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E-Learning Tools and Projects on EUCIP Core

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This article covers two projects whose goal is to produce e-learning material to help EUCIP enter the market with a complete scheme: syllabus, question database (both the responsibility of ECDL Foundation) and learning material (books, and on-line course). E-learning tools are widely recognised as a valid means to help the vocational market address the learning phase of a certification.

Keywords: Certification, e-Learning, EUCIP, European Projects.

1 Introduction

This contribution reports on two large projects devised to produce learning material for the EUCIP Core certification. The first project was carried out by CINI, a consortium of Italian universities active in EUCIP certification since 2004 [1]. The second is a European endeavour within the Leonardo framework, called EUCIP-MAT [2], led by a consortium of six partners from Estonia, Latvia, Sweden and Italy (namely, The Estonian Information Technology Society EITS, BCS Koolitus, an Estonian training and consulting company, the Estonian IT college, CINI, that replaced AICA, the Italian Association of ICT Professionals, the Latvian Information and Communication Technologies Association LITKA, and Amfora Training AB, a Swedish company active in science based education). While the CINI effort completed the production of a set of e-learning courses in 2006, the EUCIP-MAT project is expected to complete its products by September 2008. The main purpose of this article is to report on possible approaches when designing courseware to support candidates of the EUCIP Core level certification. The Italian model strongly reflects the university background in which it was conceived, while the European project has been designed along different guidelines. Some feedback is already available from the CINI project, and it will be interesting to compare the outcomes of the two projects once the second one is completed.

The questions that any approach to developing courseware has to answer are: i) the relationship between the EUCIP syllabus and the body of ICT knowledge to embed in the courseware, with special regard to the depth of the subject matter to be treated; ii) the level of granularity

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of the objects that make up the courses; iii) the teaching model (e-learning vs. classical face-to-face learning), and iv) the intended audience.

2 The Italian e-Learning University Approach to EUCIP Core

2.1 Motivation

In 2004 AICA and CINI signed a three-year agreement to support the diffusion of the EUCIP certification model within the Italian academic system. The agreement listed many activities, along with the development of e-learning courseware targeting the Core level certification. This effort was jointly supported by both institutions: AICA was interested in offering a high quality set of courses the market of prospective EUCIP adopters and learning providers, while CINI was eager to help the process of diffusion of an independent, professional ICT certification by deploying the teaching skills available among university professors. The ultimate goal was to set the level of certification so that the ICT community would perceive the new scheme as a truly qualifying one.

The first question at the outset of this effort was the definition of the target audience. At the very beginning of the EUCIP project in Italy a few options were available: one could address primarily the fairly large number of professionals active in ICT, whose formal training seldom comes from computer science or from computer engineering de-grees; one could consider the set of people active in public administration, involved with ICT processes and tools at various levels of expertise; finally, students enrolled in university courses could be considered, on the assumption that the degree of ICT coverage in many technological tracks is scarcely uniform and that business schools often cover just a minimum of the principles of informatics and prefer to offer a short-term, practical approach to ICT.

With so many and such diverse possible profiles for the audience, no clear guideline could be drawn, and CINI decided on a simple criterion: quality first. At first glance this seems a very naïve way to decide, but if one considers the task at hand carefully, it is not.

Indeed, the Italian university system has a long established tradition in developing courseware, and ICT university tracks are rich in textbooks and even in e-learning modules covering the wide spectrum of knowledge of this field. Nevertheless, this learning material is usually conceived without reference to any specific body of knowledge organized in a syllabus, broken down into categories and topics, like the EUCIP syllabus. It is worth noting that from 2005 to 2006 G.I.I., the community of ICT professors of computer engineering tracks, designed and released the so called BOK (Body Of Knowledge) [3], in an effort to help the community design the content and structure of new ICT tracks. A similar effort has been made within the computer science community G.R.I.N. [4]. These attempts to structure the "minimum knowledge" to be embedded in the com-

No.	Modules	Study hours
1	**KNOWLEDGE AREA 1 – PLAN**	**130**
1.1	ORGANISATIONS AND THEIR USE OF IT	30
1.2	MANAGEMENT OF IT	20
1.3	IT ECONOMICS	15
1.4	INTERNET AND THE NEW ECONOMY	15
1.5	PROJECT MANAGEMENT (PM)	20
1.6	PRESENTATION AND COMMUNICATIONS TECHNIQUES	15
1.7	LEGAL AND ETHICAL ISSUES	15
2	**KNOWLEDGE AREA 2 – BUILD**	**140**
2.1	SYSTEMS DEVELOPMENT PROCESS AND METHODS	30
2.2	DATA MANAGEMENT AND DATABASES	30
2.3	PROGRAMMING	50
2.4	USER INTERFACE AND WEB DESIGN	20
2.5	TECHNICAL ARCHITECTURE	10
3	**KNOWLEDGE AREA 3 – OPERATE**	**130**
3.1	COMPUTING COMPONENTS AND ARCHITECTURE	20
3.2	OPERATING SYSTEMS	20
3.3	COMMUNICATIONS AND NETWORKS	20
3.4	NETWORK SERVICES	30
3.5	WIRELESS AND MOBILE COMPUTING	10
3.6	NETWORK MANAGEMENT	10
3.7	SERVICE DELIVERY AND SUPPORT	20
	TOTAL	**400**

Table 1: Core Level Study Time Breakdown. EUCIP Core Syllabus *Version 2.4, 21 May 2002.*

puter and informatics tracks share a much wider scope than the EUCIP syllabus in that they detail not only ICT skills, but also basic engineering, mathematics, physics and similar ones. However, they are narrower in their coverage of economics, organisation structures, business models and processes which are a relevant section of the EUCIP Core specification, particularly in the PLAN "knowledge area".

