eLearning

Project Title: **DELPHI: European Observatory of e-Learning Practice**

Deliverable Title: **IDENTIFICATION OF COMMON RESEARCH TRENDS AND POLICY RECOMMENDATIONS**

Contract No: ***2002-4075/001-001 EDU-ELEARN***

Deliverable No: **4**

Work Package: **4**

Deliverable Type: Public

Deliverable Title: **Identification of common research trends and policy recommendations**

Version: **Final**

Date: September 2004

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1. Introduction

The DELPHI Project, funded under the e-Learning Action Plan, has reviewed the results of thirty projects variously funded under the Socrates Minerva, the IST and Improving Human Potential Programmes. The project has aimed to shed light onto whether fundamental changes have arisen at the level of the methodologies and the learning processes necessary to propose a future agenda for enhancing the innovative use of ICT across a wide range of educational sectors. It has done this by trying to answer a series of transversal research questions which encompassed the following questions:

1) What are the new methodological approaches to learning in technology-based learning scenarios and what is their efficiency? What are the new co-operative learning processes, the cross-curricular skills and changes in teaching/learning, role changes configuring technology ICT-based learning innovations? How is effectiveness considered in the different innovations analyzed?

2) What are the consequences for organizations when introducing these new ways of learning, including European cross-cultural issues involved in the process?

3) What are the contributions of ICT to lifelong learning in terms of access to education and training? Does the introduction of ICT stimulate the dual society and thus social exclusion?

At the same time the project has sought to utilize knowledge generated by a range of sub-activities in the context of developing an Internet-based Observatory on Learning Innovation. These activities have ranged from thematic study reviews to expert group discussions, envisioned the establishment of a monitoring system and the maintenance of the Observatory.

The project review process, which constituted Stage One activity within DELPHI, was undertaken to facilitate the development of an analytical theoretical structure based on a matrix of indicators of change. The reviewed projects were contextualized within an area perspective and, in the case of Socrates Minerva projects, an additional sectoral perspective (schools, adult education and higher education). The areas demarcated were pedagogical, institutional and cross-cultural / socio-economic. Within these areas particular focus was located in respect of the identification of methodological trends, issues related to learning scenarios, gender perspectives to ICT Assisted Learning and socio- economic variables affecting/affected by ICT Assisted Learning. The project's Stage Two activity is aimed at eliciting guidelines for key stakeholders in the e-learning area and facilitating the **formulation of indicators** for the assessment and evaluation of innovation in on-going projects, **areas for policy consideration** and enhancing progress towards **new development models**.

This report is an output of Work Package Four, "Identification of common research trends and policy recommendations" and constitutes the fourth deliverable. Deliverable 4

comprises two sections: Section 1 (described as Deliverable 4.1 in the original plan) is a *synthesis report on common trends out of the projects analysed, including an outline of results and limitations and preliminary trends in policy recommendations* and as Section 2 (the same, as Deliverable 4.2) is *a draft joint report of projects' results, research issues and trends, initial proposals for future research, as well as policy recommendations, to the light of the transversal research questions guiding the research.* This section is a key document for discussion in the Workshop organized in WP5.

The report is concerned with an overview of the findings and the emergence of possible indicators which might be relevant for policy making and formulating suggested pathways for future research. The theoretical and methodological parameters which have underpinned DELPHI are revisited. The report is divided into two sections, the first of which will briefly outline the methodological background to the project review process and detail the synthesized findings. The second section will generalize the policy context and setting of DELPHI within the e-learning landscape in Europe, elaborate proposed indicators and initiate discussion on future research trends and recommendations for policy formulations.

1 THE REVIEWED PROJECTS: METHODOLOGY

1.1 General Approach

DELPHI conceptualized itself as a project of a meta-evaluation and reflection about innovation in emergent e-learning practice. The aim has been, through a critical review of the outputs of research projects of similar thematic orientation, to indicate how an agenda of dialogue between the "projects" (in terms of their outputs) and policy makers could be derived. The review of different sets of projects was undertaken in order to identify similarities/differences and trends of an organizational, socio-economic and pedagogical nature which would facilitate the **formulation of indicators** for the assessment and evaluation of innovation in on-going projects. A critical analysis aimed to define the specific pedagogical and socio-economic parameters for the discussion between the investigated projects and policy making.

The project has defined in its Technical Annex, a set of transversal research questions as a starting point:

1• what are the new methods and technologies (supporting these methods) and what is their efficiency? What are the changes in teacher-pupil roles, and in the whole learning environment?

2• what are the new learning processes, the new cross-curricular and communication skills, the market-oriented issues, and , specifically, the new collaborative learning methodologies involved?

3• what are the components of cost-effectiveness and cost-benefit analysis in these respective projects, and what are the results included in the final reports (taking into consideration how cost/effectiveness and cost/benefit is defined in the projects)?

4• what are the contributions of ICT to lifelong learning in terms of access to education and training? Does the introduction of ICT stimulate the dual society and thus social exclusion?

For purposes of clarity the DELPHI project viewed e-learning to be *a process of inter-active learning in which the learning content is available online and where automatic feedback is provided to enhance the student's learning activity*.

1.2 Context – Input – Process – Product Evaluation Model

The project's first stage activity was operationalised at several levels via a 2-phase approach where the first phase constituted a reflective meta-evaluation process of projects undertaken under IST, IHP and MINERVA programmes and the second phase consisted of a summative assessment of the outputs of on-going projects or completed projects. The methodology adopted involved application of a *Context – Input – Process – Product*

Evaluation Model which allowed a reference frame for the organization of the review work undertaken. The model had been selected amongst other reasons for its perceived strength in allowing identification of the policy implications at various levels of project activity and contexts. DELPHI's strategic approach towards the identification of critical indicators of change for evaluation and assessment is shown below.

Level 1

STAGE 1

REVIEW

1st Round Projects:
Cluster of projects
(from IHP, MINERVA and IST Calls)

SCOPE OF THE REVIEW

1• Identify Innovation Scenarios
2• Identify Methodological Trends
3• Identify Issues of Learning Scenarios
4• Identify gender perspective to ICT Assisted Learning
5• Identification and Selection of Socio-economic variables affecting ICT Assisted Learning

EXPECTED OUTPUT

Creation of an Analytical Thematic Structure (indicators)

STAGE 2

Critical Indicators identified in stage 1

Review process

Classification of projects

Continuous assess

Refinement of Critical Indicators

Policy Recommendations:
1• Periodic assessment outputs
2• Policy briefs
3• Synthesis Report

Establishment of a European-wide discussion researchers – policy makers)
on ICT – Assisted Learning

Level 2

Laboratory

Level 3

Observatory

1.3 Project selection

The review parameters governing project selection were defined within the original DELPHI proposal and were further enhanced during the process of consortium discussion and partial elaboration of that discussion in the state of the art literature review. They included:

1○ selection of education sectors
2○ selection of projects
3○ specification of review parameters
4○ design of instrumentation
5○ negotiations with projects
6○ review of project documentation
7○ drafting of case project reports
8○ drafting of sectoral reports
9○ review of commonalities / differences amongst the sectors
10○ reflective analysis of sectoral reports content for the identification of
11○ indicators mainly in the areas of learning methods where ICT is involved,
12○ new skills and roles for teachers / trainers and new organizational issues
13○ reflections on policy needs and drafting of recommendations.

The following areas of key-innovations in e-learning were elaborated to define the scope of the reviews.

Pedagogical issues	**Organizational & institutional issues**	**Socio-economic issues**
Teaching & learning philosophies	Large scale operations	e-learning standards
Teaching techniques, methods & devices	Cost effectiveness	LMS systems
Teacher workloads	Flexibility	Globalization & competitiveness
Assessment	Incentives	Systems integration
Teacher training	Accessibility	Funding & commercialization
Teacher collaboration		M-learning
Bandwidth & rich media		

The columns indicate the three main research areas and the issues in each of them which formed the basis for the development of a template for the input of data and findings from the reviewed projects. Additionally, a sectoral division was elucidated based in the notion that education sectors traditionally tackle e-learning relying on attachment to paradigms and metaphors. This was expressed as follows:

Distance Education	Information Society
Training (Corporate Sector)	Knowledge as a commodity
Schools (Secondary)	School of Tomorrow
Higher Education	Virtual Campus
Special Education	Integration
Adult Education	Lifelong learning/the market society

These sectors were aggregated into three sectoral areas supported by specific educational paradigms. The sectoral classification of MINERVA projects was located in these areas:

11. Adult/distance education LLL, the learning citizen
22. School-based education School of tomorrow
33. Higher education Virtual Campus

Teacher training was considered a cross-sector of clear interest, since it is present in all academic levels as a key factor for the success or failure of the learning innovations.

The review process encompassed:

1○ selection of projects
2○ specification of review parameters.
3○ design of instrumentation to record the data in a similar and organized manner.
4○ negotiation with projects
5○ use of primary and secondary sources of information
6○ drafting of case project reports
7○ drafting of sectoral reports
8○ review of commonalities / differences
9○ reflective analysis of review content for the identification of indicators mainly in the areas of learning methods where ICT is involved, new skills and roles for teachers / trainers and new organizational issues.
10○ reflection on policy needs and drafting of recommendations.

An initial template designed as a tool for the review of the MINERVA projects (details can be found in WP2) was later amended as the experience of that review exercise suggested that change was needed in order to elicit clearer understandings from the reviewed projects. The revised instrument (see below in section 2.5) was seen as more open-ended in nature and included parameters that were not taken into account in the initial design.

1.4 The projects selected

Thirty projects funded under the EU Socrates Minerva programme, IST and Improving Human Potential programmes which fell under the scope of identifying trends for/of e-learning were eventually selected for review. Eighteen of the selected projects were funded under the Socrates Minerva programme, eight were funded under the IST programme and four cluster projects were selected from the IHP programme. The Minerva projects were seen as pedagogically - oriented, which offered possibilities of facilitating identification of pedagogically driven indicators for change, whereas the IST and IHP projects were perceived as offering possibilities of identifying organizational and socio-economic variables as indicators of change.

Projects reviewed under the MINERVA programme were located under the sectors described above and included:

Adult/distance education:

1- AODL1: Adult Education Network

2- AODL2: European Online Seminar on Urban Transformations
3- AODL3. Inter North Sea University
4- AODL4 vital ageing lifelong learning course
5- AODL5: Virtual Institute for Modelling of Industrial Manufacturing Systems
6- AODL6: Open Distance Learning in Teacher Training for Inclusive Education

School-based education:

- SB1: collaborative electronic based networks of teachers
- SB2: An innovative approach to the usage of the Internet in a interdisciplinary framework
- SB3: Observation and Analysis of the Uses of Information and Communication Technology in European Primary and Secondary Schools: An Intercultural Approach
- SB4: e-learning information in geography
- SB5: Open and Distance Learning for Secondary Art Schools
- SB6: open and distance learning tools and activities

Higher education:

- HE1:Benchmarking of Virtual Campuses
- HE2: Group for Advanced Learning Environments using Communication and Information Aids
- HE3: Collaborative Learning in an International Environment
- HE4: Surveys of European Universities Skills for ICT for Staff and Students
- HE5: Improving Open and Distance Learning in a Network
- HE6: Studies in Educational Technologies and Training for Teachers

A further twelve case-studies were selected for review from recently or nearly completed projects funded under the IST and IHP programmes. Eight of these comprised IST projects which were felt to generally fall across the Programme's main Application Areas, which included:

1. Open Platform and Tools for Personalized Learning,
2. European Youth in the Digital Age,
3. The Flexible University, Advanced Training Systems,
4. The Learning Citizen,
5. Pioneering Research for the Future of Learning,
6. Consensus Building for Education and Training,
7. Preparing for Future Research Activities.

In consultation with IST programme officials the following projects were selected for review:

1- IST1 (Area: Preparing for Future Research)
2- IST2 (The Learning Citizen)
3- IST3 (Consensus Building for Education and Training)
4- IST4 (Advance Training Systems)
5- IST5 (Flexible University)
6- IST6 (Pioneering Research for the Future of Learning)
7- IST7 (Open Platforms and Tools for Personalized Learning)
8- IST8 (European Youth in the Digital Age)

This set was comprised of one project from each of the IST main Application Areas, in an attempt at ensuring representation of all key aspects reflected in the Programme design.

The selection of Improving Human Potential (IHP) projects was enabled by a consortium review of the "Briefing Papers"[1] prepared for all IHP projects. Four cluster projects were selected representing IHP principle cluster areas: these were:

11. Research on Higher Education,
22. Research on school-to-work transitions,
33. Research on new governance models for education and training,
44. Research on the use of information and communications (ICT) in learning
55. Research on education, inequalities and social exclusion)

The corresponding cluster projects for review were identified as:

- IHP1 Education, equity and social exclusion,
- IHP2 Education and Labour Market Change,
- IHP3 Towards the Learning Economy and
- IHP4 Synergy between Practitioners' needs & opportunities: research orientations & decision making on the usage of ICT in primary and secondary education

Projects once selected were distributed for review among the consortium partners on the basis of expertise and interest.

1.5 Tools and instruments used in project reviews

Data and findings collected on the projects was noted under the parameters itemized in the templates. Specific details can be found in deliverables 2 and 3 and the headings in final revised review template can be seen below

Primary and secondary sources of information used in the reviews, where available, were final reports of projects, the most relevant deliverables, any project web site content if available and in some cases academic articles and books presented by the projects' partnerships Following the review of publicly available documentation on the project cases Delphi researchers attempted contact with the projects' contractors This resulted in the gathering of additional information on the projects and their activities and or clarification on project objectives, findings and conclusions. It should be noted here
that response levels were variable. In some it was high but in others little interest was shown in collaborating.

Template headings

Name of Project
Programme and Call
Research Task within the Programme
Current Status
Main and specific goals

[1] http://www.pjb.co.uk/np1/#Briefing%20Papers

Envisaged outcomes
Socio-economic aspects
Target population (academic level, sector, etc.)
Statement of the problem
Research questions posed
Objectives of the project
Learning technologies applied
Learning scenario

2. New methodological approaches to ICT-based learning innovations
2.1 Definitions and approaches to e-Learning
2.2 Main Learning issue(s) intended to study
2.3 Teaching techniques, methods, and devices
2.4 Teaching and student roles
2.5 Teachers and students interactions
2.6 Attitudes of teachers and students towards ICT
2.7 Assessment
2.8 Teacher workload
2.9 Teacher collaboration

3. Institutional/organizational changes as a result of ICT and e-Learning implementation
3.1 Main institutional changes resulted from the introduction of ICT and AODL6into existing structures
3.2 The role of staff training
3.3 Main actors, adopters and resisters to the adoption of the innovation as identified in the project
3.4. Organizational conditions that are (un)supportive to innovation
3.5 Cost effectiveness
3.6 Flexibility
3.7 Accessibility

4. Other socio-Economic aspects of the innovations
4.1 E-learning standards: consequences decisions problems reflections
4.2 Globalization: consequences decisions problems reflections and actions
4.3 Other socio-cultural and national factors that influence learning processes
4.4 Funding and commercialization
4.5 Implications for LLL

5. Innovation addressed/intended; its sustainability and diffusion
5.1. What was considered innovative?
5.2. Role of the ICT in the innovations
5.3. Were the innovations studied sustainable/scalable

1.6 Constraints on effective data collection

In terms of the effectiveness of the template for extracting coherent data, it is important to note that some of the projects under review had not yet reached their final outputs and others had been completed, but the timeline was too short for effective evaluation of their impact.

Further, the projects under review were funded under EU Programmes which intrinsically adopted different methodologies and expected outcomes. IHP, for example, flows from the legacy ring fencing of European social sciences research whereas IST, notwithstanding its inclusion of horizontal socio-economic dimensions, was not per se about research but application[2]. A key objective of the IST programme has been to ensure European leadership in the generic and applied technologies at the heart of the knowledge economy. Within the IHP clusters review programme, analyses were attempted of research activities which were then found to have little or no direct relevance to the explicit issues addressed by DELPHI. This was particularly evident in IHP1 which, with the exception of one project within the cluster, had no direct relevance to the defined objectives of the DELPHI project.

[2] Subsequent and current indications are that beyond Framework 6 differentiation of programmes such as these will disappear and a process of complex convergence is/will be taking place as solutions based methodologies are adopted.

The DELPHI methodology implies an underpinning of an approach which attempts to put aside commonly held formulaic notions of success in ICT projects (e.g., the ideal ratio of computers to students or the ideal application of ICT in educational environments).There is the recognition that the relationship between outcomes is not predictive and linear but is the result of a complex process of interactivity among essential variables and how they develop over time. It became clear during the progress of the project that the lack of detailed sub indicators under the general template headings presented difficulties which encouraged generalized statements (often of intent) rather than evidence-based data on real effects and outcomes. The socio-economic review required, for example, was constrained, to some degree by the shortcomings of the DELPHI checklist to allow a holistic analytic landscape to be constructed against which the reviewer could paint in the outcomes and characteristics of the reviewed projects. It is evident also , in this regard, that a more thoroughgoing delineation of the notions of "innovation" and innovation systems and what they mean within educational arenas has been needed. This will be discussed later.

The next section deals with overviews of the findings of the review process.

2. Overview of the findings in the Reviewed projects

The following section gives an overview of the findings from all the project reviews.

2.1 Socrates Minerva Projects

The Minerva projects were located within three sectors and comprised:

Adult/distance education:

1- AODL1: Adult Education Network
2- AODL2: European Online Seminar on Urban Transformations
3- AODL3. Inter North Sea University
4- AODL4 vital ageing lifelong learning course
5- AODL5: Virtual Institute for Modelling of Industrial Manufacturing Systems
6- AODL6: Open Distance Learning in Teacher Training for Inclusive Education

School-based education:

- SB1: collaborative electronic based networks of teachers
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Higher education:

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- HE5: Improving Open and Distance Learning in a Network
- HE6: Studies in Educational Technologies and Training for Teachers

2.2 School-based education sector

All six projects reviewed shared a common point of departure which was set by the wider aims and goals of the Socrates Minerva programme. A generic theme shared by all projects was the development of some kind of theoretical framework accompanied by methodologies and tools for the integration of ICT into primary and secondary education in European Union countries. The projects reviewed however vary considerably in focus. The implementation of open and distance learning models, tools, activities and training was the focus of the SB6, SB5 and SB2 projects, each targeting a specific area: SB6 on science teaching and learning with emphasis on meteorological phenomena, SB5 on contemporary art and artists, SB2 on agricultural products and their trade. In the context of the SB1 project open and distance learning was implemented in the form of "research partnerships", collaborative electronic-based networks of teachers, researchers at local and international level. On the other hand, the SB3 project, was primarily focused on the identification of

differences and similarities of ICT integration in primary and secondary education in European countries. The SB4 project focused on e-learning information in geography.

Potential beneficiaries of the outcomes of the projects were primary education teachers and students (all projects), ICT coordinators (SB1), school administrators (at school, local, regional and national levels) and policy makers at national and European level (SB3, SB1), local communities/enterprises (SB2), teacher training institutions (SB6, SB1, Euro.Geo) and pre-service teachers (SB6).

New methodological approaches to ICT-based learning innovations

The review findings in respect to ICT – based learning innovations where they were introduced in projects and studied can be categorized in terms of products, training materials and guidelines, impact on schools, teachers and students involved. Project web-sites were commonly considered as an innovative component by the projects, mainly on the basis of their contribution to information and knowledge diffusion (info about the projects, their activities and results, as well as materials such as workshop proceedings organized by the projects, electronic magazines etc) and communication (through forum facilities). However some did not extend beyond the life cycle of the projects.

The SB2 project developed the "SB2 e-shop" platform, and the "e-tool". The " e-shop" is a distributed learning environment for students. The e-shop platform includes facilities to monitor financial activities of a real shop. And the "E-tool" is an educational tool, for the visualization of weekly sales made by participating students. Other products included CD-Rom titles, videos and printed materials. The SB5 project produced a series of short videos on art and "The SB5 CD-ROM" which contains research outcomes, the collection of the artworks created by the students involved in the project, a presentation of the project and the training course developed in the first year of the project. 10000 copies have been distributed to European schools and European Educational Public Authorities. The SB6 project produced its own CD-Rom title "Young Researchers in Action" essentially containing the project web site materials, and a printed handbook. The SB2 project developed training materials for teachers in three areas: ODL, e-commerce and guidelines ranging from technical guidelines on the use of videoconferencing tools and web development to instructions for business plans, and lesson plans on the basis of the e-shop platform. The SB4 project organized content in geography for enriching the teaching activity of the subject matter. The SB6 project developed a series of short presentations for teachers on various issues from technical (how to develop web pages) to guidelines for the construction of lesson plans and the use of ICT from scientific enquiry.

