge and Berkley

## Education

- UvT has been producing graduates who have gone on to be successful and senior professionals for nearly 25 years
- The freedom of choice of courses gives students the opportunity to follow a programme of study targeted at specific career choices, either business or technically oriented; however this freedom can make it difficult for students to choose a selection of courses that needs their educational needs; this can lead to an overall programme of study that is less than satisfactory, despite the high quality of the courses offered. There are proposals for a course structure to address this issue

# UPM, Madrid

## Background

- The Universidad Politécnica de Madrid, founded in 1971, has faculties all over Madrid. UPM has 14 schools granting long degrees, 8 schools granting 3-year degrees and three associated institutes.
- UPM has approximately 40000 students.

## ICT Overview

- The main functions of the current ICT infrastructure in relation to education is to provide support for grading, keeping the student machines up-to-date with the needed software, giving support for the learning platforms (moodle and lectures broadcasted by videoconference).
- The wireless network is a part of EduRoam http://www.eduroam.org/?p=europe.
- There are plans in place for decentralised and distance learning, as well as joint courses with other univerisities.

## E-learning

- **Moodle** (http://moodle.upm.es/). There are several moodle installations focused on different types of programs (such as graduate studies, postgraduate studies, summer schools, internal training, and cross-cutting basic scientific capabilities)
- **Distance learning** (http://www.gate.upm.es/). Quite focused on video broadcasting, sometimes live.
- **Open Course Ware** (http://ocw.upm.es/). Study material made freely available.
- The current technologies used include Moodle for storing slides, exercises and a board; and, for video conferencing, h323 and Isabel.

## Funding and Co-operation

- Co-operation in Open Course Ware initiative fostered by Universia http://www.universia.es/.

## Education

- E-learning is used not only to supplement and support classical approach to teaching/learning, but also as a stand alone method for more than 200 courses.
- Some courses that have been completely shifted to a moodle-based environment still have laboratory-like classes.
- The teacher and student experience of e-learning is viewed as neutral to positive. There are many advantages, but there are still certain limitations in the use of e-learning.

# University of Limerick (Lero@UL)

## Background

- The University of Limerick (UL) was founded in 1972 and became a University in 1989. It is one of 7 Universities in Ireland.
- It is based on one campus, and awards degrees in a variety of disciplines - science (including computer science), engineering, business, education, humanities.
- UL has 4 faculties and approximately 13,000 students, of which approximately 20% are postgraduate students (Masters / PhD)
- Lero@UL is a research institute within the University of Limerick, and is part of Lero – the Irish Software Engineering Research Centre.

## ICT Overview

- The provision of ICT services is handled centrally within UL. Services include both LANs and a wireless network which is available to students and staff.
- Web-based facilities are also available. These include the provision of access to student records, teaching administration tools (such as class lists, timetables), library catalogs, past examination papers, external internet access and email.
- Faculties, departments, research institutes and staff maintain their individual web pages according to the guidelines set out by the University.

## E-learning

- There is no centralised e-learning system within the University of Limerick. Some staff and academic departments use systems such as Moodle and Blackboard.
- Some academic departments have set up facilities for members of faculty to put their teaching materials on the internet.
- Individual members of faculty may use their personalised web pages to include teaching materials.
- The centralised system used within the University Limerick is Sulis (based on Sakai). This is linked to corporate systems for timetabling and student/staff registration. This central system is supported academically from the Centre for Teaching and Learning and technically by the university's central computing service. There is significant additional use by academic departments, research centres and individual staff members of other learning management systems, mostly Moodle.

## Funding and Co-operation

- Funding is mainly from internal sources within the University, but some external funding has been received for the development of courses for distance education.

## Education

- E-Learning facilities are mainly used to support traditional teaching methods. However, there is a growing adoption of less traditional techniques within the University, particularly problem based learning, where learning management systems are crucial to success.

# Appendix 3: Services education – courses and modules which currently exist

## University of Trento

### International Graduate PhD School of DISI

- Service-oriented networking
- Advanced Topics in Agent-Oriented Computing
- Information Retrieval and Search Engines
- Web information retrieval

### Trento Master of Science in CS program

- Web languages

### Trento Professional Master in e-Government

- Conceptual Modelling, Ontology Design, and Semantic Interoperability
- Application integration and Business Process
- Interoperability and integration at work in e-Government

## USTUTT, Stuttgart

- Foundations of the Architecture of Application Systems
- Workflow Management
- Semantic Web Services
- Message-based application integration
- Web-based Application integration

## Politecnico di Milano

### Milano Master level (second level degree): Computer Engineering: Networked services

- Service Technologies 1
- Service Technologies 2
- Advanced Topics On Information Systems
- Economy Of Networks & Services
- Business Information Systems
- Management Of Information Technology
- Computer Security Engineering
- Secure Software Systems
- Computer Systems Performance Evaluation: Techniques And Applications