The task of designing courseware that would support candidates of the EUCIP Core certification was therefore a difficult one, since no precise reference existed. The depth of university courses, even introductory ones, and their approach to the subject, seemed a good starting point, but the structure of the syllabus, its type of categorisations, and the expected "study hours" for the various topics are not very compatible with the average "university course". We quote below the definition of study hours and the breakdown of the effort measured accordingly in the "modules" (see Table 1) as specified in version 2.4 of the EUCIP Syllabus (the initial specification for the CINI courseware developing effort): *The typical study time for the entire core syllabus is set to 400 hours. Study time is defined as the time spent by the student in acquiring the competence, regardless of how this is acquired, through self-study, lectures or e-learning services. The hours are however meant to reflect an average spent on **well-proven and efficient learning/teaching principles, such as employed by e.g. universities and colleges**. Thus a candidate who wants to document real and non-formally acquired competence may have spent substantially more time e.g. learning by experience. The table below gives an overview of how study time might typically be distributed among syllabus modules and categories.*

A quick inspection of Table 1 clarifies the distance between the EUCIP presumed effort and the average time spent in university courses on these subject areas. Just to give an example, the "Data management and database" module weight is 30 "study hours"; if we compare its corresponding area in the G.I.I. BoK [3], we find a recommended 52 "hours" of lectures and hands-on activities.

With a very practical attitude, the design process of the courseware for preparing a candidate for the certification exam could have been based on a completely "utilitarian" approach. Since the certification is awarded on the basis of the record of achievement in an exam consisting of a set of multiple-choice questions drawn from the Question and Test Base (EUCIP QTB), the courseware could have been tailored to these questions, presumed known and stable enough to be a reference for the design. This method has the advantage of steering all learning effort towards a set of concepts that are in fact the only ones used in the exams; any "study time" is indeed well spent, since it goes to the point in every item covered by the courseware. But it has some important drawbacks: on the one hand, the QTB may change over time, thus undermining the presumed 100% coverage of the initial release of the courses; and on the other, this approach swaps the roles, because it sets the level of the "concepts" at the level of the "verification of the concept" and it pre-

vents building a "ground knowledge" of any length of time.

In accordance with the above arguments, CINI decided to take a "quality first" approach, by asking authors to develop learning material with the same scientific approach they use when working for their university courses. However, to help them choose a proper level of depth in the treatment of the concepts, CINI distributed the QTB to them, with permission from AICA and the chief of the Product Development Board and under a Non Disclosure Agreement. Analysis of the questions can help the author verify whether the approach taken to the subject matter is appropriate. Obviously, it also serves the very important question of coverage: the user of the courseware must be guaranteed that any question that he will face during an examination can be answered either using the material directly from the courses or by proper inference from it.

CINI expected more outcomes from this development:

■ To offer the ICT community a set of high quality, short courses on the most relevant areas of ICT, independently of EUCIP.

■ To produce e-learning material that serves the immediate learning needs of an individual enrolled in EUCIP Core.

■ To show that e-learning technology can be effectively exploited in a nationwide teaching experiment.

Two more questions were also open at the beginning of this project: i) which teaching model to adopt and ii) which language to use, English or Italian. As to the former, very soon the e-learning scheme was agreed upon. The e-learning model section will go into the details of the actual implementation chosen. At this point suffice to say that the broad objective of preparing courseware to be used in many diverse learning environments (formal training in institutions, whether public or private; personal, ad–hoc schemes for professionals looking for an upgrading path; corporate training) called for a very versatile scheme, and e-learning was the only choice. The language issue was more controversial: according to implementation guidelines for the local societies involved in the EUCIP programme, each country can deploy the certification scheme either in English or in a localized version. At the time of the set up of the CINI AICA cooperation, the EUCIP QTB was not available in Italian, so that the exams were delivered in their officially released English version. Nevertheless, the courseware was designed in Italian, under the assumption that it would be used in the university environment as a test bed, but that its primary target would be the general public, and the public administration as well (where the use of the Italian language is still mandatory in almost all cases). The command of the English language is not widespread in Italy, so courseware in English could pose a further barrier to the acceptance of the EUCIP scheme. We will come back to this issue when we report on the experiments carried out both within universities and in some small companies.

2.2 The CINI Courseware

In this section, we describe the overall structure of the

courseware developed, and we also touch on the developing process itself. More than 50 people were involved in various roles, for a period of time that spanned over a year.

2.2.1 Structure

The EUCIP syllabus is broken down into three "knowledge areas", each split into more "modules". Within a module, "categories" are "conceptually homogeneous subject matters", and "topics" cover the main aspects of a category" (definitions are drawn from EUCIP Syllabus 2.4). This is an appropriate structure for developing learning material, and such an approach has been followed within the EUCIP-MAT project described later.

The CINI approach to structuring the EUCIP courseware was different. The learning material is organized into 18 "courses", one for each of the "modules" of the syllabus. Otherwise, no effort has been made to map the syllabus "module" structure into that of the "course". Rather, authors were asked to organise the material freely according to their teaching experience, using the notion of "learning object" (to be discussed shortly) as a guideline to obtain self-contained learning units. The rationale for this choice stems directly from the "quality first" approach described above. The EUCIP courseware should be a short, consistent and good introduction to computer science and informatics. When dealing with the concepts categorised in the syllabus, it was by no means intended to adopt the same type of organisation, nor to infer any privileged sequence of concepts. Loosely speaking, the CINI courseware "learning object" can be compared to the EUCIP syllabus notion of "category", but this only clarifies the granularity of the notion, not its actual implementation. Of course, authors have

been given appropriate instructions to show syllabus coverage by referencing the "learning objects" they set up for a "course" to syllabus "topics".