The reviewer reported that the impact of innovations in these projects was only possible to evaluate at a short term level, i.e. while the projects were being implemented. The impact of the projects' activities on the teachers and students directly involved can be generally summated. External evaluation indicated that the SB1 project increased teachers' understanding of the educational benefits of digital tools, educational software and particularly internet use. Participating teachers gained knowledge about ICT use best practice and general attitudes towards ICT become more positive. The schools as an outcome now have a library containing new resources and tools which the ICT coordinators

constantly seek to renew. However, according to the external evaluation report communication between students and teachers of different schools at the international level, was weak mainly because of language barriers. Teleconferencing activities, in particular, had had a relatively little impact on pupils' learning.

The reviewer noted that pre/post-tests performed in the context of the evaluation phase of the innovation introduced by the SB6 project suggested that: there was no detectable effect concerning the enforcement of the social attitude of the students towards foreign students, there was no detectable effect concerning the students' positive attitude towards collaborative learning or teamwork, the experimental group showed a better performance in terms of their familiarization with scientific methodology as compared to the control group which did not participate in the project and served as reference group, and the students' performance improved in relation to the interpretation of graphical representations.

SB2 reported that one of the most obvious results was a change of attitude of teachers towards ICT. Many teachers that had been reluctant to use of ICT in learning not only lost all reluctance but had come to use the computer and the Internet for school work in general. Students showed enthusiasm to participate in the project; in some cases students taught each other and their teachers how to work with the Web more efficiently. Some students, because of their implication in the project's activities, also considered very seriously the possibility of working in Web design, or e-commerce. However, the overall interest among pupils regarding foreign cultures slightly decreased during the project. In detail, the interest in information about foreign cultures slightly increased in participating technical schools and decreased in conventional schools. Concerning these quantitative results, the evaluation report argues that it is generally admitted that in open and distance learning, the social parameter is weaker compared to the other components, and does not play a central role in students' interests. The fact that this socio-cultural interest increases in technical schools and decreases in conventional schools is probable due to the general curriculum of the latter and pupils' previous knowledge on the subject.

In the context of the SB5 project, students and teachers through the focus on contemporary art deepened their understanding of creativity and expanded it to other areas of their lives. Although some problems were encountered in teleconferencing sessions, pupils who did engage in computer conferencing responded positively. Furthermore, the pupils came to realize that contemporary art meant many different things in different cultural contexts. The success of the project appeared to lies in two fields – the work done at the time by pupils and teachers and the sustainable resources developed. The resources were developed to a high presentational standard and made available to all local city schools. The project enhanced the awareness and proficiency of some art teachers with ICT and the afforded opportunities for exploiting the technology.

New teacher-student roles resulting from innovative pedagogical practices

One of the main findings of the classroom observations made in the context of the SB3 project is that there is a shift from technology-focus towards a teaching– learning centred

approach to ICT in education. This finding is emphasized by the rest of the projects reviewed. This shift is accompanied by shifts in the traditional teacher-student roles in innovative open and distance learning pedagogic practices which are encouraged by the use of ICT. According to the SB1 project, ICT can be a catalyst for thinking about one's roles and responsibilities as a teacher. The use of computers makes it easy for teachers to try out new methods and measure their effectiveness but first, according to the SB1 project, they must make a transition in which some teaching styles and skills will be perceived as more valuable and others less valuable than before.

The role of teachers as *collaborators* of pupils and of colleagues both face to face and from a distance was commonly practiced in all projects. For example, in the SB2 project, students and teachers from European countries came into contact exchanging ideas and experiences and efforts were made to enhance their collaborative experiences. The SB1 project developed collaborative networks of teachers and researchers. In the SB6 project teachers collaborated in developing shared activities. Teachers' collaboration skills and dispositions are identified as crucial in many respects. First, they support teachers in participating in formal and informal networks of teachers, which, according to the SB1 project, can help teachers become more open towards the use of different technological approaches in solving teaching tasks and can thus lead to better teaching. Furthermore, collaboration in electronic networks makes possible the opening up of educational institutions so that a larger flow of information, knowledge and know-how is made available to a broader circle of practitioners. Good collaboration skills also enhance the capacity of schools to integrate ICT into teaching and learning. According to the SB3 project, increased collaboration and rich interpersonal relationships among the teachers minimize power-related tensions that may arise among ICT coordinators and the teaching staff, supports the decentralization of decision-making, and has a positive impact on the effectiveness of the introduction of ICT in curriculum-based activities. Other teacher roles as related to innovative pedagogic practices were also identified. According to the SB6 project, within the open and distance learning approach, the role of the teacher shifts towards the role of co-learner, facilitator of students' inquiries, guiding student work and offering individual help; the teacher's role in coaching, observing students, offering hints and reminders, providing feedback, scaffolding and fading, and modelling are further powerful enhancements to any learning situation. The teacher as trainer of other colleagues was also identified by SB3 as a valuable role in general.

On the other side, the projects observed or encouraged shifts in students' roles which were characterized by considerable variation, but all stressed the importance of active learning. According to the SB2 project, student's self-action was the leading element in the teaching process, a point which is also stressed by all other reviewed projects which introduced open and distance learning pedagogic innovations. The SB6 project, for example, encouraged pupils to become "young researchers" who use new technologies to process, represent and communicate 'scientific' data collected on the basis of real-life observations and teamwork. In the context of the SB2 project,
students assumed several different roles: recipients, instructors, team and individual workers etc. In the SB5 project, students developed strategies for solving problems in team work.

Patterns of teacher-student, teacher-teacher and student-student interactions as a result of innovation

A general observation shared by all projects is that the patterns of teacher-student and student-student interactions, accompanied by a shift in the teacher/pupil roles and the use of ICT, changed from conventional classroom patterns where teachers initiate and direct classroom interaction, dominate talk and define success, to more pupil-centered, team interaction and collaboration patterns. This is observed not only in innovative practices because, according to the SB3 project, teachers encourage cooperation for both pedagogical reasons and reasons related to scarcity of resources; thus, pupil to pupil interactions are often based on small group co-operation, collaboration and shared construction of meaning. In the computer rooms, the pupils are often co-operating two and two or in a small group. They learn to listen to each other and to discuss the findings from Internet etc. Teacher-student and student-student interactions are also influenced by computer-lab arrangements and in particular how computers are arranged in the schools (traditional class, small group projects, or individual work). Learning from a distance with the use of ICT also greatly affects interaction patterns in learning activities; however, interaction through ICT is often problematic and heavily dependent on the quality of infrastructure in schools (low connection speeds for example) and the foreign language skills of the teachers and students involved (projects reported that communication with schools abroad was often minimal because teachers and pupils did not know well a foreign language).

Teachers' attitudes towards ICT and open & distance learning

According to the SB3 project, observations in regular classroom (not involved in innovation) revealed that the attitudes towards ICT among teachers varied enormously from fear, scepticism and indifference to wild enthusiasm and excitement. This is a point also stressed by the SB1 project, which argues that while some teachers put a lot of effort in the successful implementation of ICT in their teaching, other teachers sometimes fear that technology will replace them. Related to the above is the remark made by SB3 project that some teachers take lack of ICT knowledge and improper ICT training by local authorities as an excuse not to use computers. Furthermore, in schools where ICT coordinators exert on their colleagues the power deriving from their know-how, there are tensions among the members of the staff and even conflicts, which put ICT in the margin of the school activities. In this perspective, crucial factors in developing positive attitudes among teachers are the provision of high quality training on ICT and the development of a collaborative climate in schools where power conflicts among teachers and ICT coordinators are minimized. For example, teachers' training on ICT and open and distance learning during the reviewed projects strengthened their positive attitudes towards ICT and ODL, something that is exhibited by their active involvement in the projects. According to the SB6 project, the positive attitudes of pre and in-service teachers that participated in the training seminars were expressed through their active participation to the videoconferences, as well as by the large amount of contributions to the Bulletin Boards. The SB2 project further reported that teachers started to use ICT in "*ordinary"* teaching outside the context of the project. Overall, teachers' training and preparation for their involvement, according to the SB2 project play an essential role because changes in attitudes, the creation of a

knowledge-base among teachers and of a stimulating learning atmosphere take time.

Affective and socio-cultural factors that influence learning processes

According to the SB3 project, ICT functions as a system that shapes students' lives, learning styles, fashion concepts and social relations and produces a multiplicity of technologies of gender, social class or national identity. ICT is more than a system of communication and production tools, it is a culture with rules, genres and consumption patterns of its own. In this perspective, affective and socio-cultural factors related to learning as a result of ICT-based activities have a profound macro-social and cultural character well beyond school culture. ICT as a 'cultural' system has a cross-national character and shares many common elements from country to country. On the other side, the school culture defers from country to country because it is deeply rooted in the differences in the learning patrimonies of European countries. This "universality" of the

ICT culture as contrasted to the national character of school culture creates many opportunities for collaboration and sharing which may positively affect learning processes in schools. For example, according to the SB1 project, trans-national cooperation can raise the quality of outcomes, especially with regard to problem-solving that can take place on a level which reflects the strong cumulative effect of exchanging thoughts and ideas. Similar arguments were also reported by the SB5, SB2 and the SB6 projects. In the SB5 project, art teachers from different countries held different perceptions on art teaching (from approaches focused on design and creation to the teaching of high art) which was productive for sharing ideas and methods. Students also showed enthusiasm in communicating with pupils from other countries which is indicative of the "attractiveness" of perceived socio-cultural differences to them, something that can greatly enhance learning at many different areas (affective and socio-cultural, domain specific, etc). For example, in the context of the SB6 project, pupils exhibited interest in communicating with pupils from other countries and through teleconferencing and the bulletin board pupils had the chance to get to know each other and exchange ideas and information especially on how to construct measuring devices for the study of meteorological phenomena. However, lack of foreign language skills among teachers and students are often barriers to effective communication and collaboration at international level. This is perhaps the reason why the SB6 evaluation research revealed that there was no detectable effect concerning the enforcement of the social attitude of the pupils towards foreign pupils.

Institutional/organisational changes as a result of ICT and ODL implementation

In terms of main institutional changes resulting from the introduction of ICT and ODL into existing structures project findings evidence of "institutional change" only at the level of the schools involved in the sense that new interdisciplinary courses were implemented as add-ons to the existing curricula. However, the courses introduced in schools by SB5, SB2 and SB6 are unclear if they continued to be part of the school activities after the completion of the projects. The SB1 project, on the other side, targeted at sustainable institutional changes through a development strategy for the integration of ICT at school level and the adjustment of teaching methods. According to the SB1 project, a successful reorganizing process moves the use of ICT as being primarily up to the

individual teacher to being a part of the responsibility of schools. ODL was used to establish "research partnerships" where professional researchers and researching practitioners co-operate purposefully on formulated development targets. In research partnerships, on regional as well as trans-national level, different actors in the educational system co-operate purposefully on formulated development targets. Teachers and school administrations have immediate access to up-to-date know-how and are engaged in the development process of their specific school. These "research partnerships" which SB1 established were seen as agents of institutional change. Other findings from project documentation offered some further insights on two institutional issues. The SB3 project concluded that the institutional context of schools is an important factor affecting the use and implementation of ICT. A major institutional factor is the school curriculum, which needs to be adapted to the learning new possibilities offered by ICT. The SB2 suggested that curricula have to be adapted in order to fit to new demands on the labour market and offer up-to-date know-how to students. At school level, the role of the ICT coordinator is sometimes not clearly defined but also schools may lack ICT coordinators. According to the SB3 project, the lack of ICT coordinators is a fundamental problem because teachers do not have a knowledgeable institutional figure to rely upon to seek ICT assistance.

The role of staff training in the projects

The role of staff training was important for all four projects that introduced innovations in schools (i.e. SB2, SB5, SB1 and SB6). Characteristically, teacher training was assumed to be part of the innovations introduced by the SB6 project. Emphasis was given to teachers designing lesson plans so they could apply ODL. The participating university students were also familiarized with the scientific methodology on the study of natural phenomena. The seminars themselves were organized in the form of open and distance learning so that the teachers could develop relative abilities. In the context of the SB5 project, art teachers were trained in the use of ODL methodologies, ICT and multimedia in education. The pedagogical methodology used in the project was based on the combination of real and virtual participation, and the combination of synchronous and a-synchronous communication. In the SB2 project, before the introduction of the project in the classrooms, an on-line course for the teachers was available, in order to serve as a reference guide for the implementation phase. The on-line lessons dealt with ODL, e-commerce and provided guidelines for teachers in the framework of the project. Finally, two recommendations were provided by the SB1 project: that staff training must not focus on single teachers but has to include all involved groups, and that research findings have to be "translated", because otherwise teachers find research findings rather inaccessible and difficult to use in real-life situations.

Main actors, adopters and resisters to the adoption of the innovation as identified in the projects

The main actors in innovation diffusion in all projects reviewed were primarily the project partners and the field researchers, as well as the teachers and students directly involved. From a wider perspective, the SB3 project pointed out that the acquisition of computer expertise as 'social currency' is an activity in which some student sub-groups – usually male – invest significant time and energy. In relation to ICT-related innovations introduced

by the projects, active participation by the students is a clear indication that students "in principle" tend to become adopters of such innovations. For example, according to the SB2 project, the students involved showed enthusiasm and eagerness; in some cases even taught each other and their teachers how to work with the Web and often worked on the project on their spare time. Teachers vary in range from being potential adopters to potential resisters. Within the SB3 project, teachers seem to take full advantage of the degree of freedom they are given by choosing to use ICT or not - based on personal choice, their taste for technology, their aptitude for computer literacy, and/or their convictions relative to the teaching effectiveness of such technology. The result is that the significant pressures exerted on all the players in schools, appear to have a relatively limited effect on the teachers themselves. Lack of ICT skills is a major factor that contributes to resistance in ICT-related innovations. Furthermore, some teachers are sceptical about the potentials of ICT for teaching. According to the SB1 project, some teachers have serious concerns about use of ICT and they want to avoid "experimenting with children". As the SB2 project observes, changing what they think as appropriate pedagogy for the learners, themselves and their subject area may be difficult. This can be even harder when teachers act in isolation from one another and are not exposed to innovative models of learning. Additionally, SB1 pointed out that conservatism and job security in some educational systems can foster resistance to technology. On the other side, teachers who are ICT literate and have positive experiences in introducing ICT into their teaching can be active adopters of ICT-related innovations in teaching. As the SB2 argues, teachers that have by themselves experienced the qualitative upgrade ODL can bring to their teaching practice are effective "promoters" of the idea in the teachers' community. The reviewer identified other pressure groups as playing a potentially important role in the adoption or rejection of an innovation in schools among parents, school administrators, pedagogues, enterprises and political authorities. According to the SB3 project, parents tend to exert minimal pressure to schools. How their demands are taken into consideration depends on local conditions and how good a relationship parents have with teachers in the school. Pressure from administration and political authorities over schools to integrate ICT into school teaching appears to be universal, systematic, and strong but there is not clear indication if this pressure includes ICT-related innovations. Non-economic lobbies do not always share positions. Some are against the computerization of schools and the tendency for commercializing education that they believe goes along with it. On the other side, groups such as educational research scientists who work in the area of the educational use of ICT exert pressure on teachers to change their methods. Enterprises can be active promoters of ICT adoption in schools and innovations related to their interests. For example, in the context of the SB2 project, the enterprises involved were main supporters of the innovations as they profited through the promotion of their products and also profited by the perspective of getting students/trainees as already qualified personnel.

Organizational conditions that are (un)supportive to innovation

The major organizational issues at school level are the arrangements regarding the placement of ICTs in schools. According to the SB3 project in many countries, the administrative authorities tend to favour the computer lab solution. This has some advantages over the solution of spreading computers in classrooms (networking, whole

classroom use). However, as the SB3 project argued, the PCs in the classroom solution allow for more profitable educational activities than those held in the computer lab, where there are schedule-planning constraints. The SB1 suggests that an ICT development plan clearly enhances the capacity of schools to integrate ICT and absorb ICT-related innovations. A detailed technology plan considering funding, installation and integration of equipment, ongoing management of the technology etc. should express a clear vision of the goals of the technology integration. Furthermore, as the SB2 project argues, an organisational culture that is characterized by teacher collegiality and formal or informal collaborative work, both supports and facilitates the development of the organization's members. Other organisational conditions identified by the SB6 project as supportive to innovation are flexible time-tables, flexible allocation of staff tasks and roles, supportive administration and incentives. As it is pointed out, flexible timetables allow involved teachers to organize teamwork and ODL activities; flexible allocation of on-duty time for teachers help teachers design activities and lesson plans, organize collaboration with other schools etc., and the existence of administrative support structures and incentives encourage teachers to engage in innovation.

Socio-Economic aspects of the innovations

None of the projects reviewed focused on socio-economic aspects of the innovations introduced. Issues such as socio-economic background of the schools involved were not raised by the projects reviewed. Other parameters such as the impact of gender or age, citizenship, inclusion were also not mentioned. This is also true regarding the potential socio-economic impact of the innovations. Only SB2 made some contributions on this point as it involved enterprises. As the SB2 project argued, it influenced students' attitudes towards e commerce; they used the Internet more often in order to buy different kind of items at the end of the project. Furthermore, the students considered the Internet not only as a communication tool or a source of useful information but also as a daily service. Finally, students acquired tele-working experiences, organizational and management skills that are key competencies for tomorrow's European workers

What was considered innovative?

The four projects that introduced innovation in schools defined innovation in different ways but shared common characteristics. SB2, SB5 and SB6 essentially defined innovation as the implementation of ICT and ODL in a specific of teaching/learning field (e-commerce, art and science respectively), collaboration among teachers and students at international level and training embedding ODL activities. On the other side, SB1 build upon the idea (and its implementation) that the essence of a successful reorganizing process is to remove the responsibility for implementing ICT in schools from teachers to higher administrative units.

What was the role of ICT in the innovations?

In the context of the SB2 project, a web enabled application platform was developed that incorporated two major components: the e-shop and the e-tool.

• E-shop: is a distributed learning environment which included facilities to produce graphical representations of the sales of a product, to compare actual and anticipated performances and in general what is necessary to monitor the financial activities of a real shop. Using the e-shop the students promoted agricultural products of their areas in order to sell them on the Internet. Students also had the possibility to endeavour the sale of products through an electronic shop that has the form of an interactive web page. In this way the reality of modern economy practices has been transferred into the classroom.
• E-tool: is an educational tool, enabling to visualize weekly sales and from which countries purchases were made, to compare the estimated and the actual sales, etc. Students could then discuss whether their estimations were right and if not what they could do to promote their product in the "market", to enhance their sales etc.
• E-mail and telephone, videoconferences and bulletin boards were used as communication facilities generating and supporting dialogue within the ODL project.

In the context of the SB5 project, communication via the project website and the development of multimedia elements on the CD-ROM were integral part of the pedagogic methodology. The SB1 project did not concentrate on specific hard- and software or tried to develop new tools but aimed at the continuing improvement of ICT implementation in teaching and training. Regarding the SB6 project, the role of ICT was central to the innovation introduced; its role was to be an add-on to existing school practices. According to the SB6 project, the involved partners tried to create a style of its own blending the 'best' of old and new practices: maintaining good teaching, maintaining the positive experience students have while working collaboratively on projects to solve real-world problems, but adding new technologies and new pedagogies to accompany these old values.

Were the innovations studied sustainable/scalable?

The "SB2 e-shop" is considered as sustainable outcome of the project which may be maintained as an e-commerce training tool by interested parties after the completion of the project. However, SB2 partners felt that scalability is limited as more project partners would lead to confusion. The positive experience gained from the SB5-project became the starting point of a follow-up project. According to the SB1 documentation, the project had an immediate impact in staff and administration of participating schools and in the policy development of participating countries. Results were also extended in other educational areas. SB1 states that for instance, in Denmark the eLearning strategies were applied in the extensive national quality programme on special needs education, Members of the SB1 network participate as partners in this innovative project about ICT and special needs education. Furthermore UNESCO is applying the strategy and experiences in an upcoming major third-world education project. According to SB1 several members of the their network participate in UNESCO's eLearning project. The SB6 project partners made an effort to integrate the use of ICT and ODL in existing school curricula with a view to maximizing the sustainability and scalability of the project activities. In this context, according to the SB6 project, an interdisciplinary subject, such as meteorology which was selected by the project, is easier to integrate in the curriculum than a "conventional" non-interdisciplinary one because the teacher will have much more time for the project's implementation during the school weekly program.

2.3 Adult, Open & Distance learning sector

General Introduction

Six projects were reviewed, all of which were initially, fully or partially funded under the SOCRATES MINERVA action. The reviews and subsequent sectoral synthesis are intended to focus on the following questions and parameters: what are the new methodological approaches to learning in ICT based learning scenarios: what are/were the main institutional/ organizational changes as a result of ICT and AODL6implementation: what are the socio-economic and socio-cultural aspects of e-learning innovations.