Software Services and Systems Network

- Computer Systems Reliability
- Cryptography And Security
- Algorithms & Architectures For Cryptographic Systems
- Data Bases 2
- Software Engineering 2
- Technologies For Information Systems
- Distributed Systems
- Foundations Of Operations Research

### Milano Master level (professional education): Master SOA

- Software engineering
- Databases
- Information systems
- System architectures
- Web technology
- Telecommunication networks
- Web-based applications
- Service technologies

### Milano PhD Level

- Autonomic Services

## Politecnico di Milano

## UOC, Crete

- Special Topics in e-business
- Business Transformation
- Web Data Management
- Advance Database Topics
- Business Process and Workflow Management Systems
- Internet Knowledge Management
- Information retrieval Systems

## TUW, Vienna

The Faculty of Informatics: Services computing

- Grid Computing
- Advanced Internet Techniques
- Web Service Composition
- Web Process Execution
- Space-Based Computing
- Web Data Extraction and Integration
- Applied Web Data Extraction and Integration
- Enterprise modelling

## UCBL, Lyon

The computer science department teaches a number of courses in the area of services computing:

- Service-oriented computing
- Security and confidentiality in databases and service-oriented applications
- Semantic Web and Semantic Web Services
- Data/Web mining and integration
- Distributed systems – peer to peer architectures
- Web programming

## UvT, Tilburg

Masters program in Information Management; four of the following seven courses are selected:

- Advance Resource Planning
- Business Intelligence
- Business Process Integration
- Business Transformation & IT
- Logistics & Information
- Management of Knowledge & Innovation
- Method Engineering

## UPM, Madrid

- Design of Web Services
- Design for Everyone – Accessible for Everyone
- Data Networks and Multimedia Services in the Digital House
- Web 2.0: Social and Cooperative Software
- Digital Public Administration

## University of Limerick (Lero@UL)

- Enterprise Resource Planning
- E-Business Architectures
- Distributed Systems
- Web programming

In addition, University of Limerick run a Graduate Diploma in Localisation.

# Appendix 4: Proposed Key Process Indicators

To check usability of proposed KPIs, the University of Crete and Politecnico di Milano each completed KPIs for one course.

# UOC, Crete

## Introduction

1. Course title - Special Topics on E-commerce (CS592)
2. Level of course (undergraduate, postgraduate etc) - Postgraduate
3. Number of students taking course - 60
4. Length of course (semesters / weeks / contact hours) – 1/15/60
5. How many times did the class of students meet with the tutor / instructor during the course (Number)? - 30
6. How many times did individual students meet the tutor / instructor during the course (Average Number)? - 5

## Responsibility

1. Are the course objectives clear? - Yes
2. Is the curriculum defined before the course starts? - Yes
3. Is the lecturer knowledgeable about his/her subject area? - Yes
4. Does the student have the opportunity to express his/her opinion about the learning activities and outcomes? - Yes
5. Does the teacher/faculty take into account the feed-back from students? - Yes

## Collaborative learning

1. Are there any collaborative writing activities? - Yes
2. Are there any group project activities? - Yes
3. Is there a virtual classroom available for the students enrolled to the course? - Yes
4. Are there any chats and discussion threads? - Yes
5. Are there any application sharing facilities? - No

## Roles

1. Does the teacher give students the opportunity to express their ideas? - Yes
2. Does the teacher give the students the opportunity to ask questions? - Yes
3. Does the teacher encourage the students to find out more about the subject? - Yes

4. How many questions on average does each student ask? (Number) – 5(whole semester)
5. How many references does the teacher provide to the student? (Number) - 20
6. How many references quoted by a student does the teacher add to their lecture materials? (Percentage) - Unknown

### Learning by doing

1. How many interactive activities are students involved in e.g. role playing, debates, class discussions? (Number) - 10
2. How many group activities are students involved in e.g. cooperative learning, case studies? (Number) - 4
3. How many individual activities are students involved in e.g. short written exercises, information seeking? (Number) - 3

### User centred design

1. Were the students' needs evaluated before the course is designed? - No
2. Was the course able to change based on the feed-back from the students? - Yes
3. Was the course able to change based on the student's progress towards the learning objectives? - Yes

### Services and materials

1. Are the course support materials available in advance? - No
2. Is there a good communication channel between student's and teacher/faculty? - Yes
3. Are there good facilities to enable communication between students, like chats, discussion threads, and virtual classes? - Yes

### Learning agenda

1. Is the learning environment flexible? - Yes
2. Does the learning environment support multiple resource tools? - Yes
3. Can the learning route be personalised based on learner's needs? – Yes, but not widely
4. Are there different levels of guidance available? - Yes
5. Are there different delivery modes available? - Yes