Each of the 18 courses consists of a number of elements: an introduction page describing the learning outcomes; a bibliography of pertinent material to be used for in-depth reading on the subject matter; a glossary of terms; a set of learning objects; a "conceptual map" that shows precedences among learning objects and which is described briefly in its set of learning objects. At the outset of the project, each module was also to have included a short video with a speaker (possibly the author) giving a short introduction and guidance to the reader, with the help of the conceptual map. This element was later dropped from actual production. Each module also contains the CVs of the authors that contributed it.

Another specification for the development process was compliance to accessibility requirements as specified by Italian law [5]. On the author side, this amounts to producing a short and a long textual annotation for each graphic object; on the designer side, the actual layout of the web pages embedding the courses must obey some more rules, one of which bans the use of animations.

2.2.2 The Notion of Learning Object

The learning object (hereinafter LO) is the key element of the courseware. It is a unit of learning material that is self-contained in that it addresses a concept distinct enough from others to be treated separately. Ultimately, a long standing outcome of CINI development effort was the production of a library of such objects, to be stored in a repository and available to create courseware in a modular fashion.
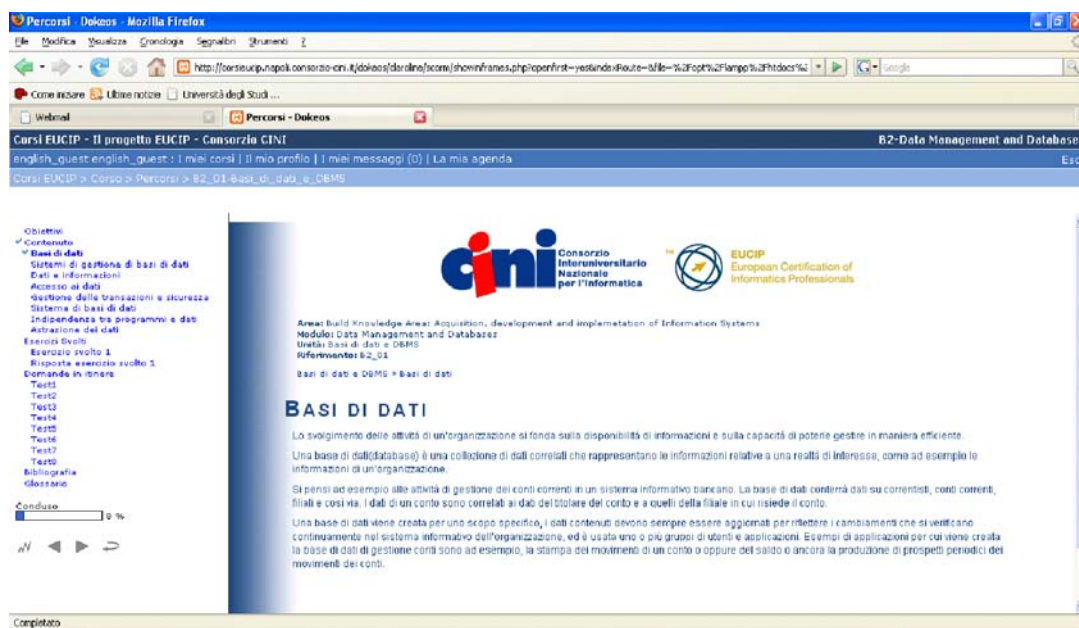

Figure 1: A Snapshot of one Page from Course B2 Data Management and Database: a unit of content (UC) in the central frame, within its learning object (LO) in the left frame.

This long-term goal has conditioned the way the LOs have been actually implemented in the software delivery platform, as we discuss later on.

Each learning object contains learning material organised in the following structure:

- Title.
- Learning outcomes.
- Units of content (UC), each a text of 800 - 2000 characters, with figures and drawings, key words, and optional in-depth sections where deemed appropriate.
- Self test questions (STQ) structured according to EUCIP guidelines (multiple choice questions, with proper feedback).
- Exercises (EX); short problems that do not fit into the pattern of a single question and that require off-line elaboration from the reader. Each exercise has a problem statement and, separately, an annotated solution.

To guarantee a degree of homogeneity in the treatment of concepts, each LO must have a minimum of 3 UC, at least one STQ for each UC and a single EX. Aside from these minimum constraints, no other guidance was given; for example, while the total number of STQ must equal the number of UCs, the author was left free to allocate questions to UCs as he deemed necessary.

The length of each UC was chosen so as to fit comfortably into a web page so as to be readable without massive scrolling. This usability constraint was somewhat questioned by authors, but it was enforced throughout the courseware.

Figure 1 shows a snapshot of a web page from course B2 on "Data Management and Databases". The central frame contains a UC (named "Basi di Dati"), which is a text-only instance of content.

The left frame contains the tree-like structure of the LO. Note the learning outcomes page ("Obiettivi"), the contents laid out in a sequence of UCs that make up the LO, with UCs already read marked off, the exercise ("Esercizio svolto 1" and its solution "Risposta esercizio 1"), a sequel of 8 STQ ("Test1-Test8"), bibliography, and glossary. Below is a progress bar with navigation buttons.

Figure 2 shows the "conceptual map" for course B2. The map is a directed graph: each node represents a learning object, each link the precedences implied by the node that it exits from. For example, the LO labelled B2.03 "Il modello relazionale" ("relational model") is considered a pre-requisite for both LO B2.06 on SQL and for LO B2.04 on relational algebra.