Only two of the projects (AODL1 and AODL2) had been at the time of the review completed under the original contractual terms of the Minerva Action, the rest continued in progress or have been extended. One has been in progress since 1999. Access to documentation about the projects has consequently been varied, in some cases interim or final reports were not available and a detailed examination of "products" or outcomes, has not been done because as yet most were unavailable. It was therefore not possible at this stage to indicate, rather than speculate for example, what effects can be determined on organizational or institutional structures in specific entities as a result of ICT and ODL implementation.

AODL2 which was a one year project initially under this action now has continuous funding under other funding sources until at least 2006 and appears embedded in the 14 European university institutions that currently offer the seminar. AODL1 is completed but there are indications that it suffered from under-funding and perhaps not meeting the expectations of the Commission which is manifested in very delayed payments, although this is not totally clear. AODL6 which started in September 2000 is still in progress and has been extended until March 01/2004. At the moment the project does not have final results. AODL3 which is co-funded stSB5d in 1999 but has been extended until the end of the summer 2003: the open and distance learning part of this project was funded under the MINERVA action. AODL5 and AODL4 which were more recently incepted are in progress.

All of the projects were concerned with the production of on-line open and distance learning courses for various target groups and users and in most cases involve training and familiarisation of all users (teachers and students/users) in the media used and an understanding of the "interactivity" or "cross-walking" that the new technology engenders. In addition, the development of course content and transmissive methods between users appropriate to multimedia platforms is perceived as a function of training/learning to be embedded into the whole process. All the projects indicate a full understanding of the need for adaptation of traditional curricula and teaching and learning methodologies to new media. As all the projects were initially funded under the MINERVA Action it was a precondition that the projects would be engaged in cross country collaborative activities which involved exchange of knowledge, results and practice and the sharing of resources and data. Most of the projects explicitly referred to issues of pedagogic practice including

course design, increasing interaction and motivation: organisational issues such as arrangements for interdisciplinary/ international collaboration, information and communication concept, and costs and marketing: issues such as functionality and multi-media integration were also referred to. Some concerns were expressed on issues relating to lack of clarity and practice in areas of copyright law and privacy.

All of the projects to a greater or lesser degree incorporated characteristics of what have been termed learning technology clusters. These include simulation systems (typically focusing on individual learners and a "cognitive constructivist" approach) – also now using virtual reality platforms. Interactive classrooms – typically retaining the conventional didactic "teacher-student" metaphor: the virtual campus – the conventional university or aspects of it revamped to accommodate to technology use: knowledge networks – mainly involving and putting together constituencies of experts – an example is the co-laboratory: and learning communities with an emphasis on social inclusion and co-production of knowledge. It is not apparent that in themselves the array of IC technologies used in the projects reviewed generated or imply new forms of learning or that they have enhanced access to education or learning opportunities previously not reached. There was however with AODL4 an attempt to reach out to a demographic group not recently associated with technological literacy – the retired and elderly. It is the case that what we do see in the main is the application of stable technologies into new contexts and new domains in an attempt to develop new forms of association within educational communities. It might be fair to comment that this represents a process of making conventional forms of learning more accessible for more people already within or nearly within technologically literate communities. Innovation as a notion in this context is therefore contested. What we do see are "innovation images" reflecting the complex interaction between economic, institutional, technological and educational forms and processes. There is little evidence that learners and users are allowed a major input into the design of the systems: systems which are often defined by assumed characteristics and needs of the target groups. There is also little evidence of new methodological approaches to learning in ICT based learning scenarios being developed. To a large extent this state of affairs in projects like these may be determined by the structure and approach of the funding agencies from which they seek support for the trialing of their activities as well as reflecting rigidities in institutional structures, methodology and practice.

All of the projects as we have noted, in line with European programme criteria, are pan European usually connecting various types of educational entities and in some cases connecting directly to industry. What is clear is that the particular structures have great variation in the degree to which they can implement new learning technologies. The disparate and outreach nature of adult education with its important component of informal and non formal learning, open access and its more varied users combined with historically inadequate funding in infrastructure has greater difficulties in accommodating new learning technologies for its purposes than is indicated for example in the implementation of the higher education based AODL2 on line seminar. These six projects involve 14 countries with a range of institutions involved: the dominance of higher education institutions was noticeable.

Country	HE	Adult Education & Distance Ed. Centres	Schools	Industry/ company	Nat/Int Organization	Outreach
Italy	6		1	1		2
France	3					
Germany	6		1			
Hungary	2					
Spain	3					2
Netherlands	2		2			
Belgium	2					
UK	5				1	
Austria	4		6	1	1	
Czech R	1					
Norway	1	1				
Denmark	1					
Sweden				1	1	
Portugal		1				

Scope of projects reviewed

AODL6 aims at developing an internet-based ODL-course for teacher training in the field of inclusive education and at providing an information and communication resource-network for teachers and experts in this field. The central course material is intended to be online or as CD-ROM for individual studies. Course providers can get licenses for the course and enrich it with their own materials and student assignments. The online course is described as "*surrounded by an information network that represents the regional infrastructure in the field of Inclusive Education*". The project follows the objectives of the Salamanca declaration of the UNESCO (June 1994), which stress the importance of Inclusive Education of children with special needs for their individual development and for the development of solidarity in society. One key issue for the development of inclusive schools is teacher training and to the knowledge of the project currently there exists no ODL-framework for this goal that is sufficiently complete with respect to the content, the targeted academic level and an adequate didactical setting. The AODL3 pilot project is described as establishing and operating an actual and a virtual network of (university) colleges in the North Sea Region to enhance knowledge and awareness about the North Sea regional and social cohesion, resources conservation and development, thus supporting a spatial development oriented trajectory to the Virtual Universities for Europe. A range of modular courses are being offered at postgraduate level within the on-line network which are: MSc in Integrated Coastal Zone Management, MSc in Sustainable Tourism & Hospitality Management and MSc in Building Surveying and Real Estate Economics. The AODL4 project is concerned with how to address the issue of increasing collaborative participation in use of IC technologies as a learning medium for the over-sixties on a pan-European basis. The dual goal is to get people normally not IC users into new media usage through telecommunication and satellite technologies in the context of a lifelong learning dimension, and at the same time, develop course materials based on an appropriate pedagogic model to train people over 60 how to live healthily, improving and developing their lifestyle and leveling up their general quality of life. AODL5 is concerned with establishing an internet-based virtual institute focused on knowledge sharing and integration of competencies in the educational and research area of analysis, design and

performance evaluation of industrial manufacturing systems. The project aims to promote an active and participatory role of students by involving them directly in concrete project works based on real industrial case studies (provided by two industrial external partners of the consortium). AODL5 is to be implemented in an Internet portal which offers students and researchers from around the globe opportunities to study, teach, research and communicate.

Of the two completed projects, AODL2 was originally a one year pilot for the development of an on-line Seminar on processes of social transformation and social exclusion impacting on European cities and metropolitan areas and to base its interaction process on AODL6IC technologies allowing a cross-country dissemination of recent theoretical and empirical findings in the field. *socializing* participants without ODL teaching experience to use IT devices within their teaching activity. It currently operates across 14 European Universities and offers a 72 hour accredited postgraduate module on an annual basis. It can be described as having achieved both sustainability and scalability. AODL1 is described as the cooperation of European partner institutions to make progress in the practical implementation of "electronic learning" in adult education at a distance: a kick off for the partner institutions to make a leap forward with regard to changing traditional ways of distance learning towards new and innovative ways of teaching and learning in LMS. Specific outcomes were the development of courses in introductions to the Internet for teacher training students customized to their particular institutional and cultural HE6ings.

Definitions of e-learning within the projects

The European e-Learning Action Plan (2001) defines e-learning as the use of new multimedia technologies and the internet to improve the quality of learning by facilitating access to resources and services as well as remote exchanges and collaboration. The American Society for Training and Development defines that e-learning is the use of the Internet and digital technologies to create experiences that educate. E-Technologies do not change how human beings learn but remove constraints: e-learning is not just web-casting lectures and not training materials dumped on-line (Horton 2001 quoted by Varis) All of the reviewed projects to a more or less degree can fall within the paradigms suggested above. However, on the basis of the so far existing available documentation, the notion of e-learning is not specifically attributed within the AODL2, AODL5 and AODL4 or the other projects. Rather it is implied as a “landscape” in which IC technologies are perceived as an “array” which add to, facilitate, go “hand in hand” with “traditional” methods of learning, discourse, instruction and teaching and which widen access for users. The clearest exposition of this comes from the AODL5 project, for example, which reports that its virtual institute concept calls for a coherent analogy with a “real” institute and this is the main design principle in the creation of the architecture of the web portal site. The AODL5 environment is not being created to completely replace "face-to-face" learning, but to support it with specific distance learning components, with adjunctive contents and the support of collaborative on-line services.

New methodological approaches to ICT-based learning innovations

The main focus of AODL6 is to develop a teacher training course for beginners in the field of inclusion and aiming at the development of a professional attitude of the students in their respective areas of work. AODL6 was concerned with developing on line course content that took account of different forms of teacher training throughout Europe. The main learning issues were not specified for AODL3 but it was indicated in project documentation, that the content of the three Master study programmes will be used to facilitate a *"learning through doing"* approach. Through partnerships with local university colleges, AODL3 will try to facilitate greater access to higher education for students with special educational needs and will deliver education programs, which are particularly suited to students in the more remote and rural communities of the region. Target groups were described as 'regular' and 'continuing' students, as well as industrial target groups, SMEs and special social groups. Students will be encouraged to complement their home university study programs with credit-bearing courses from other institutions. Additionally, they may be able to complete their final year studies at optional campuses if they so desire. All AODL3 study programs will be accredited in line with national credit accumulation and transfer standards.

AODL5 is concerned with evaluating the effectiveness of its technology platform particularly as a means of examining whether teachers and students will be able to a greater or lesser degree share questions, information and knowledge exchange. The platform will consist of five sections modelled on the structure of a real university and providing educational material and tools for theoretical lectures, practical laboratory activities and virtual visits to industrial manufacturing companies. There will be auxiliary services of the Internet site, such as chat, forum, messenger and other services, to facilitate communication amongst students and researchers. AODL5 courses will be designed according to a modularization principle in order to allow customisation and delivery of on-line courses in the different educational institutions of each national project partner. For AODL2, the interaction via chat (synchronous) or via forum (asynchronous) is perceived as creating a new learning community, exploiting the new IT and allowing debate on precise issues addressed in the written lectures and in the reading material. These relatively new media are seen to partly modify the interaction rhythm and the way contents are presented. Both students and scholars go immediately to the information/communication point and what are termed *shy* students are expected to participate more actively to the interaction process. The notion of co-production seems underpinning in that scholars- tutors- students proactively function together in the "learning process". AODL1 reported that there was a strong focus in the partnership on the practical work with adult learners, which meant that each of the partners working with adults dealt with pedagogical issues in the implementation of e-learning methods, in particular with the methodological challenge in the change from paper-based to web-based material.

Teaching and learning philosophies

The reviewer noted that for AODL6 the main goal is to have *"…. high structure and high dialogue" ….. believe, that highly structured course material is necessary to ensure a scientific level of interaction and to make the inherent cohesion of the subject visible. We*

don't think that only open tasks and assignments with a high level of dialogue and cooperation are sufficient to reach this goal. (Besides the workload of teachers would be exorbitant when trying to reach the same results only in discourse.) And …. think that a high level of discourse is not a contradiction to highly structured materials. On the contrary, the combination of these issues ensures the utmost autonomy of the learner while guaranteeing a discourse on an appropriate level of scientific understanding". Students are able to reach a high level of understanding of the subject by studying individually and contribute their findings to an open discourse with peers, tutors, and teachers. AODL3 reported that the programs are developed to support flexibility. AODL1 perceived that pedagogical and methodological issues are at least as important as technological ones. However the project commented that, *we felt quite left alone, as a so-called methodology of e-learning is hardly in sight until the present day.*

The AODL5 platform has been planned in order to be modular and adaptive to the characteristics and needs of the users: the teaching methodology of the teachers: the peculiarity of the content and topics concerning the different subjects. In addition to the educational materials a great number of synchronous and asynchronous services have been provided as routes for users to get in contact and interact. The project will be able to examine whether teachers and students will be able to a greater degree to share questions, information and knowledge exchange. In AODL4, the underpinning of the pedagogic model proposed is rooted in extensive research in gerontology and pedagogy in an open and distance learning context and on practice in the field. Modern technology can bring about *"presence at a distance"* (through video-conferencing, chat rooms…et al) and AODL4 has developed an ODL didactic model with a method of teaching/learning that is synchronous (teaching and learning happening at the same time, but not in the same place) and diachronic (training and educational processes that are no longer tied to the same time and place). AODL2 considers all participants to be co-producers of knowledge or "multipliers". Each on-line seminar adds to the knowledge and experience previously gained. There is a trickle down effect which first produces and adds to material in the field and secondly "socializes" those participants without ODL teaching experience to use ICT devices within their teaching and learning activity. The use of innovative technologies allows the overcoming of the time-space gap giving more effective access to up-to-date information from ongoing research at a European level. Whilst essentially the, *"seminar",* is a traditional scholar-tutor-student relationship with embedding in what can loosely be termed as an intelligent tutoring system platform, a distinctive feature is the underpinning notion of all participants being "multipliers" – adding to the general stock of knowledge.

Teaching techniques, methods and devices

AODL1, in order to address the pedagogical and methodological questions and the transfer from paper-based to web-based material, initially decided to develop their own LMS which proved very difficult and in consequence decided to focus on testing commercial systems and to develop evaluation criteria for their use in daily practice within adult education. These included Blackboard, First Class, Lotus Learning Space, eLS and Formare. BSCW was used as an electronic workspace and communication tool. Electronic networks were established and electronic learning platforms were established in partner institutions

working with adult learners. AODL6 developed online course material to be used by the individual student and rich media (mostly video) was used to present insights into classroom or other field work. The system included Base LMS. eLearning Suite (Hyperwave Systems) but had to be substantially modified to suit project needs. The most important modifications were: introduction of a course graph with required and optional paths for the student instead of a linear course structure: provision of an appropriate navigation system for this complex course structure: introduction of SMIL-based media (e.g. video plus subtitles): implementation of an assessment workflow that required the student to perform certain tasks before accessing the next content. This then allowed exchange with peers, tutors and teachers in structured forums: live communication in working groups (chat-based): group work in projects based on workspaces: experts-exchange on specific problems (problem solving approach): providing different assessment methods that gave enough flexibility for complete online assessment, but integrated conventional assessment (offline): provision overviews of assessment results for the students, tutors and teacher: implementing direct links between course content and forum discussions.: implementation of a small workspace feature for project oriented group work in close relation to the course content. For the exchange platform the project adapted a version of the community platform phpbb, added expert lists, a voting scheme and content-management features. Video is perceived as the main medium for presentation of practical examples into the classroom ISU uses web based content and services. Face to face seminars incorporated visual material (video) and new information was able to be presented online every week.

The AODL5 platform has been planned in order to be modular and adaptive to the characteristics and needs of the users: the teaching methodology of the teachers: the peculiarity of the content and topics concerning the different subjects. In addition to the educational materials a great number of synchronous and asynchronous services have been provided as routes for users to get in contact and interact. The project will be able to examine whether teachers and students will be able to a greater degree to share questions, information and knowledge exchange. The AODL5 consortium will test this integrated learning scheme in the context of different educational institutions, ranging from Universities (i.e. IFA, INPG and Politecnico di Milano) and research centres (i.e. SZTAKI) to secondary schools (i.e. ENFAPI Briantea). The devices specified included: Virtual lecture theatres: Virtual Tours of industrial sites: Virtual laboratories: Virtual library; Content providers: Network services: Content services (modules & tools): Communication Services (Blackboard, Agenda): Interaction Services (Forum, Chat –in real time, User Homepages): Evaluation Services (self assessment, examinations): Administration Services (Administer course, edit course with on line web editor, edit quiz). It should be noted that AODL5 derives from extensive testing in single institutions over a significantly long period of time. In AODL4 – the open and distance learning component is comprised of -teacher's video-lessons (broadcast over television) -practice exercises (through Internet, multimedia material, video and computer conferencing) distance tutoring (through telephone, video, audio, and computer conferencing, fax, e-mail, computer forums and chat rooms). The Web site is aimed at allowing the target group to be fully involved in the project and at the same time to be tested regarding their attitudes towards new technologies and ODL courses. In particular the didactic function of the web site will allow linkage of lessons broadcast on TV with the activities part of the distance learning method. Through the web site the users

will interact with their tutors, carry out exercises on the web, study and extend knowledge on some specific themes surfing on the web, using computer forums and chat rooms. The users will be involved in the set up of a direct channel with the video-teachers, the tutors and other users to create a meeting crossing point in a dynamic environment where everybody can share and discuss his/her opinions.

AODL2 uses two main technological environments: a web site on which all the didactic material is published: a computer conferencing system - realized via the FirstClass© software -that permits the creation of virtual classes in which professors, tutors and students can interact: QTVR technology for visual mapping. QTVR allows the creation of interactive virtual reality scenes with point and click simplicity: photos and computer renderings can be turned into 360 degrees views called panoramic views as well as object movies that allow users to view an object from all sides: both objects and panoramic views can be fully interactive, with zooming, animation and hot spots linked to other multimedia objects. The FirstClass© software permits: send and receive e-mail messages in a protected environment (just emails related to the seminar will be processed in this environment: send e-mails to public forums on specific topics: Chat in a protected environment. Each teacher prepares a written lecture on a specific topic that is published on the AODL2 web site and is discussed with the students in a synchronous chat. The teachers participate in an online forum (minimum period: the week after the chat), to answer the questions that the students may pose him/her by e-mail and, eventually, to tutor one or more students for his/their final paper/s. The role of the European tutors is to co-ordinate the work of the local tutors and to moderate the twelve synchronous chats. The local tutors (one in each participating university) have the following functions: They inform the students about the reading material and the activities to be done each week: they answer the e-mails sent by the students about various problems related to the seminar: They co-ordinate the relationships between the online students and the forum students: They help the students, in collaboration with the professor, in the preparation of the final paper. The web master's role is to organize the structure, the graphical appearance and general organization of the web site and to this collaboratively. After this first organization, together with a constant monitoring and upgrading of the web-site, her/his functions are the following: To publish on the web site the twelve lectures provided by the teachers each week for online reading: To publish on the web the text of the chats: To create and manage an online forum: To create the online evaluation environment: To answer to the questions and comments posed by tutors, teachers and students related to the general organization of the web-site. The IT Manager has to provide a stable and user-friendly technological environment for the correct development of the seminar in collaboration with all participants. For each university involved in the AODL2 project 3 or 4 students are able to participate actively to the seminar. The total number of the online students is always only between thirty and forty.

Teacher and student roles

All of the projects indicated recognition of the change from a teacher-centred to a learner centred approach – a trend not wholly deriving from new technology use. However, it is clearly not the case that this trend makes redundant the traditional role of teacher. What is interesting as far as can be ascertained is the retention of what is called the traditional role

of the teacher together with not merely a recognition of "students" as co-producers of knowledge but a real intent to explore whether the technology will enhance that extra dimension in the teaching/learning process and if so how to embed it. This could imply a new methodological approach in the pedagogic paradigm in the context of new learning technologies but only where it also encompasses a self-conscious recognition of the need for new competencies for all users and a thoroughgoing process to recognize and develop those competencies. This is a complex process and goes beyond, but includes, training and socialization of users in technology devices and introductory courses to the Internet. Overall, in all the projects the roles of teachers and students, regardless of the context remain unchanged. This does not mean that this will not change but the evidence for this is not yet apparent in the reviewed projects. The outcome of AODL4, however may give rise to some differences as the target groups of users are among people long outside the protocols of the educational arena. This may also be true of the AODL6 approach. The AODL2 project is based on the interdisciplinary co-operation of well established academics in the field of urban studies in general and of social exclusion, housing, segregation, migration, poverty, social policies in particular. Whilst it presents as a traditional postgraduate academic seminar conducted virtually, it is significant that that each participant including technical support is perceived as a co-producer of knowledge. In that respect the IT manager and web master are embedded into the process. As in some of the other projects the notion of "roles" of teachers and students in some emergent way is being challenged.