### Feedback and monitoring

1. How soon after the evaluation are the results made available to the students? (Number) – 5-10 days
2. Is the rank of the student calculated, and communicated to the student after each evaluation? - Yes

3. How frequently is a student assessed? (Number) - 3
4. Is there a variety of assessment instruments used? - Yes

## System indicator

1. Is there a policy document and a strategy plan that describe the direction and the approach of the educational system? - Yes
2. Are success criteria established? - Yes
3. How often is the progress assessed? (Number) - 1

## Partnership

1. Is the institution open to external collaborations? - Yes
2. How many concurrent collaboration research and industry projects are running at the same time? - 1
3. Are research results and industry examples incorporated with the course materials? – Yes

# Politecnico di Milano

## Introduction

1. Course title – Information Systems in Public Administration
2. Level of course (undergraduate, postgraduate etc) - undergraduate
3. Number of students taking course - 20
4. Length of course (semesters / weeks / contact hours) – 1/15/
    a. Hours: Recorded classes 30 – on line sessions: 8 hrs
5. How many times did the class of students meet with the tutor / instructor during the course (Number)? – 6 on line
6. How many times did individual students meet the tutor / instructor during the course (Average Number)? – contacts on forum and e-mails 10

## Responsibility

1. Are the course objectives clear? – Yes
2. Is the curriculum defined before the course starts? – Yes
3. Is the lecturer knowledgeable about his/her subject area? – Yes
4. Does the student have the opportunity to express his/her opinion about the learning activities and outcomes? – Yes
5. Does the teacher/faculty take into account the feed-back from students? - Yes

## Collaborative learning

1. Are there any collaborative writing activities? - Yes
2. Are there any group project activities? - Yes
3. Is there a virtual classroom available for the students enrolled to the course? - Yes
4. Are there any chats and discussion threads? - Yes
5. Are there any application sharing facilities? - No

## Roles

1. Does the teacher give students the opportunity to express their ideas? - Yes
2. Does the teacher give the students the opportunity to ask questions? - Yes
3. Does the teacher encourage the students to find out more about the subject? - Yes
4. How many questions on average does each student ask? (Number) – 5 (whole semester) + some (3) organizational
5. How many references does the teacher provide to the student? (Number) – on line material

6. How many references quoted by a student does the teacher add to their lecture materials? (Percentage) – 25% (very few provided)

## Learning by doing

1. How many interactive activities are students involved in e.g. role playing, debates, class discussions? (Number) - 5
2. How many group activities are students involved in e.g. cooperative learning, case studies? (Number) - 1
3. How many individual activities are students involved in e.g. short written exercises, information seeking? (Number) – 2

## User centred design

1. Were the students' needs evaluated before the course is designed? – Yes (for the general online approach design)
2. Was the course able to change based on the feed-back from the students? - Yes
3. Was the course able to change based on the student's progress towards the learning objectives? - Yes

## Services and materials

1. Are the course support materials available in advance? - Yes
2. Is there a good communication channel between student's and teacher/faculty? – Yes, not very much used
3. Are there good facilities to enable communication between students, like chats, discussion threads, and virtual classes? - Yes

## Learning agenda

1. Is the learning environment flexible? - Yes
2. Does the learning environment support multiple resource tools? - Yes
3. Can the learning route be personalised based on learner's needs? – Self-paced course
4. Are there different levels of guidance available? - Yes
5. Are there different delivery modes available? - Yes

## Feedback and monitoring

1. How soon after the evaluation are the results made available to the students? (Number) – 10 days
2. Is the rank of the student calculated, and communicated to the student after each evaluation? - Yes
3. How frequently is a student assessed? (Number) - 3

4. Is there a variety of assessment instruments used? - Yes

## System indicator

1. Is there a policy document and a strategy plan that describe the direction and the approach of the educational system? - Yes
2. Are success criteria established? - Yes
3. How often is the progress assessed? (Number) - 2

## Partnership

4. Is the institution open to external collaborations? - Yes
5. How many concurrent collaboration research and industry projects are running at the same time? – unknown (asked for the whole university?)
6. Are research results and industry examples incorporated with the course materials? - Yes

# Appendix 5: E-learning platforms

Moodle and Blackboard are two of the most widely used e-learning platforms. Following are brief details on these two popular systems

## Moodle

- Moodle is an open source software e-learning platform.
- Moodle is designed to help educators create online course materials with opportunities for rich interaction. Its open source license and modular design allows people to develop additional functionality.[8]
- http://moodle.org/
- Open-source system

## Blackboard

- The Blackboard Learning System is a Web-based server software platform.
- Features include course management, a customizable open architecture, and a scalable design that allows for integration with student information systems and authentication protocols. Its main purposes are to add online elements to courses traditionally delivered face-to-face and to develop completely online courses with few or no face-to-face meetings.[9]
- http://www.blackboard.com/inpractice/global/
- Proprietary system

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