2.2.3 The Developing Process

The actual production of courseware required a careful design of the process in all its phases. First of all, CINI set up an editorial board responsible for the general scheme of courseware and for all decisions regarding its production. The main phases and activities were:

- Choice of in-house development and subsequent operation of courses delivery vs. a hosting approach.
- Selection of the software model and standards for the final e-learning "product".
- Selection of the software chain to produce the e-learning modules.
- Detailed specification of the courseware structure and associated instructions to authors.
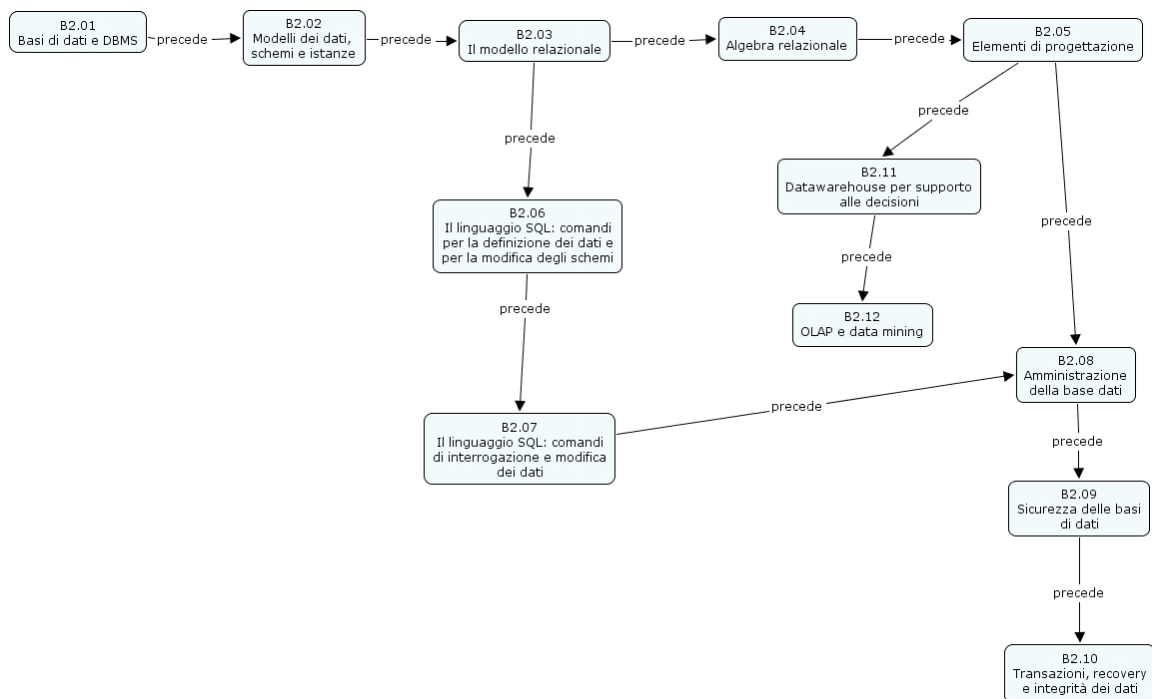- Selection of authors.

Figure 2: The "Conceptual Map" for Course B2.

■ Design of the reviewing process and recruitment of reviewers.
  ■ Production by authors.
  ■ Reviewing process.
  ■ Post-production to generate LOs for deployment on delivery platform.

The activities began in September 2004 with preliminary meetings of the editorial board, and the first on-line course was offered to a class of university students in November 2005. The last of the 18 courses was completed in spring 2006.

CINI decided to run the whole process using the resources of member universities and of its national laboratory. In a first nationwide attempt to launch a huge e-learning experiment, the consortium decided to test its ability to collect resources from different universities, professors, ICT technicians. This was definitely a somewhat bold step, in that the consortium had never managed such a huge effort on its own.

The software model and environment was readily identified within the open software family. Since the long term goal was to prepare a repository of reusable learning objects, adherence to an industry standard was mandatory, and SCORM 1.2 was the simplest choice [6]. Choosing the software chain for producing the final object, however, was by no means that simple. While there were many alternatives that appeared to be fairly comparable, the choice went to a software tool-chain [6] developed by one of the members of the consortium, the University of Bologna. We made use of the experience gained within that university in developing e-learning ICT courseware for internal use in technical, non-informatics curricula. That tool chain was adapted to suit the specifications, notably with regard to accessibility requirements. Authors were instructed to use a specific set of styles when composing the material with MS Word; the documents were later checked against a set of edit rules and, once formally correct, they were transformed, according to a suitable XML schema, into XML documents and subsequently converted into html web pages.

Along with detailed instructions on the use of style for preparing the material, authors were provided with a "Guideline" document highlighting the purpose of the effort, describing the structure of the courseware (the notion of course, learning object, multiple-choice question, etc.). It goes without saying that a great many discussions helped to clarify the task at hand.

Selecting the authors was a major effort in itself. For each of the 18 courses, a single, principal author was identified; eventually 16 people were involved in this role. Most of them are university professors and some are professionals (mainly for the PLAN area). The real difficulty in their involvement was "selling the idea"; it proved to be quite a task to convince a few of them to cooperate in a task that usually required them to reshape learning material in their field of expertise and to adapt it to the EUCIP spirit and syllabus. However, all of them were very cooperative and passed on some comments on the syllabus structure that

could be taken into account within the EUCIP Expert Working Group. The actual list of people involved is large, because many of the principal authors shared the effort with one or two "secondary authors".