Teacher and student interaction

All of the projects are concerned with enhancing teacher, student, user interaction and all of the projects contain a similar range of services which they specify as aimed at improving interaction. These as noted above, include content and communication services, interaction services (Forum, Chat –in real time, User Homepages) and Evaluation Services (Self-assess, examinations) together with Administration Services (Administer course, edit course with on line web editor, edit quiz etc). Interaction depends not merely on the technology devices used but on the users clearly *"seeing"* how to do it. Some projects appear more transparent than others in this respect. Users of AODL4 through the web site can interact with their tutors, carry out exercises on the web, study and extend knowledge on some specific themes surfing on the web, using computer forums and chat rooms. Users will be involved in the set up of a direct channel with the video-teachers, the tutors and other users to create a meeting crossing point in a dynamic environment where everybody can share and discuss his/her opinions.

AODL2 typifies a high level teacher-tutor-student interaction which is characterized and contained by the limited number of participants in each seminar. This does not preclude "public access" in that students from the other courses of the teachers involved in the project can visit and interact in the on-line forum. Interaction in respect of AODL2 can best be understood by viewing the format of the seminar: The current form of the seminar corresponds to a course of 72 hours (run Jan to June each year). Participants have to read papers in the English language, attend the online seminar according to the syllabus and the visual seminar, and write a final paper. Specifically this involves: attending 12 online lectures after having worked through the reading material prepared ad hoc: make use of a

web based forum for further academic discussion on the issues at stake: participate in the visual seminar during which they will be asked to take pictures of their own city or urban environment according to common guidelines: write a final paper, either at their home institution or at one of the university/research centres the scholars belong to or within the UrbEUROPE RTNetwork which is now co funding AODL2 : All activities are carried through the internet and participants receive userID and passwords to access restricted area domains. A typical "week" of the current online seminar is organized in the following way: The first day of the week a written lecture, integrated with bibliographical material, will be published online.: The students have the possibility to read it for thirteen days: On the fourteenth day the teacher, the students and the tutors meet each other in a virtual class in the Firstclass environment for a chat.: On the fifteenth day the web-master will publish the text of the chat: In the following days, all the chat actors have the possibility of continue interacting in a public forum published on the web site. What is characteristic of AODL2 is the transparency of its structure to all participants and the integrated technological platforms that facilitates interactive virtual working.

Attitudes of teachers & students towards ICT

AODL5, AODL2 and AODL4 all indicate highly positive attitudes from teachers and students. In the case of AODL2 all participants are fully committed to the use of new technologies as the purpose of the project was the creation of an online seminar using multimedia platform which was rooted in considerable technical demonstration and practice derived from four successful experiences in line distance learning. All three of these projects derive from long standing experimentation in the field and it may be that a cadre of committed practitioners and users has moved forward together accumulating knowledge and experience and able to operate in established (if not perfect) structures for virtualized ODL. On the other hand, as has been noted, within adult education and in the arenas outside of higher education, open and distance learning in electronic learning environments, as AODL6 has emphasized, is a very big challenge for staff members. They comment that on the one hand, it quite often leads to higher motivation among younger teachers, but on the other hand it favours competition among teachers and fosters anxieties which include being regarded as a loser in case of computer illiteracy and increases the readiness to retire or leave the institution. Teacher attitudes can therefore be hostile and unsettled. Within adult education, students perceived the PC as a useful learning tool but AODL1 found that many adults who used PCs in their workplace were less than enthusiastic about using the PC as a learning tool. AODL3 reported the comments of one teacher who taught the same course for traditional on campus students and for distance online students. He noted that he used the same online course material for distance students and for on campus students and that his personal view was that the face-to-face students were less enthusiastic about the online material and also that they obtained better grades than the distance students. In AODL1 six colleges for second chance adults in one province were selected as model schools focusing on practical implementations of e-learning. The outcomes appeared successful on the part of the students and it was clear that teachers were happier when focusing on teaching and pedagogy rather than the technology and administration.

Assessment

All of the projects incorporated various forms of online assessment including self-assessment. Within AODL6, types of assessment-workflows were integrated into the LMS and included formative assessment (Self-tests with direct feedback: Directly linked contribution to a forum requesting peer feedback: Submission of tasks to tutors with ASAP response) and Summative assessment: Submission of papers to teachers with grading workflow: Submission of group results to teachers based on workspaces: Integration of offline assessment results into the assessment workflow) AODL6 described the assessment system as forcing the student to engage seriously in the learning process: Peer feedback leads to mutual help and sharing of knowledge. The assessment system integrates well into the conventional workflow of teacher training institutions. The project reported that their evaluation process will be mainly concerned with contents, tasks and assignments and adequate assessment procedures with the clear objective to enhance the course by itself. It can be assumed that the outcome of the evaluation process will more clearly present the pedagogical issues specific to this very specialized area.

Within AODL3, traditional exams have been used together with ECTS grading. In respect of AODL1 the reviewer reported that the project stated *..."it (assessment) turned out to be hard. We only had experiences with comments & feedback in word documents"*. Later in the project focus was turned onto assessment tools that were integrated in commercial LMS systems. Initial activities undertaken were with regard to electronic corrections and marking. AODL2 requires completion of 72 hours of course work, successful completion of which will earn 9-18 ECTS credits and various self assessment and checking systems are available online.

Teacher workload

It was reported, particularly by AODL1, AODL3 and AODL6, that although face-to face meetings as well as communication, feedback and guidance via Internet-services are regarded as essential elements of computerized distance learning, it is very time-consuming and demands adequate evaluation. Currently teachers feel that they have to do lots of extra work without getting extra money. AODL6 teachers needed professional support with regard to content creation and the use of authoring tools and did not want to be exploited as cheap content developers for companies. The project did not provide any recommendations on how to decrease online teacher workload. There was a clear and obvious increase due to the fact that teaching at a distance in LMS requires large input and coaching on the teachers' part. Within AODL6 - self-tests for students are used to reduce teacher workload; also many tasks address groups of students and ask them for peer evaluation. Readymade expert-statements in forums are introduced automatically when the students have written their contribution. Most important for the reduction of workload is the use of tutors (alumni): Teachers can handle a larger number of students than in conventional courses. In AODL3 - teachers reported a heavy workload, even though they could be characterized as technology enthusiasts. They received additional pay for the teaching or the project paid the department to reduce their ordinary workload. AODL1 reported that new flexible competence centres for distance trainers were to be founded to also provide technical support in the field of multimedia. No reporting from projects was available on this area from AODL2, AODL5 and AODL4

Teacher collaboration

All the projects were aimed at increasing teacher collaboration. Within AODL6, the "teachers-exchange" platform offered teachers the online-facility for cooperation – and to problem solving with respect to the e-learning course. Teachers provide others with their experiences and offer new modules and ideas for enhancing the courses. AODL3 reported that online teaching was a *lonely* activity and that there was little collaboration among online teachers. The communication was between the tutor and the students.

Within AODL1, for example material was developed within the project and a European network of teachers was established in the project's electronic workspace to foster co-operative activities among teachers in the participating institutions AODL2 comprised international scholars who are well known in their field and to each other and who are used to common and regular exchange of ideas, experience and knowledge: Collaboration is high. AODL5 and AODL4 indicated high levels of collaboration.

Institutional/organizational changes as a result of ICT and e-learning implementation

In terms of the main institutional changes resulting from introduction of ICT and ODL into existing structures , AODL3 reported that the project faced various administrative and financial challenges. Among other things it has learned to: Start with clear agreements, including realistic budgets, work plans and legally binding contracts between partner schools: Ample time is needed to apply for permission from government entities to create new programs and market the programs successfully. AODL3 was restricted in its timeframe. Legal issues also needed time to be resolved: Individuals need the backing of their institutions. Likewise, administrative bodies need to have gained the interest of teaching faculty: Be prepared for personnel changes. There were however several barriers related to copy right issues which raise serious questions for organizations.

The following comments were contained in the review of the completed project AODL1 on organizational change: *All partners who work with adult learners realized computer based open and distance learning courses in electronic learning environments by the end of the project period which can be regarded as a big step forward, in particular because most of them used the project as a vehicle for innovation in their own institutions thus restructuring the courses. Obviously, this can be regarded to be part of the success story of the project. However no specific details of change were included*

In respect of AODL2, from the technical point of view, the project was located and derived from four successful experiences of online distance learning: Urbana 98 :Economica Online: Urbana 99 and the Italian intra university online seminar, held in Italy within Urbana99 in connection with Economica Online and the University of Naples (ad *hoc* domain on the Urbana server). These courses indicated that the organizational and technological structure (including LMS) proved to be adequate in fulfilling similar aims in

respect of AODL2. This might of course merely reflect the infrastructure available to the university sector where joint information infrastructures have long been a feature of this sector, in varying degrees of quality and extent, of course. However it is clear that other sectors like adult education because of historical under-funding and lack of organizational coherence, are burdened by a lack of or uneven development of information infrastructures.

Both AODL2 and AODL5 have been tested over a long period of time and as a result appear not to have particular organizational problems relating to systems integration nor in extending to access outside of their university environments. AODL5 is able to test the integrated learning scheme presented in its project across a variety of institutions, including universities, technical training institutes, research centres, and secondary school. The project has also consolidated long standing industrial liaisons to function within and as a supporting bridge out into the industrial landscape. AODL4, also benefits from deriving from RAI-NETTUNO-SAT experience, a tried and tested open and distance learning exponent in satellite, internet and multi-media integration.

Undoubtedly the special aspect of outreach work in an excluded sector will generate problems of organizational change for this project but there are indications that the flexibility of the existing system will be able to absorb and adapt to any new requirements.

Staff training

The view that the teachers' role changes considerably with the introduction of computer- and web-based training courses and this change requires tailor-made teacher training in ICT in general and tailor-made teacher training courses in particular is apparent in all the projects.

The AODL1 project noted: "*Not surprisingly, the role of the teacher "from the sage on the stage to the guide at the side" was at the core of their considerations. Today it appears to be a plain truth that effective e-learning at a distance requires a lot of coaching, advice and communication between teachers and learners. Thus we felt that teacher training has to be a main priority and we therefore set up a lot of activities in the teaching staffs of the partner institutions and integrated teacher training in our work plan. Participating institutes for the further training of teachers contributed in this respect and our own AODL1 course model for teacher training was developed."* In AODL1 special emphasis was placed on teacher training and a large number of courses were realized in the participating countries. A joint AODL1 training model for teachers in adult education was developed by the participating teacher training institutions from Austria, Italy and Sweden]. Various and widespread initiatives were undertaken in in-service training at the participating institutions, with specialized courses referring to LMS and material development and additional courses at regional, provincial and national levels in co-operation with teacher training institutions. AODL1 however reported that "as far as the coordinator knows, the "old" partner institutions pursued their efforts to do teacher training on a broad scale", which would imply some issues of follow-up.

AODL6 was focused on teacher training in the field of inclusive education. The instruction

of teachers and tutors for handling the course is done by starter seminars at the partnering institutions, with handbooks for the different roles in the course and short meta-courses on course-management. Teachers and tutors are able to offer a course based on the LMS. Clear strategies for on line teacher training have been presented by this project. They made the point that there is no general strategy for online teaching and the uniform-ness of e-learning platforms suggests that a given toolset is sufficient for the implementation of any course. They consider five issues as crucial for the successful use of online courses in teacher training which include: learning and working in groups: rich student activities: guidance by tutors and teachers: integration of face to face seminars and classroom and field work examples and tasks. Online education cannot avoid the need for integration of real contact and field work from local and regional settings. With AODL3 - the only training the tutors had was a course about the LMS system which was offered to all college employees. For AODL2, training or "socialization" to the technology is undertaken at the inception of each new seminar. AODL4 training is embedded in the sense that course content development is done by tutors who are familiarized with the technology and the architecture of the media. No information was available as yet on AODL5.

Main actors, adopters/resistors to the adoption of any innovation identified within the project

Findings from some project reviews indicated that where staff perceive the technology as in some way threatening their jobs or significantly adding to their workload serious obstacles present themselves to implementation. It does seem that current systems are best suited for courses with a high percentage of presentation which means that they are easily adapted to technical subjects and subjects with high degrees of facts and fixed information. It therefore is easier, although not problematic to adapt these kind of courses to distributed presentation within existing structures. AODL6 noted that integrating existing curricula makes it easier for an institution to absorb the course into their curricula.

Organizational conditions (un)supportive to innovation

Within the adult education and school sector implementing and servicing electronic learning management systems is extremely difficult and often cannot be sustained within existing organizations. A very important point has emerged that is related to the need for experimentation and testing and which does have organisational implications. Current e-learning systems and platforms show a wide variety of systems based on different paradigms and emerging standards: most systems have a very specific focus and feature set. The ideal situation would be to develop the whole content and the course structure, devise all tasks for individual students and groups with the appropriate evaluation procedure and then survey and select existing systems and choose the appropriate platform. As noted by AODL6 this approach is impossible within the required results and funding structures for Socrates projects. Most organizations particularly outside of the higher education sector cannot afford either in terms of investment or time to allow that kind of in house activity. The indications are that extra or supra entities are necessary to ameliorate the rigidities of existing organizations in this respect.

The outsourcing of the tasks required was often necessary including the development of

content. Higher education structures, whilst maintaining rigidities, however do have large joint information infrastructures which often operate nationally and internationally and have done so for considerable periods of time. This allows for considerable support for students and teachers in accessing and manipulating new technology and in wider opportunity for customized content development. In view of the difficulties noted particularly within the adult education projects there seems to be good reason for investigating how large scale information infrastructures could be developed at regional, national and international levels.

The experience of AODL1 highlights this problem. Rapid technological development required a new orientation in the project and the work plan. Within the contractual period (1999 - 2001) several adaptations had to be made, as more and more electronic learning management systems appeared on the market which made "home-made" web-based solutions not only look unprofessional but also unsatisfactory. The presentation and evaluation of electronic learning management systems (LMS) supported the decision making process of the participating institutions as the priorities were set upon the development of evaluation criteria and the reliability of LMS in the daily practice]. The lack of standards and evaluation criteria in educational software and electronic learning management systems is still noticeable and makes decision-making very difficult. Beyond that it also turns out to be an obstacle on the way to convince teachers to use ICT for their ODL-classes and it was hard to develop feasible incentives for teachers to start using the technology and in the beginning the project was regarded as the teachers' enemy. Technology issues and services should be "outsourced" to specialists but there are cost implications in this.

On the other hand, *"quick and dirty products"* – tailor-made interactive assignments - are gaining more and more importance as they rather correspond with the teachers' needs and approach rather than highly professional and complex multimedia material, designed for the leisure-time market and not for courses aiming at a qualification level.
Copyright issues (sound, pictures and texts) still seem to be unsolved for teachers and the insecurity in legal terms makes them withhold material they have developed. A solution at the EU-level is urgently needed. A requirement for a stricter standardization of distance learning courses is noticeable compared to the traditional classroom teaching.

Cost effectiveness

The issue of cost effectiveness was not really addressed within the projects and this may reflect the nature of the requirements of the funding programme from which they receive support. It is clearly the case that many of the projects required technical outsourcing and the use and testing of commercial products but in no respect does the funding authority require any kind of business plan or indicative costing that specifically addresses this issue. The projects are not funded under a pure research programme but clearly the projects involve to greater or lesser degrees research functions with their main aim of practical outcomes. It is unclear how projects funded under this programme can effectively address the issue of cost effectiveness. Cost effectiveness can be achieved through joint working and sharing of infrastructure and by entering into contractual arrangements with commercial and other entities. Within the university and higher technical sector clear analytical frameworks for cost analysis exist and this is particularly so with the further

development of the joint information infrastructures that most European universities operate collaboratively. This area is extremely opaque for other sectors.

AODL1 noted that they were obliged to develop their own learning material as they were dissatisfied with the commercial products available. Cost effectiveness has not been discussed in the project and it was not given a high priority. AODL6 found that the costs for the establishment of the contents were covered by the EU-project but that institutions had to share the technical infrastructure required to offer the course. It was hoped that training costs would be covered by tuition fees but there was the issue of maintaining adequate payment for teachers and tutors offering training to students not enrolled in their own institutions. Little indication was given of any notion of what student numbers would constitute cost effectiveness. AODL3 noted that high-quality video content which was produced by professionals was very expensive to produce and that it is hard to justify such investments. It was not cost-effective to use a professional television team to produce course content with the number of students on the Master programmes. The videos become too expensive.

AODL2 did not discuss cost effectiveness. AODL4 also did not raise the issue of cost effectiveness. In both cases this does not mean that it is a non- important issue. AODL5 however noted that the cost effectiveness of distance learning using new technologies was perceived as an important factor for companies, if it could be demonstrated.

Flexibility

All of the projects indicated the achievement of flexibility for their target groups was an objective and all of the projects indicated this in presenting different versions of courses customized to specific settings and with different degrees of access and communication.

Accessibility

The AODL6 project indicated a fundamental problem with the access of non sighted people to the course, since almost all practical examples are based on video and observation. These cannot be made accessible by transcripts because the observation tasks do not apply to the transcripts as well. In other respects the e-learning framework by itself complies in most parts to WAI standards.

Distributed learning can meet the needs of people at a disadvantage (geographical reasons, un-regular working hours, social reasons).

Socio-Economic aspects of the innovations

In regard to e-learning standards contained under this heading more extensive comments are made above. AODL6 noted that the chosen LMS in its current form did not comply completely with e-learning standards. The implementation of SCORM and AICC is currently under development by Hyperwave, but this can only be implemented within a possible follow-up project of AODL6 which they have so far not been successful with. They did not have the resources to restructure all their current work. In AODL3 the project

has not been engaged in any work regarding e-learning standards.
The AODL1 project pointed out that standards could be beneficial for exchange of learning material and services and that agreed standards would make it possible for teaching units to be used in any LMS system. This area was not addressed specifically in AODL2, AODL5 or AODL4. although it is clear that all were using platforms which presented no problems for them in the sectors and areas within which they were operating.

Globalization

AODL6 builds on existing European curricula, so it provides basic support for cross-institutional certification. All modules aim to have a clear outcome in terms of ECTS-credits based on the evaluation process by autumn 2003 and the course will be available in English and German – a Czech and a Dutch version are under development.

The AODL3 project revealed that there is an interest for international collaborative programs but after the initial phase, however, the project discovered that there might be different agendas and vicarious reasons for collaboration. At this stage, two of the partners withdrew from the project, although it is not clear why. The project documentation noted that it may be thought that institutions are primarily interested in collaborative efforts if they recruit more foreign students to their home institution and not place any of their students abroad and Norwegian institutions are especially interesting as "partners" since Norwegian students pay higher tuition fees than students from EU countries.

In AODL1, it was felt that the international co-operation in the huge partnership has actually worked. The exchange of experience, information and know-how provided in the project favored and initiated the implementation of open and distance learning on the national as well as regional level. The exchange of example materials among the partners and their usage, however, was greatly hindered by the language barriers across Europe. This limited cooperation and exchange of materials to language-learning and *made us envy the Anglo-American* countries where material developed by one partner can be used by hundreds of millions. The AODL1 project felt that it contributed to the eLearning initiatives in the participating partner countries with practical concepts to meet the challenges of the ambitious goals formulated by the Lisbon European Council 2000 and by the European Commission 2001 in the eLearning Action Plan 2001.

Although not foreseen by the original AODL2 proposal a publication of written lectures both in English and Italian will be made available at some point. A section of material from the seminar will be freely accessible to all *surfers* to widen the dissemination potential. Topic related discussion lists and forums on the web are informed about the seminar. Exploitation plans were related to the outcome of the pilot project and are aiming at establishing a European Master in Urban Social Exclusion Analysis. The funding of the project until 2006 facilitates this. The AODL2 on-line seminar is well suited to wide dissemination because it combines the possibility of access to overarching theoretical frameworks in the field of urban development whilst offering a virtual architecture to test those frameworks in localized and regional settings. So it can be used, tested, observed and customized in China, Indonesia, the suburbs of Los Angeles, Kuala Lumpur, Manchester or Bergen. The content of the seminar, the recognition and implementation of devices for

"seeing", recording and understanding local urban processes indicate that this seminar could easily find a place within the hugely expanding open and distance learning markets in China, South Asia and elsewhere outside of the EU. The same possibilities can be ascribed to both AODL4 and AODL5. The latter especially so because it promotes a well established scientific and technological discipline with universally accepted standards. AODL4 is more complex because it is located in a precise pedagogic model derived from Eurocentric research about ageing – a model not necessarily appropriate in Japan or among the elderly in the foothills of Laos where 74 year olds can act as jungle trackers displaying physical and mental agility quite beyond what is expected of their peers in Europe. In this respect the issue of so called "globalization" is contested because of important methodological and cultural questions. Scientific and technology content courses appear less problematic as do all courses which present "facts" – and as such can easily find a place within a global ODL marketplace. It is not the case that a "European" view, often derived from an "American" practice in appropriate methods of teacher training is either suitable or interesting to teacher trainers in Asia, Latin America or Africa. They may be interested in issues raised but their concerns will be to develop content and systems appropriate to their unique socio-economic and cultural determinants.