The reviewing process was a very important part of this effort. The editorial board decided on a two-level scheme: a detailed review of each module to be carried out by three people with different profiles and skills, and a final, synthetic review by the editorial board itself. It is worth describing the "low level" review process. Since the intended audience of this courseware includes university students in technical curricula, professionals already active in ICT for many years, and people from public administration with scarce prior knowledge in informatics, the editorial board decided to enrol as reviewers both skilled personnel (PhD students from computer science and computer engineering) and other people with moderate to low informatics skills (technicians responsible for the day-to-day operation of computer labs): some even had a degree in humanities! This group of reviewers (6 people all together) read all the LOs and compiled: i) a review report form for each module consisting of a general assessment of the module; ii) a detailed analysis of each LO: in respect of the constraints in terms of length of each UC, readability, correct number of STQs and adherence to MCQ guidelines, etc. The review form for each LO has 10 categories, the form for the course as a whole only 4. The analysis of these reports has been carried out within the editorial board. After the reconciliation of very few conflicting reports, appropriate feedback was forwarded to the authors and the edited material was acquired for further processing.

It was quite a job to coordinate some 60 people, with delivery milestones, files to be uploaded into a central repository, checks to be executed through the software chain, and reviewing comments to be fed back them.

2.2.4 CINI Courseware in Numbers

Table 2 gives the final figures of CINI EUCIP Core courseware. The central repository contains over 2000 files: 1,165 of these make up the final release. A total of 770,265 words and 725 pictures and drawings are distributed among some 3,400 "pages". The materials are organised in 193 LOs with 2000 UCs and the same number of self-test questions, and 400 exercises.

Words	Lines	Pages	Images
770265	103569	3422	725

Table 2: Overview of the Numbers of the CINI EUCIP Core e-Learning Material.

2.3 The e-Learning Model

Developing the learning objects was only the required, preliminary step in order to set up a learning offer. As anticipated, CINI decided to operate the courses from some central facility. To do so CINI had to set up the technical platform for delivery and maintenance and, after inquiring into public institutions and private companies offering a

hosting service, decided to locate the technical infrastructure within its national laboratory "ITEM Carlo Savy" [8] located on the premises of the University of Naples "Federico II".

2.3.1 Choosing a Platform

The next step was to choose a delivery platform that matched the two main requirements: being an open software solution and effectively supporting SCORM 1.2. A taskforce was appointed to assess the available solutions, and a preliminary analysis restricted the choice to A-Tutor, Dokeos or Moodle. An analytic approach was then carried out according to GQM methodology [9]. The main characteristics for which metrics were specified and assessed were: modular break down of learning material into didactic units, lessons and course; possibility to set up a learning path in a tailored fashion; type and features of content management tools; SCORM support; communication tools; other didactic tools; test and surveys. The result of the assessment [10] showed that DOKEOS was the solution which offered the broadest average support to all criteria and notably to SCORM compliance. We ultimately wanted an environment that would provide an easy and flexible way to trace the learning progress of each individual.

2.3.2 Setting up the Courses

The didactic model for offering a EUCIP learning path was also given proper attention. The various "objects" available in the CINI repository could be assembled according to various learning models: a completely free model, with no prerequisite, barriers or other compulsory tests for the learning path or, conversely, a tightly controlled mode, with a pre-designed linear pathway without choices or exits. This design spectrum existed at various levels: within each LO with reference to its sub-parts (learning outcome section, units of content, self-test questions and exercises); among the LOs themselves within a module; and finally, even between modules.

The notion of a learning object and its presumed self-contained structured led quite naturally to choose a strict path within the LO. It was therefore decided that the UC should be read in the order in which the author had specified them, and that self-test questions and exercises could only be used after completion of the UCs. The software set-up of the SCORM LO embeds this constraint. With reference to Figure 2, the tree structure of the LO must be traversed in a linear order, from top to bottom, with progress through the units made available by the marks for each unit read. One unit cannot be accessed unless the previous ones have been read.

As to the LOs and their dependencies described in the "conceptual map", a more flexible approach was preferred. The platform shows the LOs making up a course in a linear order; this order was specified by the author as one of the possible visits of the graph embedded in the conceptual map. No constraint however is enforced in the platform, and the user is free to open the LO in any order. The conceptual

maps clearly identify dependencies among the LOs.

The further level of granularity, that of the courses, seems to offer no option. Yet, the modularity of the LO approach opens up the way to experiment with the construction of individually tailored courses that assemble LOs from different EUCIP courses and even areas. No such experiment has been carried out by CINI at this level, with reference to single individuals. But the offer prepared for the university community, to be described shortly, did assemble modules from different areas to suit the needs of specific sections of students.

2.3.3 Setting up Nationwide Virtual Classes

The production process of the e-learning material was controlled in such a way to deliver first the modules for the PLAN knowledge area and part of the Operate one, namely the C.7 module on "Service delivery and support".

The rationale for this schedule was to have a set of courses ready for experimentation within university tracks in computer engineering and computer science. CINI in fact decided to test both the material developed and the delivery model in universities, and chose to do so with students that were well acquainted with ICT and presumably needed no special training in the Build and Operate syllabus knowledge areas. It was widely expected that these students would lack proper training in the PLAN area and in the subsection of the Operate specific to managing contracts and customer relationship. So, the first e-learning offer was called PLAN+C7.

The next step was to set up virtual classes and to design the supporting scheme. The teaching model for any e-learning experiment must take into account the communication capabilities offered by the delivery platform and the need to control the progress of students both on-line and with periodic face-to-face meetings. The first experiment in the EUCIP effort did not have enough resources to schedule a proper blended model because the intended audience consisted of students from any computer engineering and computer science tracks of CINI member universities. So a nationwide classroom model was chosen: individuals subscribe to the learning offering, are put in a virtual classroom with a dedicated tutor, and are given free access to the instance of courses for which the classroom is set up.

2.3.4 Tutor, Expert and Controller

As required by any learning scheme, the e-learning model has its specific requirement. A virtual classroom is an effective means of carrying out a teaching experience if a number of conditions are met: a good service is provided with the help of supporting figures (such as the tutor/facilitator); good communication capabilities are available through the software platform for sharing the learning experience (forums, messaging, e-mail among asynchronous tools); proper tracing of the enrolled student is actually carried out by the tutor with the tools provided by the platform; proper feedback is collected at the end of the experiment from the students in order to review the process.

The support figures chosen were the tutor of the class-

room, the expert of the subject matter, and the controller of the tutors.

The role of the tutor and his/her duties were set out formally, with a detailed specification of: previous experience in managing a virtual classroom, type of support offered to the classroom (in the reactive mode: minimum number of connections to the platform per day and week, maximum delay allowed to take care of any question raised by a student either though messages or through discussions posted in forums; in the proactive mode: setting up of forums in domain specific areas, such as platform usage, identification of students lagging in the learning path, etc).

The expert in the subject matter is an unusual figure in e-learning experiments, that came about because we expected students to raise questions that the tutor could not answer directly. The reason for this was that the courseware would be offered first in the PLAN area, a very specific knowledge domain for which the people that we could enrol as tutors were unlikely to be experts. So, we agreed with the authors of the course that they would step in as subject matter experts for those questions that the tutors could not handle themselves.

The controller is a third figure that helped guarantee overall quality. As we shall see in the upcoming sections, at a certain point during the delivery process, up to four virtual classrooms were active concurrently, with some three hundred students active on the e-learning platform. The service agreement signed by the tutors needed proper control, and a fairly tight one. So a person was chosen and contracted to check on the activity of the tutors and to report on a regular basis to the project management.

2.3.5 Student Agreement

At the outset of this project some experience had already been collected within CINI member universities in running e-learning virtual classrooms. One of the lessons learnt was that e-learning requires a mutual agreement between the two partners: the "teacher" and the "student".

The organisation that is active as the "teacher" specifies its offer with an open declaration of services: platform avail-

ability, tutoring system, course content and scopes, etc. But the user must sign an agreement: he must subscribe to the teaching model offered and must obey the rules stated in this model.

Indeed, experience shows that a completely free approach to the virtual classroom leads to consistent dropouts or misuse of the services. Unless driven by compulsory requirement, users of e-learning courseware tend to defer the effort: they usually show some interest at the very beginning, then delay the activity and finally try to catch up when their allocated learning time is close to expiration.

So, we decided that, upon enrolling in a virtual classroom for the PLAN+C7 offer, the student should sign a "learning agreement" with the following main points: The first access to the virtual classroom has to be within the first two weeks and the student must also read through a single UC within any of the LOs available within the same time interval. The student must complete three of the seven courses within two months. Failure to comply with either rule leads to expulsion from the virtual classroom. The agreement also specifies that the student has a right to support from the tutor for three months, and that he can access the platform for one more month. So, each classroom has duration in time of 4 months.

2.4 The e-Learning Experiments

The e-learning facility and courses prepared by CINI for EUCIP Core have been used in two different environments: in a large university experience, led by CINI itself, with the support of the EUCIP4U project launched by "Fondazione CRUI" [11] (FCRUI in the following), and in a small test bed within the Rome branch of the ICT section of "Ordine degli Ingegneri", the Council of Engineers. Here we shall mainly describe the university experiment.

The motivation for the experiment within the university tracks was twofold: CINI and AICA were eager to expose students to the concept of certification performed by EUCIP Core. The overall effort is described in an accompanying article in this issue. FCRUI joined in the task by urging computer engineering and computer science tracks to grant

Students	Edition instance	Course	Starting month
282	PLAN1, PLAN3a, PLAN3b	PLAN+C7	November 2005 December 2005
109	PLAN4	PLAN+C7	January 2006
196	PLAN5a, PLAN5b	PLAN+C7	March 2006
98	PLAN6	PLAN+C7	May 2006
110	BUILD1	BUILD	June 2006
69	OPERATE1	OPERATE	June2006
864	Total number of participants		

Table 3: The Editions of CINI Courses Delivered to University Students.

university credits to students that obtain the EUCIP core certification. So, the availability of suitable courseware was perceived as an enabling factor: ICT enrolled students are lacking in formal training in economics and service delivery, and the CINI PLAN+C7 courseware fitted in well. Other students, mainly from the telecoms and electronics areas, receive little formal training in informatics and can profit most from the BUILD and OPERATE courseware.

CINI agreed to offer free access to the courseware, for a limited period of time, spanning from November 2005 to September 2006 to students enrolled in the EUCIP programme (that had therefore bought the record of achievement and the minimum of three tokens for EUCIP tests) and attending university tracks that joined in the FCRUI project. This period was also chosen to fit in with the scheduling of courseware releases. As already anticipated, the PLAN+C7 courses were completed by September 2005, while the BUILD and OPERATE were completed by May 2006.

The editions of courses planned until September 2006 consisted of 7 instances of the PLAN+C7 offer, and a single instance of the BUILD and of the OPERATE offer. The actual editions and the number of students enrolled are listed in Table 3.

Running these editions required close coordination between the technical staff responsible for the platform and the associated IT infrastructure, located in CINI premises in Naples, the tutors, one for each instance of the course, the controller and the management of the project.