Other socio-cultural factors influencing learning processes

Issues of varying cultural and language backgrounds, demography and gender were reported as of significance. Intercultural awareness can be developed through distributed collaboration as information and experience are exchanged about local environments, structures of institutions and civic and cultural protocols. Multilingual presentation is not a problem at one level. It is the enormous resources required to transform and translate content into a range of languages. It is however unclear that where partner institutions operate within a limited international range and where there is little previous experience of different cultures how within projects such as these there is enough time for analysis of, reflection on and exchange of experience of differing cultural biases.

Funding & commercialization

This was perceived as a hugely problematic area and which has been touched on above. It has been indicated by AODL1 that students in upper-secondary adult education usually do not have the financial means for top-level IT-equipment and fast internet-connections – the students' equipment sets the standard for practical work with ICT. Implementing and servicing electronic learning managements systems (LMS) has proved a task far too ambitious for an average sized school: Running a server with an LMS has to be outsourced and serviced by experts to guarantee a reliable and working system, including a hotline and support for teachers and students alike. This is expensive. AODL6 were currently negotiating with publishers to be able to offer the course on a commercial basis. But this is no more than an option at the moment. The view of AODL6 is that economic potential is based on the ability of institutions to charge tuition fees. In AODL3, the Building Surveying and Real Estate Economics program will be offered as a commercial program in the future and such commercial programs as a potential source of extra income.

Implications for LLL

The AODL6 course will be offered for in-service training, so it is clearly devised for lifelong learning. It is hoped also that the emerging learning communities will develop a lasting relationship that enables them to manage their own further education together. The second outcome of the AODL6 project – the experts exchange platform – is seen to be a means of intensifying this cooperation on a lifelong professional basis.

In AODL1 the contribution to the concept of lifelong learning is seen in the project's focus on adult learners and in particular on how to ease the access to education and training for them and thus contributing to social equality. The AODL1 project contributed to the European concept of lifelong learning by its practical approach in adult education. Thus the co-operation on a European level and the development and implementation of practical concepts supports the demand for enabling European citizens to become digitally literate and to bridge the gap between those who have access to new technologies and those who are excluded from the knowledge society.

This is a problematic area for AODL2, as the seminar is clearly located within an elite European academic environment. It is monolingual in that all process is conducted in English. Total access is subject to selective registration and fee paying (although all students accepted receive fellowships) Registration currently costs 250 Euros. Admission requirements are clearly stated as: Late undergraduates (just before their diploma) and early PhDs (in their first years) in social & political sciences, humanities, liberal arts or economics, geography, urban planning etc: Outstanding academic results and/or rich professional experience: Evidence of a good working knowledge of English (possibly correspondent to TOEFL score of at least 550 points or to an IELTS score of at least 6.5): Full internet access: Strong motivation & professional or personal interest in participating in a European online distance course on the issues at stake. It can be noted that the design of the AODL2 project allows disadvantaged groups (e.g. disabled) easy access to the seminar via IC technologies. Participant institutions are not barred from using material in local languages if they choose in their own environment which meets the "trickle down" notion. Costs of translation are a factor.

With AODL5, any internet user can freely access the homepage which contains descriptive and promotional materials relating to the project, to the partners and to the EU Minerva Action: two links as registered and anonymous user (guest) are available to access the Virtual Institute. This provides a continuous source of reference, state of art in specific discipline for practitioners and professionals. This is a trans-European project by well-established practitioners in a specific discipline with course customisation to the learning patrimonies of participants. While developed and tested in a university environment the project also addresses industry needs. There is recognition of the fact that over the last few years an increasing interest in distance learning technology can be seen in the industrial world in order to maintain the skills and competences of employees and to help the merging of knowledge acquired in different places. In that sense it contributes to professional lifelong learning. Other potential users of this environment may be persons interested in increasing their skills independently and established practitioners interested in keeping up to date with state of the art.

With AODL4 successful validation of the pilot project could speed up a new innovative approach to the Lifelong learning educational dimension for this specific socio-economic group. In fact the pilot project after being tested on the target groups is intended to be used across Europe to try to spread not only the final outcomes through the web site but also to introduce a large number of people to new technologies. It is assumed that the pilot will have a deep impact on the target groups and consequently lay the basis for extension across Europe. The final results will be disseminated around Europe through Internet and satellite TV transmission.

Innovation defined: sustainability & diffusion

The reviews indicated that the notion of *Innovation*, if it is has been considered, is viewed less as encompassing the technology but more in terms of the content developed or specified target groups. For AODL6 it is contained in the attempt to develop a collaborative knowledge pool encompassing the field of inclusive education. For AODL4, the innovative dimension seems to be fulfilled using a multimedia integrated platform made of video lessons, web site, chat rooms, forums of discussion, face to face and distance interactive tutoring to demonstrate the validity and the effectiveness of the open and distance learning NETTUNO model for the target group involved. In large measure the "innovation" is perceived as the group at which the integrated multimedia is aimed. In AODL2 the technology merging of sociology and photography as a device for seeing and understanding local urban processes within the field is perceived as innovative and significant in terms of disseminating knowledge and archival collection in and of local urban environments. The use of IC technology allows a means of addressing the recognition of difference literally by "showing".

What was the role of ICT in innovations

All of the projects included: Online course material to be used by the individual student: Rich media (mostly video) to present insights into classroom or other field work: Exchange with peers, tutors and teachers in structured forums: Live communication in working groups (chat-based): Group work in projects based on workspaces: Experts-exchange on specific problems (problem solving approach). This is clearly shown in the AODL2 model. The interaction via chat (synchronous) or via forum (asynchronous) is perceived as creating a new learning community, exploiting the new IT and allowing debate on precise issues addressed in the written lectures and in the reading material. These relatively new media are seen to partly modify the interaction rhythm and the way contents are presented. Both students and scholars go immediately to the information/communication point and what are termed shy students are expected to participate more actively to the interaction process. The notion of co-production seems underpinning where scholars, tutors and students proactively function together in the "learning process".

Were the innovations sustainable/scalable

Sustainability is dealt with in some of the projects in the sense that indications are given that networks are being set up to maintain long standing distributed collaboration. Within the adult education projects these have a voluntaristic aspect. AODL4 and AODL5 like

AODL2 appear to have sustainability and scalability embedded and this may be due to the fact that all these projects derive from already well established operational practice. AODL2 in particular, within its clearly defined remit, is sustainable and is currently embedded in at least 14 European universities.

2.4 Higher Education sector

General Introduction

Within this sector DELPHI analysed 6 MINERVA projects. All the projects belong to the 1999 Call; they started in the year 2000 and finished around 2002. The projects as a whole produced a large amount of documentation: projects' reports, books, papers, articles, etc., although there are quite remarkable differences in what respect to the documentation available by each project. This fact will be reflected in the analysis of the projects; those projects rich in documentation have been thoroughly analysed; in all projects we took the Final Report as a key document.

Scope of the projects reviewed

The projects of this section were classified as part of the Higher Education Sector, including also the collaboration of Universities with the private sector; so most of the results of the analysis must be contextualized within this sector. However many of the phenomena is present also as we will see in other sector analysed by DELPHI. HE1 aims at providing decision makers with systems for evaluating *Virtual Learning Platforms* that will allow them to improve their development as well as get to know other platforms better; benchmarking for the establishment of quality criteria is the final purpose of the evaluation of virtual campuses. HE2 takes a different point of view but complementary in some way to HE1, looking at evaluating the implementation of multimedia, ICT based material when applied to different courses, with distinct methodologies, ODL schemes and cultural realities.

HE6 focuses on the implementation of ICT and specially virtual learning environments in the strategic planning of Universities for its implementation, while HE5 intends to identifying a comprehensive list of all critical factors of networked e- learning, by surveying the most relevant networks and to determine the key factors that allow them to provide benefits and to solve problems of networked e-learning. The project HE3 aims to improve the understanding of the impact of open and distance learning models on the organization of the learning process. The project addresses collaborative learning on the basis of a problem-based approach and specifically focuses on the impact of the international context of the learning process. Finally, HE4 looked at experience, skills, confidence and attitudes of students and academic staff with respect to ICT in order to do a comparative study about ICT skills students acquired during their studies and their future needs in this area. Quality was also a concern.

Definitions of e-learning in the projects

Implicit definitions of e-learning and other related terms are of utmost importance for the understanding of the projects conceptions and results. Interesting is to notice that projects have a different viewpoint when looking at e-learning: concepts as virtual learning, virtual campuses, e-learning, networked learning, etc, are in many ways contradictory and complementary. They share some dimensions, but in fact the starting point differs on interests of institutions and of problems to solve. For instance, for the project HE5 e-learning is seen as:

"learning supported with the aid of all kinds of information and communication technology (ICT). We do not restrict e-learning to only using the Internet for didactical purposes in higher education, as is often the case. Also more traditional media, such as video, audiocasHE6es, television, radio, telephone, CD-ROM, or even satellite communication are envisaged as well. A shift is made away from the scenarios as a basis for problems, to a more-abstract matrix in which problems are classified in terms of their nature (attitudinal or practical) and their basis (pedagogical, technological, organisational). (final report, p. 6)

For this project ***networked e-learning*** *(more than the two direct partners, teachers and students, are involved)* could be that students at different universities in different countries establish a learning community and take the same courses, collaborate on the same projects and communicate in a sophisticated virtual way. It could also mean that teachers across institutional or national borders find each other and jointly develop courses, share learning material and divide the tutoring activities. It could include far-reaching collaboration and policy making amongst institutes of higher education on the educational use of ICT at the highest strategic level. It could be of interest to other parties as well, such as financial institutions, local municipalities, NGOs.

Networked e-learning should not only be defined as learning through the Internet, although it is certainly of utmost importance and probably the most obvious and most visible format. In this sense we subscribe to the definition of the European Commission: "The use of new multimedia technologies and the Internet to improve the quality of learning by facilitating access to resources and services as well as remote exchanges and collaboration."

For HE1, virtual learning is an idea that is close to managerial higher education matters. This can be seen in the definition of the Virtual Learning Environment as a framework, which will incrementally integrate all of the academic businesses of the institution into a coherent whole through the use of ICT. The system must ultimately deliver a significant improvement in the manner in which the institution conducts its business. Further, e-learning is closely associated to the virtual learning in general and to the organizational and delivery system, the virtual campus.

New methodological approaches to ICT-based learning innovations

The reviewer noted that there are different approaches in the development of the project, or supported by the projects. In any case all the projects suggested that the introduction of educational technologies necessitates a comprehensive re-moulding of the pedagogical process. The web and the Internet are technologies that require a fundamental rethinking of teaching practice. There is certainly a need for new pedagogical models and the optimization of existing ones. The use of classic didactical models in the new environment is seen as not advisable. Also methods of evaluating and verifying learners' participation have to be reconsidered.

It was reported in HE6 that of utmost importance, and maybe previous to all pedagogical innovations the mapping out of ICT skills of students and teachers is needed, not only at the current time, but in the near future . The university may wish to bring about quality improvements in student learning by putting in place more effective measures calling for the use of educational technologies. This may involve access to external information sources, the setting up of monitoring and individual tutoring and the development of on-line modules, the development of complementary and support courses for traditional courses. Examples of complementary work could include supervised work sessions or practical workshops, examination practice and optimizing the use of lecture space. In addition to this the institution could consider the development of systems for validating knowledge or accessing European courses through video-conferencing. All of these elements could potentially improve the quality of learning at the institution. The university may hope to become one of the leading institutions in these teaching techniques. This could involve the putting in place of an internal communications infrastructure, an intranet linking all of the constituent parts of the university, students, staff and other university personnel. It will also require the development of new learning methods, supported by opportunities provided by educational technologies (distance monitoring and tutoring, accessing courses through the use of video conferencing, a choice of on-line courses, accessing valuable research documentation).

The case of virtual campuses is of particular interests. The pedagogical approaches within this particular delivery and organizational system lies in new pedagogical interests, as for instance the creation of an educational community, as a group of people with similar interests who are able to relate to and collaborate with one another (HE1). The standard methods of pedagogic evaluation that rely heavily on the use of psychometric-based instruments to measure ability and achievement that are found to be culturally biased, and to place undue emphasis on innate ability rather than learning, there is a need to develop evaluation methods that are learner-focused; there is a need for collaborative learning and collaborative evaluation that represents evaluation objectives in terms of stakeholders.

The project HE3 tackled particular pedagogical problems, those related to collaborative learning on the basis of a problem-based approach, and specifically focuses on the impact of the international context of the learning process. The development of innovative approaches for including innovative summative and formative evaluation approaches which enhance an approach for research into social, organizational, pedagogical and even psychological effects on the learning process was also part of the pedagogical problems posed. What are the teaching skills necessary for teaching at a distance? What are the instructional design models used in e-learning? The pedagogy of e-learning is dependent of two dimensions: attitudes and practical matters. Based on these general dimensions, issues related to the changing role of teachers, teaching skills, tutoring, language and cultural issues, teachers' workload, etc come into action in networked learning in international settings, and in general in e-learning (HE5).

Project HE2 examined and evaluated how dependent the learning environment is on the multimedia educational material supporting a course. Can we use the same material for different course levels, different student types, and different learning models? How long and how much effort involved in adapting the material to each situation? Does this

adaptation depend also on the European regions involved?

Teaching and learning philosophies

Teaching and learning philosophy underpinning the use of ITC, enlighten any kind of analysis of ICT learning innovations. HE6 mentions some key trends in education and training that frame the analysis of virtual learning. These included an irreversible trend towards the concept of "learning": integration of information and communication technologies into everyday teaching practice: using open and distance learning to increase flexibility: new technologies are both a cause and an indicator of change: increasing the opportunities for access: the Europeanization of courses and the use of new educational technologies: new educational technologies are a means allowing well-identified strategies and the need to establish new strategic management.

For Project HE1, benchmarking the implementation of virtual campuses (description, evaluation and comparison of all aspects of virtual campuses) implies the discussion of general aspects as guidance, support, authoring, evaluation and other teaching and learning areas which are the foundations of the pedagogical approach of e-learning. HE1 had noticed on the benchmarking exercise that one factor that differentiates one model of virtual education from another is the type of learning environment it creates. It is necessary to frame learning processes within the particular learning environment of each virtual campus. The benchmarking system has devised an elaborate method for defining and distinguishing each unique learning environment and another one for evaluating learning; at the core is the belief that learning is very complex and difficult to quantify, thus necessitating a set of methods that reject reductionism and oversimplification. The pedagogical approach of HE3 addresses collaborative learning on the basis of a problem-based approach and specifically focuses on the impact of the international context of the learning process. Through the establishment of an open, virtual, collaborative learning environment where test groups of students participated in learning modules based on the problem-based approach, an environment for extensive research has been created. An important tool for the research executed in this project was the innovative summative and formative evaluation approach, which enhanced an approach for research into social, organizational, pedagogical and even psychological effects on the learning process.

Teaching techniques, methods, and devices

The Web and Internet are technologies that require a fundamental rethinking of teaching practice. There is certainly a need for new pedagogical models and the optimization of existing ones. According to HE5, the use of classic didactical models in the new environment is not advisable and methods of evaluating and verifying learners' participation have to be reconsidered.

The HE3 educational model was Project Centered Learning (PCL). By using PCL, students gets a real-life assignment, which they have to solve in a team environment. HE6 noted that in spite of all the efforts, no real teaching method yet exists which is based on educational technology. The models and methods of traditional teaching approaches have been computerized. Research and systematic experimentation needs to be put in place to test this.

Teaching and student roles

ICT has begun to change education by its direct use in learning and teaching, with its advocates holding out the promise of a "new paradigm" for learning and teaching that moves from a teacher-centred to a learner-centred approach. In this sense, changes in roles are important for many reasons. One of the key ones is that by knowing the new emergent roles we could talk about a set of competence dimensions useful to develop training programmes. For HE3, the advantage of Project Centered Learning (PCL) is that students' skills of presenting, writing, team management, etc. are developed. The students also learn to apply learned knowledge in a real-life context (student as a team member). The new methods used by HE4 based on virtual platforms as chat rooms or video conferences allow for new roles and interactions: whereas teachers are not necessarily better skilled than students, a common learning process is emerging, where teachers have to share their leadership with more expert students.

For project HE5 teachers needed to adapt their perception of what it means to be a teacher. Faculty who engage in the development and delivery of courses at a distance may find that the roles to which they have become accustomed in a traditional university environment have changed in the online environment. They may find a fundamental shift from a teacher-centred environment in the classroom to a more learner-centred environment online: the role of the teachers changes from one of transmitting knowledge to one of mediating learning, from the role of instructor to the role of mentor and guide.

For HE6T the role of the teacher in virtual learning environments needs to change. He or she needs to assume the role of a tutor/mentor, to accompany the student in the process of acquiring knowledge. Such a change is inevitable and will be accompanied by the emergence of new job profiles within the university. Experienced assistants working in the field of educational media and technology could be invited to give their support to academics in the process of integrating these new technologies.

Teachers and students interactions

HE3 reports that new ways of co-operation brought a totally different interaction between the students or rather partners, which were still accustomed to traditional methods of teamwork. Building up a team by networking them only by the Internet, without any physical contact, had as result an innovative work basis.

Attitudes of teachers and students towards ICT

Within this category some projects have directly addressed this issue, whereas within others we could only map out some of the trends. Attitudes towards ICT and confidence in its use are just as important and perhaps more so, for learning to learn and transferability of skills are now seen as vital in enabling graduates to move beyond their current level without prolonging training, and to take up new opportunities without needing direction. One clear attitude of students towards ICT that is becoming more positive is the increasing

importance of ICT for their professional careers. New students also show different behaviour with respect to the emergence of web skills, growth of PC ownership, etc. For those students with difficulties in use of ICT, the attitude of staff inculcating positive attitudes to technology in their students is crucial, through implicit and explicit messages (staff who are under skilled send negative messages to their students). This is particularly important in the emerging use of e-learning, where pedagogical as well as technical issues arise.

HE4 found that technology based IT skills differed between the various universities. Ownership of PCs and ancillary equipment was high among the students, and they had good ICT skills, as measured by the number of ICT applications that they reported they could use unassisted. Almost all students could handle word processors, web browsers, email and chat. New students had less experience then established students with presentation managers and bibliographic databases, suggesting that they do in fact acquire these skills during their courses. Most of the interviewed academic staff felt reasonably well skilled in use of ICT, although there were variations in age, confidence and gender.

Students are not homogeneous in their ICT skills and attitudes, varying between universities in their skills and gender. Project HE4 noticed that female students were generally less confident than males, and reported fewer skills and lower competence levels. On the other hand their view of ICT to their careers was similar to those of male students. One of the key questions is to what extent these results reflect country-specific experiences, age, gender, or the main subjects students intend to study.

HE5 had noticed that instructors often have negative perceptions of technology-supported learning and open and distance learning. They prefer a face-to-face learning environment and cannot see the educational benefits or the potential of new ICT-based methods. They question whether the Internet can actually be used effectively for educational purposes and resist this new mode of instruction. To deal with the attitudinal obstacles (such as ignorance of the potential of new ICT-based methods, prejudices against ODL as an alternative to face-to-face education, resistance to the changing role of teachers in the educational process, etc.), this project suggests methods advanced in the literature and previous research to sensitize, motivate, reduce resistance, and overcome prejudices with the general objective of evoking an attitude and mentality change.

Assessment

Assessment in e-learning for some projects requires special attention. There were many approaches, which reflected different assessment theories. These approaches range from the dominant positivistic paradigm in pedagogic evaluation, to a constructivist-oriented evaluation focused on learner-centered and learner-directed assessment. For instance, for HE5 traditional methods for assessment of distance students may have to be pursued. Constructing a rigorous, fair and comprehensive exam is not an easy process, and standard exams cannot be given to a remote audience unless proctoring is arranged. In online courses, assignments are submitted via Internet, but in most of the cases the final assessment is face-to-face based. In other cases, knowledge is assessed continually, and supplemented by limited formal assessments at group meetings (HE6). If institutions use a

commercial product for online learning, they might use the different types of assessment these tools allow (e.g. Blackboard allows for real-time online conferencing and formative assessment), although this is a sensible issue. software package), although students do not take full online summative assessment with through this method. Another online institution mentions an assessment system, which had a dual approach. In the first place, the students are continually assessed during their course. In the second place, students are also required to attend a face-to-face, individual assessment at the end of each term. This was intended to give the institution confidence that its methods were working and secondly to reassure a nervous marketplace that quality could be maintained. Currently some universities are moving towards phasing out the face-to face aspect of its assessment system, but still is too soon to ascertain that these systems will consolidate in online learning.