The choice of an open software solution for the e-learning delivery platform paid off almost immediately. In its official release Dokeos did offer some reporting capability, but the requirement specified by the service agreement between "student" and "teacher" and the desire to have a more advanced control on the progress of the students enrolled in the virtual classroom called for enhanced, tailored reporting facilities, not available in the platform. These were developed by the technical staff as add-ons. The tutor and the controller were able to collect, say, averages on UC read and STQs visited and passed, computed on the traces stored in the database supporting the platform.

The overall process went fairly smooth, notwithstanding some initial problems regarding the DBMS (MySQL) configuration which were quickly identified and resolved.

2.5 Lessons Learned

The experiment and the overall process have given some insights into the EUCIP Core development carried out by CINI.

Part of the agreement with the students was the completion of a questionnaire at the end of the course. The data was collected and analysed for a subset of the edition instances, not for all of them. The reason is simple: since the questionnaire was not compulsory, many students skipped this phase. Also the first feedback on the process suggested that the structure of the questionnaire was too detailed: there were a total of 42 questions. As an example, in the first

virtual classroom the questionnaires were filled in on the last C7 "modules" while only a fifth of them were filled on the first "module".

The output from the questionnaires for PLAN+C7 shows that over 65% of the students considered the learning material useful or very useful. Even students who had some formal education in their curriculum in nearby areas (mainly introductory economics and business organisation) stated that the e-learning material was new and more tailored to the syllabus. Indeed, the large majority of them considered that the material was well suited to the syllabus.

The interaction mode and platform implementation were considered average/good. This reflects an initial difficulty due to unbalanced use of the DBMS from within the Dokeos code, a problem that was eventually solved with proper tuning but which impaired the speed of the platform in the first instances of virtual classes.

If one considers that the users were students enrolled in the EUCIP project, but still mainly oriented to getting their university degree, it should be no surprise that attendance of the virtual classroom and the general usage of the facilities available was not good, but not that bad. The pattern is completely different today for those instances of courses that have been sold outside the university; participation is more active, since the enrolled persons have a more focused attitude towards the certification.

The experiment carried out with a small group of engineers and other ICT people in Rome gave other outputs. The first is that the EUCIP Core scheme can be effectively used by people that have been working even for some years in the ICT field, because it is a valuable and useful way to get updates on the basics of the profession. Often, ICT people have developed a personal expertise in their field, even though they may have had no formal training from college or university. The basics of ICT specified in the syllabus and well developed in the courseware have been considered a useful tool to broaden competence and upgrade it, especially in areas not closely connected with the current profession.

The second feedback from these groups is that the current version of CINI courseware requires too much time to be used to its full extent. A professional (and possibly an employee in a company) does not have the time to read and use the whole offering effectively. This is a useful hint, but by no means diminishes the quality and the usability of CINI learning material. As explained above, the repository of learning objects can be used to assemble tailored courses. By properly profiling a candidate for certification, or even anyone interested in assessing his/her coverage of ICT knowledge, it is possible to build a specific learning path that fills in the gaps and skips the area already understood.

One more consideration is worth making, at least for the Italian situation. CINI courseware is in Italian and currently the EUCIP exams are run in English. Many students have questioned this and a strong request has been put forward for proper learning material in English. Actually, the request is much stronger for the PLAN area than for the

other two, and this also comes as no surprise. Most of the students that joined in the experimentation are enrolled on ICT tracks. For them, English is more familiar in these knowledge areas where it is being used consistently in technical documentation of software products, operative systems of laptops and desktops, and the like. Some university courses even adopt English textbooks. The pattern is completely different in the PLAN area. Here, the technical jargon of ICT offers little support, and the user of an Italian courseware faces obvious difficulties when required to answer EUCIP core questions. This is one of the reasons why CINI agreed to join the EUCIP MAT project, to be described in the remainder of this article.

3 EUCIP-MAT, a European Project for the Vocational and Professional Market

EUCIP-Mat [2] is a Leonardo da Vinci programme supported project which aims to create e-learning materials for the EUCIP Core programme. The users of the project results are IT students of the vocational school and the students of the first courses of colleges and universities in the technology area as well as IT practitioners who do not yet have vocational certificates. The project target group contains everyone who is responsible for IT job market planning and regulation: policy makers, employers, employees, training providers, and career consultants.

The professional exams, managed by independent certifying bodies, should on every qualification level characterize any examinee fully, and be transparent and independent in accordance with general principles of certification. An ultimate need for the success in exams is the need for training materials. It is recognized that the production of learning materials is difficult because the IT field is developing extremely fast. Therefore students need the possibility to study using materials that are in line with examination questions and current subject content. Another reason for developing the learning materials is to help learning providers implement EUCIP based learning in a professional manner.

EUCIP certification started some years ago and it became clear that training institutions such as vocational schools and the like are not able to produce these course materials by themselves, due to either a lack of knowledge or time. Feedback from teachers and students ultimately shows that there is a demand for learning material in these vocational schools. Through these learning materials it is possible to create overall basic knowledge and skills standards for IT specialists. These standards will be vendor independent as is the entire EUCIP system. These learning materials will help schools start training courses quickly or integrate certification requirements into existing courses.

3.1 Leonardo Framework
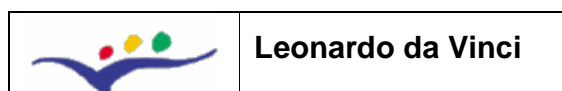
| | **Leonardo da Vinci** |

The **Leonardo da Vinci programme** has three general objectives:

- To improve the skills and competencies of people, especially young people, in initial vocational training at all levels. This may be achieved, inter alia, through work-linked vocational training and apprenticeship with a view to promoting employability and facilitating vocational integration and reintegration.