Teacher workload

There are widespread concerns about the increased workload in using ICT in education which may be a main obstacle at all levels (pedagogical, technological and organisational). The workload is largely dependent on the subject but also on the potential market. There arises the question of evaluation and certification of the courseware. For the HE6 project, pedagogical worries involving e-learning included the task of preparing a course, which uses educational technologies, seen as more onerous than a traditional teaching approach. Staff should have incentives when participating in innovations. The integration of new pedagogical methods requires new training policies in the institution and very often the setting up of resource centres to support academics wishing to invest in these new approaches. The university, therefore, need to give some consideration to this question when new professional profiles appear in the university. The university will need to put in place a policy recognizing and validating academic cooperation in the setting up and development of educational technologies: financial, career, responsibility for leading research groups, scientific and administrative responsibility (directors of study departments etc), lightening of the teaching load for academics engaged in a development project.
For HE5 incentives and guidance for any instructors involved can be provided, (again, this guidance can be partly handled at the network level); for example, incentives for faculty members to spend extra time and energy in developing material, etc. and incentives and support for engaging in technology-mediated learning and developing tools and course materials for the distributed learning environment.

Teacher collaboration

Teacher collaboration is not considered or supported generally by universities (HE6). European universities fail to encourage their academic staff to integrate ICT into their teaching, and no investment in these approaches is taken into account in an academics career profile, which thereby restricts academic collaboration with relevant research projects. Universities and teachers can only create the necessary high quality learning materials and services by joining their efforts and resources. From an institutional and teachers point of view the use and sharing of international resources is a considerable advantage and result in economies of scale. (e.g. exchange, sharing of learning material and courses, seminars, access to the equipment, laboratories of other institutions, etc.). The creation of a database for reusable learning and teaching materials will get a far greater

number of entries, and its maintenance may become more cost-effective by sharing costs and income. It helps capitalization of 'teaching acts' as reusable learning resources. A university network should also certify-accredit each other's websites and collaborate in the development of a directory of reliable learning websites. In online networked online learning new degrees of collaborative work between geographically disparate teams are possible. Staff has the opportunity to work collaboratively and closely with colleagues.

Institutional/organizational changes as a result of ICT and e-learning implementation

Findings from the projects indicated In terms of the main institutional changes resulting from the introduction of ICT and ODL into existing structures, universities are undergoing fundamental changes, as sources of knowledge; as providers of mass education programmes in their undergraduate programmes. In addition to this, they are under considerable pressure to create vocational streams. Knowledge in itself is not enough, education must lead to employment and the mission to ensure vocational education includes the responsibility for maintaining it and for developing it within a framework of continuous learning. Faced with this recent turn of events, for HE6, universities, which do not have a monopoly on education, have had to open their structures to the outside world. They need to be capable of demonstrating their scientific credibility at an international level but also have to respond to drivers from the industrial, social and cultural environments. In such a context, information and communication technology (ICT) appears today as one of the most appropriate tools. It affords the possibility of allowing everyone to learn, when he or she wishes it, whether as part of initial or subsequent learning. Networked and computer-based learning cause an initial increase in costs for the organization: costs to develop and deliver online courses, the cost for the technical infrastructure (e.g. connectivity, network access, etc.).

Staff training

From many points of view in the projects, teacher training is recognized as of utmost importance. New ways of working should be devised which put emphasis on the exchange of knowledge and skills between different specialists in support of the new pedagogical project. It will almost certainly take a few years before this changed paradigm can be put in place: for integration of new methodologies: Universities should re-think their recruitment systems, the on-going training of both academic and administrative staff, but above all their promotion criteria

For HE6T any strategic ICT implementation plan needs to consider teacher training. The university will need to give some consideration to this question when new professional profiles appear in the university. Universities should re-think their recruitment systems, the on-going training of both academic and administrative staff, but above all their promotion criteria. In e-learning to be hold some specific technical skills is a necessary condition. For project HE5, the lack of technical background, lack of basic computer literacy of the students as well as of the instructors, and lack of technical support are obstacles to introducing ICT in education. Because of this lack of technical skills, ICT is used at a level below potential (e.g. websites that are merely textbooks-on-screen). One of the

consequences of that is the need for staff training (also students training) in the different tools and learning environments, at the level of users or content designers.

Main actors, adopters and resisters to the adoption of any innovation identified in the project

In e-learning innovations, we should bear in mind that resistance arises when these are not part of the regular courses. Project HE3 reported that short timelines for the innovation to consolidate and knowledge are serious constraints. For HE5, many instructors and students do not like to learn how to use a new electronic learning environment. Lack of technical background, lack of basic computer literacy of the students as well as of the instructors, and lack of technical support are an obstacle in introducing ICT in education. Because of this lack of technical skills, ICT is used at a level below potential (e.g. websites that are merely textbooks-on-screen). For HE6 resistance to change by academics and administrators is without doubt one of the most important factors encountered in institutions. The most obvious and certainly the most important change in the overall process concerns the future role of academics as well as students. The former will no longer only have to transmit knowledge but from now on they will have to teach how to learn. In the same way the student will have an active and driving role in the process of learning. It will be necessary therefore to define what some people call a new educational contract between the different partners establishing the rights and responsibilities of each one.

Organisational conditions that are (un)supportive to innovation

The HE5 project indicated some key aspects to take into account for higher education institutions in order to implement successful e-learning and/or virtual campuses. These covered: Access to local facilities for distant students including making library resources available: Timing: Co-ordination and planning problems may emerge because of learners and teachers working in different time zones: Registration: Institutions offering programmes across countries should simplify administrative problems: Payment: Registering for a course usually implies payment: Security when all contact and communication between universities, teachers, and students is happening through the web, security becomes an important issue: Infrastructure/access: students can be frustrated by computer and network facilities available to them or by features in the electronic tools they are being asked to use: Financial aspects - networked and computer-based learning cause an increase in costs for the organization--costs to develop and deliver online courses, and the cost for the technical infrastructure: Accreditation/credit transfer: courses attended at another university or offered by a consortium on line may not be accredited in the student's home university: Copyright – intellectual property: the creative effort of academic staff should be protected from copying, use and sale elsewhere, keeping the different national legislations in mind: Competition: universities face a significant and growing competition from other and new types of e-learning providers: Networking: gives opportunities to universities to collaborate not only on the design and development of courses but also on the delivery of courses, and on Internet or web based education materials and curricula.

For HE1, the institutions needed to elaborate a *"map of competencies"*, which gathers together the basic criteria to be kept in mind in any evaluation of virtual learning

environments. The map of competencies is the result of identifying and analyzing all the competencies required by an institution in order to define, implement, manage, and evaluate a virtual campus from the educational, technological, organisational and economic standpoints. HE1 proposes three types of indicators: structural, practice and performance indicators. The aim was to develop a set of Meta-indicators which are as simple as possible while sufficiently detailed to mirror all particularities of virtual learning organizations that need to be characterized. These are: Learner Services: Learning Delivery: Learning Development: Teaching Capability: Evaluation: Accessibility: Technical Capability: Institutional Capability.

HE1 proposes with respect to organisational constraints and practical obstacles, that these come from analyzing the local situation in measuring and comparison with other institutions.HE5 includes the need for new pedagogical models and the optimization of existing ones, the (non)availability of and/or lack of compatibility between technical infrastructure, copyright issues, language problems, quality control and credit transfer.

Cost effectiveness

Working together can generate economies of scale, e.g. joint research and development (and even investments) in technology and infrastructure and joint marketing of courses. Where pedagogy of ICT based education and training is still largely missing, well-balanced joint research can lead to faster and better results. Networking can help the ODL institutions in overcoming the problem of professional marketing and sales of their educational and training services, which is a precondition of reaching the "critical number" of learners, sufficient to cover the cost of development and delivery of quality courses. It may enlarge the 'customer base' of a university and facilitate international promotion as well as acquisition of relevant competencies and know-how from partner universities. Functions such as the development and distribution of learning materials, tuition, assessment, online registration and record-keeping, award-granting, learner support, and general administration can now be shared through a wide variety of organizational arrangements marked by specialization and "added-value" partnerships involving both the public and private sectors. For HE5, online learning can be at least as cost-effective as face-to-face teaching. Moreover, the development of virtual delivery models will most likely result in a higher degree of cost-effectiveness and a cost reduction. Costs can be reduced through standardization, resource sharing, economies of scale, increased productivity, and by purchasing hardware and software jointly. Additionally, travel costs can be lowered. The implementation of Open and Distance Learning in a networked environment offers a great potential, such as flexibility, course development, or cost sharing. But, in spite of the various efforts that have been invested in the different e-learning networks, there is still a great reluctance to embark on large-scale activities that are self- sustainable and permanently embedded in mainstream education. Also funding can be attracted more easily where several universities come together and pool resources for maximum impact. Distance education programmes can also be not only self-supporting but can generate additional funds to support other departments at a traditional institution. .HE6 studied the economic aspects of setting online education in universities, given the fact that the development and use of educational technologies involves the institution in considerable cost where the acquisition of materials and the conception of products are concerned. In a great number of

situations in universities, one of the key elements put forward for not investing in new educational approaches concerns the cost. The analytical frameworks for proceeding to cost analysis can vary considerably. The university needs to be capable of: Carrying out an evaluation of its technological infrastructure, both internal and external: Knowing all the initiatives that have been taken in its institution to develop new educational approaches: Putting in place a benchmarking system in order to have a better knowledge of what is going on elsewhere and at what cost: Carrying out a first cost analysis by combining direct with hidden costs : Direct costs to analyse: -Cost of materials (servers, PCs, peripherals etc) -Cost of software Costs of network infrastructure -Costs of communications Cost of maintenance and updating -Staffing costs (technical staff managing infrastructure and cost of those responsible for the development of projects): Cost of tutoring: Cost of technical assistance: Staff training costs: Costs of consumables (cables, diskettes etc).

In this context, the life expectancy of equipment and cost of replacement needs to be taken into account: Other indirect costs to be taken into account: Time spent by academics learning the educational technologies.

Flexibility

Flexibility is a key word in e-learning. For project HE6T, flexibility is understood in many ways: flexibility of the tools selected: Web portals are the newest delivery mechanism for providing information to users in an institution, the key advantage of a portal over other solutions being its flexibility. Institutions will customized it to suit them and furthermore, it will be very quickly alterable to suit differing sets of circumstances.
Students access: The intention of this was to improve quality of service to their existing students and increase flexibility of access in order to build new markets for their course offerings: Curriculum: One major challenge which teaching institutions will face during the coming decade, most especially in higher education, will be the transition from traditional institutions with fixed courses and relatively stable programmes towards organizations where flexibility will be the central element:: Course management: Online teaching increases the teachers' flexibility with regard to time and place. Teachers appreciate this, but on the other hand they realize that online workload is higher.

Accessibility

Findings from the projects indicate that access, and more specifically online access is understood also in many different ways: as access to online learning services: as access to a vast amount of knowledge directly rather than through teachers: as access to tools as freely available software: as access to training products and materials: as access to information to everybody

Other socio-Economic aspects of the innovations

For HE5 in regard to e-learning standards, content and technical standards need to be adopted that will optimize interoperability with other institutions in areas such as the creation of learning databases, information databases such as libraries, administrative systems and learner support strategies as well as the facilitation of interactions among

learners and teachers. Building an educational repository that provides access to learning objects requires standards and structures that can facilitate object storage,
retrieval and aggregation to suit the needs off learners or the pedagogical intentions of instructional developers. Campuses should consider whether they are positioned to provide the requisite technological infrastructures, to create alliances. Content and technical standards need to be adopted that will optimize interoperability with other institutions in areas such as the creation of learning databases, information databases such as libraries, administrative systems and learner support strategies as well as the facilitation of interactions among learners and teachers. Building an educational repository that provides access to learning objects requires standards and structures that can facilitate object storage, retrieval and aggregation to suit the needs off learners or the pedagogical intentions of instructional developers.
In terms of Learning Management Systems there have been moves to produce standards for Instructional Management Systems. This initiative, the IMS Project (www.imsproject.org) has led to a comprehensive set of guidelines, which relate to the interoperability of computer systems in the educational field. According to HE6, several standards currently exist in open distance education: AICC, SCORM and IMS for example. They are intended to ensure systems' portability (compatibility), reusability, and interoperability. Educational resources must be able to operate independently of all software platforms and presentation.

Globalization

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Universities face a significant and growing competition from other and new types of e-learning providers. In the higher education market, traditional universities not only have to compete more and more with other universities but also with virtual and commercial organizations and companies, all offering the same type of courses. A possible decrease of institutional or “brand” loyalty must be considered and may redefine the relationship between a campus and its students. Institutions enter an international and competitive marketplace. Institutions perceive that ICT will enable them to increase their market share and to extend its influence. The e-education market, particularly in higher education, has grown considerably in the last years. With globalization, one questions whether the very survival of institutions is under threat. Will it be necessary for institutions to be able to provide credible education in huge marketplaces where new technologies will enable universities to increase the number of their customers? For HE6, from now on, the concept of productive organization will be indivisible from that of the learning organization. This calls into question the organizational and human resources of any economic entity and highlights the need to think and develop new mechanisms for the transmission of knowledge and know-how. Our ability to integrate and accept this new paradigm will largely depend on our competitive situation in the world. In a situation, which is based on the globalization of trade from now on, communication will be a determining competitive factor.
Paradoxically globalization generates a requirement for stronger local strategies and policies. Increasingly, knowledge and information are the driving forces behind the new social structures. Consequently, the objectives of education and training systems will need to be shaped to cope with the rate of change. Universities are undergoing fundamental changes, as sources of knowledge; they are tasked with mass education programmes in their undergraduate programmes.

Other socio-cultural factors that influence learning processes

The main socio-cultural influences between the different countries with respect to the use of ICT come from different aspects. In project HE4 they report the differences come from the varying cultural and language background, also from ICT skills and attitudes, varying between universities (so countries), age and gender. Nevertheless, despite the cultural differences of the single countries, there are similarities between students at all the universities. The differentiation in knowledge, in particularly concerning the computer skills and the use of modern technologies, is generally due to the dissimilar learning skills of the different universities. HE5 indicated that international networking can provide a European dimension, sharing international learning experience in education and training by cross-border delivery of courses. A sense of community for the students from different countries working together on an ODL project emerges. Students come in contact and can work collaboratively with students from other countries and cultures ("virtual Erasmus"). It gives educators, trainers and learners with different worldviews the opportunity to exchange ideas and information and learn from each other, thus expanding each participant's global view and gaining a broader perspective on a specific subject as well as on the world in general. It helps to develop the habit of intercultural communication for learning and non-learning purposes, so raising tolerance for difference and inter-cultural awareness and broadening or breaching cultural, social, and political boundaries.
In any case intercultural differences are present in e-learning, specially in international contexts. HE1 places great importance on the problems of cultural bias and cultural differences when making comparisons across cultures in order that each virtual campus may benefit from the benchmarking system in the way that best suits it.

Funding and commercialization

For HE6, it is clear that institutions cannot successfully fund the development and deployment of technology-based instructional management systems and learning tools, except on a very limited basis. Institutional leadership requires that new models for development and deployment of these systems be provided, as the competitive nature of the virtual environment is such that it constitutes a serious threat to the stability and viability of traditional educational institutions. This needs a financial plan, gathering funds from both the public and private and private sector.

Implications for LLL

Lifelong learning is a key concept linked to e-learning. Nevertheless there is more literature about the potentials of ICT and e-learning than realities. This was confirmed also by DELPHI analysis. In general it is assumed that the integration of new technologies will enable the university to position itself in the market more successfully not only at the level of undergraduate education but also in the field of lifelong learning.
HE6 quotes: "New educational techniques, based on ICT, will enable a close link to be established and maintained between the University, its alumni, and the business world. In this sense the alumni will become a vector through which lifelong learning can be promoted, encouraging awareness of and better satisfying the established need in business

and industry for continuous further education". Nevertheless, this is more an intention than a reality, since they do not provide data in this respect. HE5 confirms the importance of the extension of the student group to the mature student in the framework of open learning, continuing education and/or lifelong learning. Nothing else. HE1 typology, though developed for higher education, could eventually be extended to lifelong learning and to continuing education and training after some adaptations.

Innovation defined; its sustainability and diffusion

The crucial issue to be resolved is how to define what is an innovation. Innovation is a novel combination between means and ends. A work results as innovative when people are creating a value by implementing new ideas. In reference to the HE4 project there were a large amount of observable innovative factors. HE3 considers that one of the innovative aspects of the project is the intercultural dimension through which students of different nationalities, and with different backgrounds regarding the problem-oriented and context-based approach, will cooperate in finding solutions to real-life problems with European companies. The creation of a "map of competencies" for each institution willing to create a virtual campus is for HE1, an innovative instrument for institutions. The map allows the evaluation of virtual learning environments and, consequently, the establishment of a comparative analysis of them, this being the basis of the definition and application of the processes of improvement in organizations. A key conclusion of the HE1 project was that the virtual campus and its associated competencies are 'evolving objects'; therefore, the competence map needed be embedded within an institutional arrangement that could capture and analyze competencies as they developed

What was the role of ICT in the innovations?

ICT is active part of the innovation progress and in a few cases ICT is the innovation. In the case of HE4, ICT is the key for future graduates to confirm in business live as every activity in modern live is or will soon be related to information and communication technology. HE4 clearly shows, that the needs for successful employment in the future will change, and universities have to stay alert to the messages that come form students, employers and from wider ICT discussions, as to the sort of sills that will be of value to graduates in the near to medium term future and seek ways to develop these through their curricula. The HE4 project found a method to identify differences in the ICT skills and attitudes of subgroups within the student population in order to enhance and amplify the education. In the case of HE3 there have been two main innovative topics encompassing
an innovative exchange of experiences among universities of different nations by using ICT and the innovative factors resulted out of the Internet customer-assistance based on ICT. According to this, the role of ICT was fundamental for the whole process of the project.

Were the innovations studied sustainable/scalable?

The issue of sustainability is problematic in the analysis, since very few projects deal with it. HE5 reported that the implementation of e-learning in a networked environment offered great potential, for flexibility, joint course development, and cost sharing. But, in spite of

the various efforts that have been invested in the different e- learning networks, there is evidence of a great reluctance to embark on large-scale activities that are self- sustainable and permanently embedded in mainstream education.

2.5 IST and IHP projects

The **IST** and **IHP** project findings have been generalized under pedagogical, institutional and socio economic headings denoted in previous deliverables. The IST projects reviewed were

1- IST1 (Area: Preparing for Future Research)
2- IST2 (The Learning Citizen)
3- IST3 (Consensus Building for Education and Training)
4- IST4 (Advance Training Systems)
5- IST5 (Flexible University)
6- IST6 (Pioneering Research for the Future of Learning)
7- IST7 (New tools and Services)
8- IST8 (European Youth in the Digital Age)

The IHP cluster projects were:

- IHP1 Education, equity and social exclusion,
- IHP2 Education and Labour Market Change,
- IHP3 Towards the Learning Economy and
- IHP4 Synergy between Practitioners' needs & opportunities: research orientations & decision making on the usage of ICT in primary and secondary education

2.5.1 Findings related to socio-economic issues covering standardization, globalization, commercialization and lifelong learning.

The reviewer reported strong concerns among some projects regarding abilities to handle the new knowledge society and how digital and mobile technologies are transforming the ways in which knowledge is constructed and utilized. These concerns were explicitly addressed in the analyses of IST8, IHP2, IST6 and IST2. The IST8 project posited the notion of how to prepare future generations to cope with cognitive, social, and motivational challenges of the emerging knowledge based society. IHP3 project grew out of the assumption that the learning economy / learning society theory will become the leading idea for the European economy / society and, therefore, new ideas about learning will be needed. . This project attempted to analyze and synthesize available research focusing primarily on the concepts of the learning organization, knowledge and competencies, and the role of ICT with an aim of identifying needed priorities, strategies, policies, and areas for further action and research. IST6 was predicated on the notion that digital technologies are transforming the ways knowledge is constructed, how it is represented and how it is shared. The project defined its major characteristics as being how learners are challenged to think about how systems operate, how digital technologies are exploited for the acquisition of personally

engaging knowledge and how the potential of the web is harnessed for collaborative construction. IST2 characterized international relevance through the conception, population, experimentation and exploitation of new models of learning and information use via next generation mobile networks through:

1• creation of **pedagogical paradigms** to support learning in mobile environments – collaborative learning, organisational learning, dynamic knowledge creation in a group.
2• **new architectural layouts** to support creation brokerage, tracking et al of learning and information contents on the mobile network thus extending existing systems
3• selection & **adaptation of existing eLearning contents** for mobile devices enabling automatic multi channel and multi device versioning
4• realisation of **new business models** based in existing success cases (DoCoMO, iMode) for self sustainability & deployment of the conceived solutions beyond the research timeframe within Europe's Knowledge Society framework for the third Millennium.