- To improve the quality of, and access to, continuing vocational training and the lifelong acquisition of skills and competencies with a view to increasing and developing adaptability, particularly in order to consolidate technological and organisational change.

- To promote and reinforce the contribution of vocational training to the process of innovation, with a view to improving competitiveness and entrepreneurship, also in view of new employment possibilities. Special attention will be paid in this respect to fostering co-operation between vocational training institutions, including universities and undertakings, and particularly SMEs.

In respect of the first two objectives, innovative counselling and guidance approaches are of particular importance.

In implementing the three objectives, special attention is given to proposals addressing:

- The development of practices to facilitate access to training for the less advantaged people in the labour market, including the disabled

- Equal opportunities for women and men, with a view to combating discrimination in training provision.

In order to achieve the programme's objectives, calls for proposals are published which set out specific priorities. <http://ec.europa.eu/education/programmes/leonardo/leonardo_en.html> .

3.2 The EUCIP-Mat Project Consortium

The EUCIP-Mat project consortium was created to develop the necessary training materials and consists of six partners from various countries with different backgrounds. Each brings its own knowledge and experience to the project.

- The **Estonian Information Technology Society** - EITS was established in 1989.

EITS objective is to establish information exchange environment for its members to:
- Improve their professional level.
- Improve their business activities.
- Find solutions through co-operation.

EITS is an organisation of persons interested in IT issues on a professional level or who represent organisations with interests in the IT field. EITS coordinates ECDL and EUCIP certification in Estonia, as a certifying organisation in the Information Technology and Telecommunication area. There are 45 ECDL test centres and 3 EUCIP test centres around the country.

- **BCS Koolitus AS** is the oldest training and consulting company in Estonia, which offers its services for ICT users, specialists and managers. The selection of services is

varied: various training courses, consultations, certifications, ICT managing projects, and the staging of development events in ICT. The company offers a full training process, from ascertaining training needs to measuring training results. BCS has several competencies, such as adult training, the methodical delivery of training courses, training material production. BCS Koolitus also has experience in managing ICT projects.

■ **Estonian IT College (ITC)** - ITC is a private but not-for-profit professional higher educational institution, established and financed by the Estonian Information Technology Foundation (EITF) in 2000. ITC is working very closely with both universities and the ICT industry. ITC provides three-year professional higher education. There are four curricula: IT System Administration, IT System Development, Information System Analysis and Technical Communication. Education in ITC is combined with International IT certification programs (Cisco, Microsoft, etc.) and has a strong applied focus. ITC teaching staff is highly skilled highly educated, and experienced. Teaching staff are sourced from partner Universities, and the ICT industry, and there are also full time teachers. IT College is a Regional Academy of Cisco CCNA, the Cisco Wireless program, and a local academy of Cisco CCNP program. ITC is a member of the Microsoft Academic Program, Oracle Academic initiative. ITC is a member of the Estonian e-University and college teachers have elaborated dozens of e-training/distance education courses.

■ **CINI** is a consortium of 30 Italian Universities active in ICT. As already described in the first part of this article, CINI and AICA agreed to launch the EUCIP scheme within the academic system in Italy. CINI has set up a network of competence centres to deliver EUCIP Core certifications in universities and to cooperate with AICA in all EUCIP development. After having produced Italian courseware, CINI agreed to step into the EUCIP-MAT project, substituting AICA in the effort to develop a new, English version.

■ **Latvian Information and Communications Technologies Association** - LIKTA is a professional association founded in 1998. It brings together over 60 important ICT product and service providers and educational institutions, as well as over 150 individual professional members of the ICT industry sector in Latvia, LIKTA is a non-governmental organisation. LIKTA members have all the necessary skills, knowledge, expertise and experience.

■ **Amfora Training AB** has a 20 year history of presenting science-based education. Today Amfora mainly creates e-learning materials that consist of streaming video, visualisations, and educational quiz-games, all presented on Amfora's own-developed e-learning platform. The high quality video content is produced by its parent company Panthera Film & TV. Amfora Training has in-house competence in project management, information processing, instructional design, 2D- and 3D-visualisation, streaming video production, system development, and programming. Amfora Training has the skills to process and present information in a comprehensible manner.

The roles and the tasks of each partner involved are described in the project plan. The main tasks to which each partner will contribute are: creation of the learning materials and tests, pilot training of the teachers and students, translation of the materials into five languages, preparation of e-learning environment, and bringing the project results to the target groups.

The training materials for IT professionals will be presented in the interactive electronic form of an online textbook. It will thus be easy to make updates and print or make CDs. These materials will be in the five languages of the project partners - English, Estonian, Latvian, Italian, and Swedish.

The learning materials content will cover the EUCIP Core level modules:

A – "Plan" knowledge area: Use and management of information systems.

B – "Build" knowledge area: Development and integration of information systems.

C – "Operate" knowledge area: Operation and support of information systems.

The learning materials proposed are new products in response to existing demand. It is recognised that the production of learning materials is difficult because of the speed at which the IT field develops. Therefore students need to be able to study using materials which are in line with examination questions and current syllabus content. Another reason for developing learning materials quickly is to help learning providers implement EUCIP based learning in a professional manner.

The proposed interactive form of materials will help students use e-learning environments and thus ensure that learning methods and possibilities are flexible for every beneficiary and target group member from Estonia, Latvia, Sweden and Italy (namely, The Estonian Information Technology Society EITS, BCS Koolitus, an Estonian training and consulting company, the Estonian IT college, CINI, that has replaced AICA, the Italian Association of ICT Professionals, the Latvian Information and Communication Technologies Association LITKA and Amfora Training AB, a Swedish company active in science based education)..

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