All these were considered to imply flexibility applicable within diverse global, national and regional environments.

IHP project findings indicate that innovation in education is seen as a complex issue and that its potential influence at a socio-economic level depends on numerous factors:

> . *"The process of innovation in education and training is complex not only in terms of what factors may trigger such innovations but also in terms of the diversity of requirements (resources, institutional and organisational arrangements, people, school culture etc) that are needed to be met for educational innovation to take place and diffuse. Important aspects of these factors and requirements are affected by national educational policies against the background of national educational patrimonies in Europe."* (quoted in Final Report Synergy between Practitioners' needs and opportunities, Research orientations and Decision Making on the usage of ICT in primary and secondary education. p. 27.)

The IST1 project posited that there is a trend towards integrated solutions that provide courses with value added services such as needs assessment, online mentoring and performance support. The analysis also indicated that content is becoming more important and that collaboration among partners could improve quality. The area of e-learning standards was addressed by several of the projects and most specifically by IST2. This project included comprehensive information about the most common standards and standardization bodies and positively aligned itself to recommendations for standardization, but with the need for definitions and clarifications of concepts and terminology. The findings from this project indicated that the entities that are involved in standardization are massive users of e-learning. IST7 and IST5 also revealed a focus on standardization of learning objects. The IST7 project emphasized that learning objects are reusable across national and subject borders encouraging cooperation. The IST5 project had developed a detailed description model for learning objects. The IST8 project was not directly concerned with e-learning standards, but posited that the open-source movement has the potential to contribute significantly to the establishment of standards. Language and cultural diversity were generally considered as components of a standards movement.

The issue of globalization was addressed in several ways by some of the projects. Most

projects focused on issues such as access to global information and cultural exchange. However, except from the fact that all projects are organized and funded as European projects, few of the analyses really show any strategic commitment or heavy involvement in globalization, although there was recognition of barriers of language and privacy laws, in particular. Attitudes to commercialization of products and future sustainability in this context, were found to be vague and most of the projects were fully dependent on EU funding. The IST4 project, however, was part-funded by the EU and were proposing commercialization of their game product but no specific proposals were available to the reviewer. Most of the projects were committed to provision of free products and services. The IST7 project noted that a major obstacle for the commercial exploitation of the technology is the non-existence of generally accepted online micro-payment systems. Such systems would be necessary for a pay-per-use business model.

The notion of life long learning which plays a key role in the formation of a new European learning society was an underpinning found directly or indirectly in all the reviewed projects but was generally not systematically addressed. All the projects perceived new learning technologies as a positive factor in stimulating and strengthening life long learning amongst a wide range of target groups, by improving accessibility, collaborative knowledge-building, and flexible professional development schemes for teachers.

2.5.2 Findings related to main institutional changes: adopters and resistors, cost effectiveness, accessibility and flexibility

The reviewer stated that the main institutional changes that occurred with ICT introduction within the analysed IST and IHP projects confirmed, that innovation is a culturally driven process, requiring responsiveness to change in people and from within the whole learning structure. Findings from the project reviews indicated that "IT enthusiasts", were more likely to be adopters of innovations than resistors. However where well established work habits come under threat of radical change, initial enthusiasm often tends to disappear. The reviewer noted that this was true also for students accustomed to traditional teaching methods having to change their learning practices. The reviewer found that teachers often have the role of primary agents of effecting change. Policy makers often engendered resistance to innovations by emphasis on instrumentalism and notions of "market readiness". There was an insufficient attention to wider general education requirements and deficits to the particular personal/social development needs at the educational and social level, A new political economy of schooling, based on competition, was exacerbating class and sectoral inequalities as funding arrangements were changed in some systems to make schools competitive and market sensitive. Modern technological aids as IT and autonomous learning were becoming increasingly important within educational sectors without compensating resource allocation being spread equitably. Resisting factors to innovation were found to be factors intrinsic to the educational traditions, practices, assessment and accreditation. IHP4 cluster project: elaborated the following as main resistors:

1• *School culture:* Schools often do not consider ICTs-related teaching/learning innovations as an important part of their mission or an important requirement of the teachers' profession.
• *School curriculum and timetable*: Regular curriculum demands tend to be inflexible

and leave little room for innovation and change. The schools' timetables often leave little time for experiments that diverge from the mainstream instruction.

- *Schools' classroom arrangements:* Traditional classrooms which encourage frontal teaching, the placing of all the available ICTs in a separate computer lab and the lack of informal learning spaces in schools are all conditions that may become barriers to innovative efforts.
- *Schools' administration:* The administration of the schools, although initially enthusiastic, didn't take practical measures to relieve the teachers' involved from regular everyday school tasks and to engage the whole school community into the innovations introduced.
- *School staff roles:* The staff of schools often does not include teachers who are responsible for departments or who can manage activities for the whole school community. The formal rules for appointing teachers to co-coordinating roles within the school are very strict and school participation in an experimental project (even if approved by the school authorities) is not a sufficient condition.
- *Colleagues:* The review of the SYPREDEM cluster projects' documentation and the Workshop indicates that the teachers who were involved in innovation did not receive much help form less motivated colleagues in the implementation of innovation activities and the dissemination of their results within the local school community.
- *Parents:* Reported in the clustered projects were instances where parents opposed to the innovation introduced exactly because it was novel (i.e. to what they assumed their children were supposed to do and learn in the school that the teachers who were involved in innovation did not receive much help form less motivated colleagues in the implementation of innovation activities and the dissemination of their results within the local school community.

The reviewer indicated the degree of difficulties engendered by different dynamics of change and of innovation in different institutional systems. The relationship of the state to schools – in for example, the increase in school autonomy that has occurred in some systems (e.g., the UK) making them more responsive to both state (in effectiveness audits) and market pressures. School autonomy is by the way an institutional condition that appeared to be rather supportive to innovation. Organisational inflexibility and lack of vision were among the conditions that prevented the rapid adaptability that is considered necessary in the learning society / learning economy. Moreover, a high level of knowledge exchanges cannot be maintained in a purely competitive economy, nor one focused only on technology rather than the people who engage in, participate in, and constitute technologies and economies. At the same time increasing managerial control within the school reduces the autonomy of the professional role of teachers, creating countervailing pressures. This dominant school ethos towards collaborative learning and collaboration among colleagues (which are closely related to institutional as well as organisational practices) also appears a crucial factor. However lack of ICT infrastructure was fundamentally limiting the prospects for ICT based innovation to be diffused in schools. Organisations, that already have an existing learning system and a substantial database of information in various forms, already have the ideal foil for changing from a centre of Learning to a "learning organisation".

Many different resources are needed to implement new standards and public sector educational as well as for-profit institutions, were seen to be moving towards more cost-effective policies in an increasingly competitive environment. The return of investment was gaining importance but harder to reach because of the high initial capital invested in the new technologies. Further the return of assets often has a medium to long-term character and is difficult to quantify and therefore requires an accurate strategic planning. A needs assessment study, encountered in one of the analysed projects, reported that about one-third of companies do not think ICT based training is appropriate for them; however, almost all say they will probably invest in it in the future. There was high interest in reducing the cost of the initial investment in technological applications. In general, the price of ICT based learning compared favourably with traditional training, and many organisations believed their training budgets will increase in the future as part of global trends. Hand in hand with implementation was the need for modifying or creating enhanced or new study and training programs. Universities and other educational institutions could save costs by sharing and re-use courses material and documentation.

Flexibility was perceived a keyword for the whole ICT development. This was conceptualised in requirements for more developed tools for flexible use of both materials and institutional resources. Flexibility would enhance accessibility to resources, knowledge sharing and collaborative communities.

2.5.3 Findings related to pedagogic issues

The reviewer noted that in the selected IST and IHP projects, pedagogical innovations were identified and addressed only to a limited extent. IHP cluster projects provided little insight to the pedagogical dimensions of ICT-supported learning. The IHP2 cluster project only contained one project with some relevance to DELPHI objectives. The IHP 1 cluster project reported that *"the area of pedagogical innovations is the least developed one and focuses mainly on curricular issues (instead of real pedagogical issues)*". Basic requirements needed to be taken into account in order to allow pedagogical innovations to take place by introducing ICT as a complementary not as a replacing tool in classroom education. Finding the right balance between student-centred and teacher-centred pedagogical approaches was an area which needed to be developed. The IHP3 cluster project stressed the need to look at "competence building" issues in organisations and institutions . Pedagogical innovation was partly addressed from a learner-centred view, by looking at the potentials of technologies to support effective learning and the development of new competences. Interactive approaches were considered to be very effective in theses terms. Communities of practice ensured collaboration among teachers for the pedagogical design and the focus on organisation related outcomes. The IHP4 cluster project did not study any pedagogical innovation in terms of techniques, methods or devices. Innovations were mainly identified as experiential and R&D based approaches (focussing on teacher and R&D communities and the relation to the implementation of innovation) but with no direct indications on pedagogical consequences.

The reviewer found IST projects with as yet little contribution to the pedagogical dimension of innovation were IST3, IST7 and IST5. IST3 as a supporting cluster of eLearning projects

was not yet at the stage to offer results from the projects. The IST7 project followed a learning content-centred approach, developed tools which would fit into a CSCL agenda, supporting learning processes by personalising learning units (material) and enabling students to individually share structured and annotated materials. IST4 was focusing on knowledge management issues. Pedagogical innovation was addressed by investigating concepts for "teaching" conceptual knowledge based on knowledge management and discovery learning. Techniques, methods and devices were introduced by a game where learners interacted in a simulated company and learned to "run" the business by introducing them to knowledge management procedures and possibilities for interventions. However, simulation as such, as a tool for innovative pedagogical approaches had not been addressed. The project IST1 suggested that a "mix and match" of learning methods can lead to more effective learning but some methods will need further investigations since they have been considered only at a very limited level. Methods were little insight is given so far are identified for argumentation tools, virtual reality and active worlds. Exploratory, collaborative, simulation based, drill and practice and self-guided learning approaches have been analysed. Some of the methods have been identified as more applicable, others as less applicable. No real data was found to support evidence of pedagogic innovation. More consideration of pedagogical innovation was found in the IST8 project and its focus on computer-supported collaborative learning (CSCL). Since there was no unifying theoretical framework, there was a wide range of methodological approaches in this field as a consequence, which was also influenced by cultural diversity. Collaborative approaches were identified as successful for sharing ideas and experiences among teachers, which also implied new approaches suggested for teacher training.

IST6 was focussing on collaborative approaches. In order to design powerful educational activities through which students aged 10-14 years explore diverse knowledge domains a pedagogical setting had been designed in order to introduce and test various IT tools supporting interaction in groups. Experiences justifying an innovative way of teaching and learning are not published yet and will need further consideration in the near future. The project is about to finish in 2005. The same applies to the IST2 project which will finish at the end of 2004. Emphasis was given here on rapid communications and access to resources and to promotion of a just-in-time learning approach. Here, the innovative dimension can be defined by the degree to which the contents are adequate to support the learning process and by the pedagogical models to be designed (or adapted) and applied to integration of mobile devices into the educational setting. Success still needs to be evaluated, but potentials were identified for diverse target groups such as users from the corporate sector with little time availability for attending training measures and the need for immediate problem solving in flexible settings.

In general, with respect to new pedagogical approaches collaborative learning remains a crucial issue to be further on explored in the future from different perspectives, taking into account organisational aspects on co-operation and collaboration as well as pedagogical, including staff development and pedagogical work in networked educational settings. Further experiences are needed to demonstrate sustainable results and concepts of good practice, analysed in a multi-cultural/European educational settings and based on different technological approaches. As some cases show, use of information technology in education and training can result in increased flexibility between working life and study by bringing

learning opportunities to the work place and by bringing working life closer to school. A prerequisite of open learning systems is, however, that various educational institutions, libraries and other information sources, as well as industry and commerce begin to perceive education from the viewpoint of lifelong learning. This requires collaboration and networking between the various parties.

Section Two

1. E-LEARNING IN EUROPE: THE SETTING

1.1 The policy context

The policy context of the DELPHI process can be located within the general targets for an *e-Europe* set by the Lisbon Summit[3] (June 2000) which posited that the European Union must become the most competitive knowledge-based economy with improved employment and social cohesion in the world by 2010. Vigorous educational strategies of member states were perceived as vital components in achieving this aim. The eEurope 2005 Rolling Action Plan (Barcelona 2002) has succeeded the *eEurope 2002 Action Plan,* endorsed by the Feira European Council in June 2000 and its aim to carry forward the Lisbon vision is based on two groups of actions, which reinforce each other. It aims to stimulate services, applications and content, covering both online public services and e-business on the one hand and on the other it addresses the underlying broadband infrastructure and security matters. It puts emphasis,

"on the widespread availability and use of broadband networks throughout the Union by 2005 and the development of Internet Protocol IPv6 ... and the security of networks and information, eGovernment, eLearning, eHealth and eBusiness"[4]

There is recognition of the need to stimulate services and infrastructure to create the dynamic where one side develops from the growth of the other: an area of tasks predominantly designated for the private sector. On the demand side actions on e-government, e-health, e-learning and e-business are designed to foster the development of new services. Public authorities, in addition to providing both better and cheaper services to citizens, are held to use their purchasing power to aggregate demand and provide a crucial pull for new networks. More specifically, with relevance to learning, education and training, eEurope 2005 actions are underpinned by the notion that it is for education authorities in each member state to develop the skills of its citizens through education and lifelong learning but the Europe-wide "eLearning" initiative promotes new online ways of learning through and across the EU. Implicit in this latter orientation is the need for the rapid adaptation of existing structures and *"ways of doing things*" to the use of diverse multimedia platforms that future technological convergence in combination with broadband enabled communication offers. The eEurope 2002 vision concretized within eEurope 2005 essentially asserts a notion of eLiving and a seamless movement between sectors, of which education and training activities, within a lifelong learning paradigm, are crucial

[3] http://europa.eu.int/comm/lisbob_strategy/index_en.html
http://europa.eu.int/information_society/eeurope/2002/inex_en.htm

[4] http://ue.eu.int/Info/eurocouncil/index.htm

components.

The aim of the EU's eLearning initiative is to mobilize educational and cultural communities, as well as the economic and social players in Europe:

"in order to speed up changes in the education and training systems for Europe's move to a knowledge-based society".[5]

and to do this by placing emphasis on key measures relating to infrastructure, training, services and content and by strengthening cooperation and dialogue.

The ongoing policy context reminds us that education, training, learning are long term processes but the speed of proliferation of technological innovations creates difficulties in achieving the degree of distance needed to consider and reflect upon the organizational, social and cultural dimensions of these innovations. For the first time, learning technologies have advanced well beyond learning theory (Salomon 1997). We have entered what Bonk (2004) has described as the *"perfect e-storm"*, where technology, the art of teaching and the needs of learners are converging, but ominously against a background of decreasing education budgets. The reviewed projects had therefore to be considered within a landscape that is constantly moving, deepening and becoming ever-more complex.

1.2 The spread of ICT in education

Within the member states of the European Union and other countries of Western Europe, there have been differing timelines and degrees of intervention via investments and activities in embedding ICT structures and accompanying measures, in line with national priorities and available financial resources. The first European report on quality indicators of lifelong learning (July 2002) published the following table demonstrating the different national emphasis given to expenditures in education in European countries:

TOTAL PUBLIC EXPENDITURE ON EDUCATION AS % OF GDP[7]

Country	95	96	97	98	99	00	01
EU	5.44	5.44	5.34	5.35	5.23	5.18	5.03
Belgium				5.19	5.64		
Denmark	7.67	8.09	7.94	8.22	8		
Germany	4.71	4.8	4.73	4.66			
Greece	2.87	3.07	3.44	3.48	3.66	3.51	3.52
Spain	4.66	4.68	4.54	4.49	4.50	4.46	4.45
France	5.97	5.95	5.97	5.89	5.89	5.83	5.75
Ireland	5.74	5.92	5.74	5.29	5	4.78	
Italy	4.87	4.86	4.57	4.55	4.55	4.62	4.49

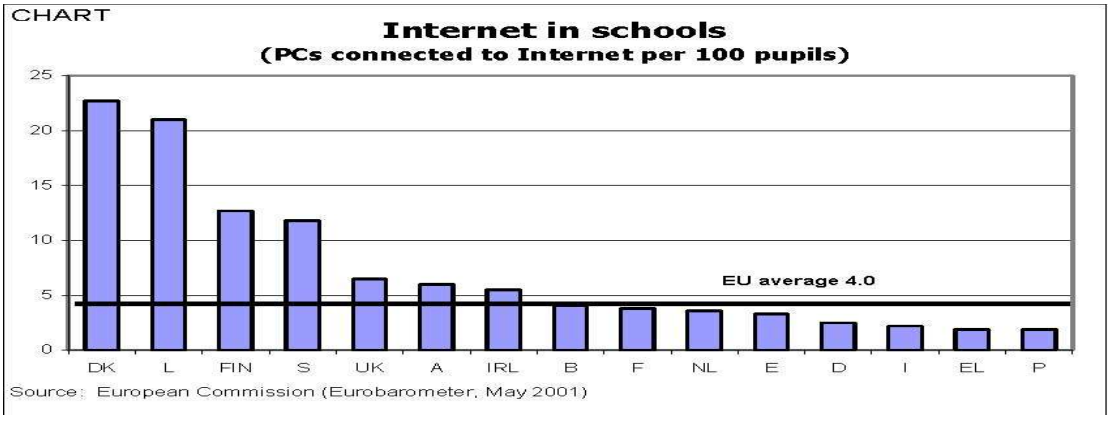
[5] key objective as presented on the web-site of the European Commission (http://www.europa.eu.int/comm/education/elearning/index.html).

Lux.	4.26	4	4.07				
Netherlands	5.01	4.96	4.79	4.87	4.78	4.93	4.91
Austria	6.53	6.41	6.30	6.28	6.31		
Portugal	5.37	5.53	5.59	5.60	5.73		
Finland	6.87	6.96	6.47	6.24	6.19	5.97	
Sweden	7.46	7.62	7.89	7.98	7.74	8.39	8.33
UK	5.04	4.84	4.66	4.58	4.60	Q4.86	4.76
Iceland	4.88	5.32	5.41	5.98			
Norway	7.15	7	7.65	7.68	7.36	6.6	
Czech Rep.						4.4	
Estonia						7.4	
Latvia						6.3	
Lithuania						6.5	
Hungary						6.5	
Poland						5	
Romania						3.4	
Slovenia						-	
Slovakia						4.3	
Cyprus						5.7	
Malta						4.7	

[7] Source: http://europa.eu.int

Shaded areas indicate GDP percentage at 5% or more

Public budgets for educational expenditures vary across European countries and have been decreasing in most cases. In terms of ICT infrastructures in European school education the assumption becomes more obvious that more investment is needed. According to the results of another study relating to the Internet infrastructure in school education[6] - a varied situation can be detected among the European countries:



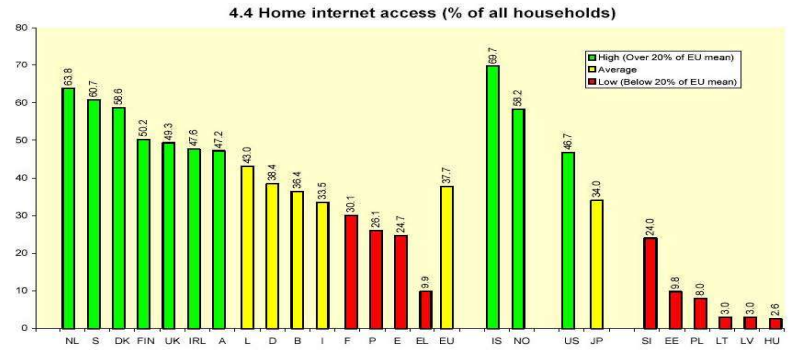
This report noted that:

• "On average, there were 12 pupils per off-line computer and 25 pupils per computer connected to the

[6] *Lifelong Learning for Innovation*. EU Benchmarking Report

Internet: half of these computers were less than three years old. However, there are considerable differences between Member States.
• Connectivity remains dominated by narrowband technologies: over two thirds of school connections are ISDN and the others mostly dial-up via a regular phone line. Broadband technologies are marginal, although ADSL and cable modem are now more widely used in a few countries.
• Whilst computers are now used by a majority of teachers, only a minority of them use the Internet for educational purposes. The main reasons given by teachers who did not use the Internet were poor levels of equipment and connectivity. Lack of familiarity does not seem to be a major problem. More than half of Europe's teachers have been trained in the use of computers and the Internet, around 90% of teachers use a computer at home and approximately 70% have an Internet connection at home." [p. 7]

In terms of ICT infrastructures and Internet available in private households the same uneven development can be observed:

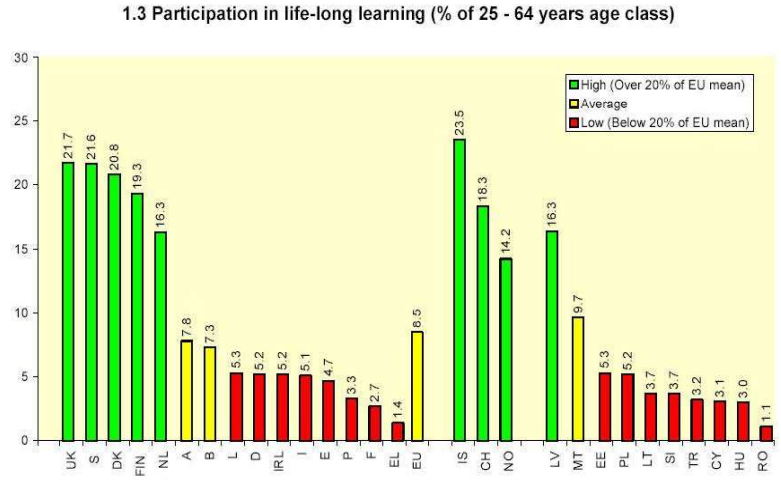


Sources: EUROSTAT/Eurobarometer; GSO survey for EE, HU and LV; years used: 2001 for all countries, except 2000 for JP, HU and LV.

[8] [eEurope Benchmarking Report eEurope 2002, http://europa.eu.int/information_society/eeurope/news_library/new_documents/benchmarking/benchmarking_en.doc]

There appears to be a correlation between in terms of level of advancement in embedding equipment, connectivity and usage and participation rates in lifelong learning if we look at the table9 below in comparison. It would be unwise however, to make any connection in that respect as population size, GDP and a host of other variables would need to be factored in before determining a connection.

Participation in Lifelong Learning (25 – 64 years)



Sources: EUROSTAT, Labour Force Survey; GSO survey for CH, LV, MT and TR; years used: 2001 for all countries, except 2000 for CY, 1999 for CH, 1997 for A and IRL, and 1996 for TR.

In 1999 the EU published a survey, *"Measuring the Information Society*"[7] assessing the availability of IT equipment to EU citizens and their willingness to pay for special on-line sources. Where connection from home to internet was concerned an average of 8.3% of those surveyed had access. There were large divergences with Sweden having the greatest on-line usage (40%), followed by Denmark (25%), Netherlands (20%), Finland (17%) and the UK (11%). In some member states less than 10% of those surveyed used the internet at home. The same survey found where demand for on-line services was highest was in services for education and training at 34% of all respondents, with overall 18% of respondents willing to pay for such services. The table below shows national variations under this section:

Country	Interest in open & distance learning on-line %	Willingness to pay %	Internet connection %

[7] INRA (1999) *Measuring the Information Society",* Brussels, European Commission

Belgium	33	20	8
Denmark	45	31	25
Germany	28	14	7
Greece	27	16	3
Spain	34	16	5
France	38	21	4
Ireland	37	17	8
Italy	34	17	6
Luxembourg	31	18	14
Netherlands	44	23	20
Austria	32	20	7
Portugal	30	9	3
Finland	47	22	17
Sweden	53	37	40
UK	37	16	11
TOTAL EU	**34%**	**18%**	**8%**

What seems interesting is that even where there is currently low home internet access there is an appreciable demand for open and distance learning on-line: a positive indicator both in terms of European goals for "e-living" and for embedding notions of lifelong learning. Recent research on Open University students in Europe (Regan 1998) and ICT access indicated that 66.3% of those surveyed were on-line. The Scandinavian countries were strongly on-line (Finland 100% for example) but the divergences were much smaller than indicated in the EU survey (e.g., Netherlands 85%, Austria 81%, France65%). In Greece and Italy, however, fewer than half of the students were on-line. What this survey[8] found was that rates of usage of email and the web for educational purposes had doubled compared to the results of a similar done only two years previously. The tables below refer to usage found in respect of IT services for educational purposes :

Use of on-line facilities

%	HOME	WORK	BOTH	TOTAL
e-mail	21.7	17.4	26.4	**65.1**
Computer conference	10.6	5.9	5.6	**22.1**
World wide web	2.9	14.9	20.3	**58.1**

Whilst all the above indicate variations in embedding ICT technologies in educational and training structures across member states and indicate variations in access, in general what is confirmed is the apparent growing demand for *e-learning*. It is a demand specifically targeted and encouraged by policy makers and importantly by the desire of national governments to orient their populations towards e-government, e-commerce, e-learning – in a word e-living. Such variabilities evident in embedding ICT technologies and so the capacity for e-learning accessibility have significant implications for policy makers when devising approaches for optimizing effective outcomes of pan European projects concerned with new learning technologies in education.

[8] quoted in *Electronic Education in Europe,* A. Robinson (2001)

2. E-LEARNING, INNOVATION and EDUCATIONAL PRACTICE: SOME AREAS FOR DISCUSSION

DELPHI reviewed the projects within a continuing discussion of what constituted key innovations in education. However, no description of a theoretical framework was given of how "innovation" develops, nor of the processes which form, shape, transmit and diffuse innovations – that is, innovation systems. Such systems have been variously described as networks of institutions which interact to produce innovation (Freeman 1987), as elements and relationships which interact in the production, diffusion, use, transfer of new and useful information, skills and artifacts which define new technologies (Lundvall 1992, Metcalfe 1995). Information and communication technologies occupy a prime position as major innovations but it is their simultaneous combination with a range of broader societal changes that creates both challenges and need for change in educational systems and practice (Molina 2003).

DELPHI approached innovation by considering what were viewed within a literature review of definitions of e-learning as key areas of innovation. These key areas have been used to formulate a review template to be used as the basis for analysis of the projects. The review of the literature revealed that the various definitions on e-learning all imply as "innovation" the use of ICT in the learning and teaching processes. In this respect the discussion below focuses more on parameters and factors related to innovation rather than on those that constitute e-learning from a conventional point of view.

The DELPHI project developed an overview on the state of the art in e-learning by outlining several dimensions which needed to be taken into account and which covered pedagogical and psychological views (e.g. learning concept, teaching techniques, instructional concept) , technological and functional views (e.g. platform requirements; features/tools) , organizational, economic and socio-cultural views. In respect of the DELPHI objectives the issues which were considered were organizational (institutional), pedagogical and socio-cross-cultural as the most crucial ones for successful policy development. . The technological view whilst considered an important dimension for investigation was not wholly focused on. DELPHI identified the following issues as indicators for innovation which need to be matched to current e-learning practices and trends.

Template for areas of key innovations in e-learning[9]

Pedagogic	**Organizational/Institutional**	**Socio-economic**
Teaching & learning philosophies	Large scale operations	e-learning standards
Teaching techniques, methods & devices	Cost effectiveness	LMS systems
Assessment	Incentives	Systems Integration
Teacher workloads	Flexibility	Globalization & Competitiveness
Teacher training	Accessibility	Funding & commercialization
Teacher collaboration		Mobile learning

[9] Source: Del. 1: *e-learning – The State of the Art*, p.4

Bandwidth & rich media		

It was assumed that as insights differ, between research and practice, both perspectives were relevant for analyzing projects according to the research questions posed within the scope of the DELPHI project objectives. In reviewing the literature it was observed that the term, *"innovation"* was used in a very broad way based on different definitions, ideas and perspectives presented in discussions of introducing ICT to education. To some degree the discussion about innovation in education was considered rather narrow as most of the existing definitions were related to the industrial domain, where technology (as a product) is seen to be the core of the definitions. If, however, applied to teaching and learning, innovation can be process-oriented as well, describing progressive changes and goals in relation to the process of organizational change as well as the process and flow of knowledge. Bates has defined four different categories for innovation: organization, administration, curriculum design and instruction. Focusing on the field of educational technology these perspectives are added to more technology-oriented approaches leading to a more general and abstract picture about the meaning of the term.

The first deliverable noted that there were various aspects as to how information technology is used in education: as a platform for the development and delivery of products for teaching and learning and as a tool for the organization of the learning contents and resources. This covered relevant aspects about environments and courses which cannot be analyzed separately due to their inter-dependency. The question thus arose as to whether open and flexible learning environments built on information technology will lead us to qualitatively better, more effective and more efficient education and how these new educational models have to be created.

The ubiquity of the internet and the world-wide web enables telematics based formal and informal education and training to come within the reach of widespread and diverse populations. Further, in addition to the synchronous and asynchronous tools[10] for online learning there are dozens of technologies now emerging which are and will be used, further radically transforming the educational landscape. These include:

1. Augmented Reality
2. Assistive Technologies
3. Blogs
4. Asynchronous Conferencing/Discussion Forums
5. Course Management Systems(CMS) & Learning Management Systems(LMS)
6. Collaborative tools & Work Team Support
7. Digital Libraries
8. Digital Portfolios
9. Electronic Books
10. Games & Simulations
11. Handheld & Palm Devices
12. Instructor Portals

[10] Asynchronous tools might include online discussion forums, electronic grade books, online exams, web link sharing, student profiles: synchronous tools often include application sharing ,web browsing, audio and video streaming, chat rooms, surveying, polling.

13. Intelligent Agents
14. Interactive News Media
15. Internet Based (IP) Videoconferencing
16. Massive Multiplayer Online Games (MMOGs)
17. Online Quizzes & Exams
18. Online Surveys & Polling
19. Online Homework and Grade Books
20. Online Language Learning
21. Peer to Peer collaboration
22. Reusable learning Objects (RLOs)
23. Synchronous Conferencing, Live e-learning or Virtual Classrooms
24. Tablet PCs
25. Video Papers
26. Video Streaming
27. Virtual Worlds/Reality
28. Voice Information Retrieval Tools
29. Wearable Computing
30. Wireless technology

Pupils and students are increasingly entering their classrooms and educational sites with laptop computers, mobile phones and various other handheld devices all wirelessly connected to the Web and with them they bring online learning opportunities more deeply into the traditional classroom setting. As they do so against the background of the burgeoning technologies mentioned above, the pedagogical possibilities of every connected student and classroom multiply (Bonk & Cunningham 1998). Increasingly younger generations will enter the arena of on-line learning expecting interactivity, high quality visual effects, rapid access to information, electronic books embedded with interactive simulations and scenarios to be played on demand.

With this landscape in view, it is clear that education has entered a period of unprecedented transition in which traditional paradigms are fundamentally opposed to new ones. Consideration is required of different types of environments and courses varying in their approach and extent to which they are attached to traditional methods of place-based or distance education or how far they are connected with new and emerging learning theories and their implementation.

The findings from the reviewed projects have demonstrated a range of different learning environments and have shown that ICT is not prone to support one particular type of learningenvironment over another. On the contrary, in the design of ICT-based educational innovations, technology has to be introduced in such a way as to create and support the learning environment desired. However, it is clear that there is little awareness of the caution that the great exponent of cybernetics, Stafford Beer, who elaborated that where society (and its institutions) are concerned computers and automation should not be used to do what had been done before, but the opportunities offered by new technology should be used to totally rethink processes and systems. In practice, DELPHI findings indicated that the development of a virtual learning environment may be as a result of pragmatic and expedient decision-making at the institution level related to cost savings rather than

pedagogic quality or with the desire to create new paradigms. There is a perceived emphasis on managing the technology (and students) as opposed to engendering the pedagogic possibilities.

The evolution of learning environments, however, is a complicated process, where an institution's cultural and historical situation with practical arrangements is often the critical factor and not the discourse of learning theory (Bourdieu & Passeron 1977). Instructional methods, the quality of courses within the different environments are not the only consideration: it is the whole setting of the educational activities which must be analyzed. Some environments are based fully on the virtual model, others are linked to traditional courses talking place on a local school/university campus. Some are taught to a trans-national audience, others to a local community, some course topics need different pedagogical features to others and finally it is the applied hardware and software technology as well determining some of the key indicators of the context. This influences the structure of the virtual environment as well as the methods being applied.

Definitions of e-learning in the projects were varied covering notions of virtual learning, virtual campuses, e-learning, networked learning, which in many ways were both contradictory and complementary. They shared some dimensions, but in fact the starting points often differed according to what sorts of institutions were involved and the problems they needed to solve. For instance, for the project HE5 e-learning is seen as:

"learning supported with the aid of all kinds of information and communication technology (ICT). We do not restrict e-learning to only using the Internet for didactical purposes in higher education, as is often the case. Also more traditional media, such as video, audiocassettes, television, radio, telephone, CD-ROM, or even satellite communication are envisaged as well. A shift is made away from the scenarios as a basis for problems, to a more-abstract matrix in which problems are classified in terms of their nature (attitudinal or practical) and their basis (pedagogical, technological, organizational). (Final Report, p. 6)

For this project, networked e-learning (more than the two direct partners, teachers and students, are involved) involved students at different universities in different countries establishing a learning community and taking the same courses, collaborating on the same projects and communicating in a sophisticated virtual way. It could also mean that teachers across institutional or national borders find each other and jointly develop courses, share learning material and divide the tutoring activities. It could include far-reaching collaboration and policy making amongst institutes of higher education on the educational use of ICT at the highest strategic level. It could be of interest to other parties as well, such as financial institutions, local municipalities and NGO's.

Networked e-learning should not only be defined as learning through the Internet, although it is certainly of utmost importance and probably the most obvious and most visible format. In this sense we subscribe to the definition of the European Commission: "The use of new multimedia technologies and the Internet to improve the quality of learning by facilitating access to resources and services as well as remote exchanges and collaboration."

For the project HE1, virtual learning is an idea that is close to higher education managerial concerns. This can be seen in the definition of VLEs:

The Virtual Learning Environment is a framework, which will incrementally integrate all of the academic

businesses of the institution into a coherent whole through the use of ICT. The system must ultimately deliver a significant improvement in the manner in which the institution conducts its business.

In proto-typical settings courses are based on written learning material available in an electronic and/or printed version, including questions, exercises and tests to be completed with some discussions taking place "on-line" with a tutor from a remote place. Other similar, more telematic oriented applications consist of a more teacher-centered approach, where "traditional" lectures predominate. A typical adaptation of this concept by means of instructional technology is real-time two-way videoconferencing in order to simulate traditional classroom teaching.

In general, DELPHI observed that in practical teaching situations the methodology used in computer assisted instruction was moving more towards ICT assisted knowledge construction, distributed expertise and collaborative learning. Hyper and multimedia-based sources of knowledge have replaced, in some cases, traditional study books with electronic books. ICT and networking makes, in many instances, the learning environment is more open in terms of knowledge acquisition during all phases of education. The increasing acceptance of online courses gives an indication that learners and users value the advantages of studying independently of time and place. Experience shows that they appreciate more communication-oriented approaches where participants have to be actively involved and where a pastoral structure exists.

Whereas traditional paradigms in education have been based on the concept of knowledge transfer (knowledge from person A to be transmitted to person B) the new
paradigms rely more on constructivist principles, a dominant tendency within current educational theory. Here learners engage in constructing their own knowledge through a process of active learning. Contemporary learning theories emphasize problem solving in the learning process and they also take into account the social nature of learning and the complexity of students' acquisition of knowledge. Such a learning process requires negotiation (Cennamo *et al*, 1996). Constructivist ideas of learning and knowledge underlying learning environments, open learning and project study are closely connected with considerations of the nature of knowledge in the teaching and learning process. The role of the teacher changes to a large extent. Within the context of new educational paradigms the new functions can be characterized by the shift from acting as a content provider and "transmitter" towards a mentor guiding and supporting learners through the process of knowledge acquisition. A reasonable conclusion of this is that there is currently a need for integrative concepts for the implementation of open and flexible learning via ITC in education that can demonstrate a methodology of good practice for educational needs. Problems relating to this lack of a full and encompassing concept have to be seen from different perspectives and within different contexts of education. Implementation is inextricably linked to degrees of transformation of the pedagogical, sociological, legal, technological and organizational structures.

An overarching assumption (and one not particularly challenged in the projects) attached to the implementation and development of e-learning is that it offers entry to a process of renewal of pedagogic models. Active learning and socio-constructivist approaches operate widely as educational practices and can be seen within many of the projects directly concerned with innovative e-learning. However uncritical and un-reflective

implementation of such approaches is fraught with risk and may not in some small measure be responsible for the difficulties many teachers have in happily using new technology. Training in technology use will clearly not solve this. As we have noted, one way of classifying pedagogic approaches is along a parameter from the transmission of formal knowledge by voice or script at one extreme to learning by doing at the other. ICT-based e-learning can accommodate both of these, from serving as a channel for the exchange of lectures-notes and student essays at one extreme to providing a manual, for example, for mechanics or doctors who are working in real time on a real engine or a real patient at the other. However, the discourse of constructivism which has arisen from school education is primarily focused on various levels of simulation or play. This discourse occupies the middle ground between the extremes on this parameter. While schoolchildren can write real poems or plant real plants, the middle ground is occupied by learning about things which are to some degree inaccessible for reasons of distance, safety or cost. Exposure to these phenomena means exposure to images, maps, models, and films, while participation means role-playing and simulation with some degree of unreality. ICT-based e-learning appears to offer the possibility of making available a wider range of such materials, at lower cost, with greater or more seamless integration and authenticity, and available anywhere and anytime through cyber-space.

It might be argued that there are two negative aspects of these opportunities. One is that access to this resource is channeled through a small screen and has to be constantly manipulated through a keyboard. The other is that the pedagogic methods of group work and dialogue which have been developed throughout the twentieth century are disrupted by the isolation which fixation on the PC causes even when the members of the class are in the same room. In a European context this is revolutionary, although we should remember that in large parts of the world children and adults have also participated for a long time in distance learning through radio and postal and other services.

The projects examined, like most other e-learning materials and systems which have been developed, have generally arisen from an understanding of the potential value of ICT technologies to expand the scope and audience of existing educational systems and approaches. They have visualized this as an expansion of the classroom and a breaking down of the barriers between education and the wider world. They have eschewed the 'transmission' model but have seen the pedagogic possibilities of e-learning in terms of a potentiation of the possibilities of the constructivist approach as a result of the greater powers of simulation and presentation available through ICTs. The communication potentials of ICTs have been used to add on tools for dialogue between teachers and students and among students in real time and through central data banks. There are three reasons for this basic limitation:

i. the need of the organization to maintain control of the process
ii. the need to assess and grade students, and
iii. the power of the idea of the classroom as the basic model and therefore of the process as basically one of simulation of what cannot in reality be accommodated in the classroom.

It is worth remembering that the constructivist model arose at a time when there was what, in retrospect, seems to have been a surprising degree of consensus about the basic "furniture" of the universe. This seemed to offer the possibility of producing a standardized

range of pedagogic material which would provide students with a realistic simulation of those parts of the universe which they for a variety of practical reasons could not directly access. In some pedagogic cultures this was to some extent supplemented by an emphasis on the need to develop critical thinking and independence of judgment. We have several centuries of experience in developing critical thinking and independence of judgment in both humanistic and scientific education through traditional methods, but we have (as yet) little idea how these goals will be affected or effected by the plethora of information available through cyberspace or by the habits of thought fostered by using it. Active learning takes place, but the designers of the system did not themselves learn in this way and thus have no real idea what it is that learners are learning.

The constructivist approach is certainly not wrong in terms of using exposure to a wide range of materials to elicit active learning through a range of targeted interventions. A problem, however, arises not from any basic flaw in the pedagogic technique but from a lack of reflection on what representation and simulation really mean in a world without a basic consensus about the reality which is to be represented and simulated. There is a distinction to be made between fostering critical thinking and simply allowing all of the dissonance of the real world to be played out within the classroom. Opening up the classroom to the real world may be justifiable on a number of grounds but should not come about simply as a result of the economic and technological attractions of ICTs and cyberspace. There is then, it might be worth noting, on the one hand, a tendency to sell e-learning short by simply using it as a cheap medium to extend the penetration of the same old learning materials and approaches. On the other hand, the real results of this are incalculable because we do not know whether the same old things really are the same old things when they are learnt exclusively through a different medium. So the result is a mixture of unintended conservatism and unreflected, undirected change. This means that the development of ICT-based learning systems and e-learning is an excellent object for the study of evolutionary processes.

Conceptual and methodological investment made in the past and currently concerning these issues is of huge significance for practitioners. Such investment has borne results within open and distance learning, particularly at the tertiary level. At the level of school programmes there is a general consensus that developing the role of teachers and redefining school programmes within the new paradigms is progressing slowly. There is as yet no consensus on how to redefine school programmes. Some indications emerge from some of the reviewed projects that whereas training in tools remains predominant, there is yet an understanding that ICT use must be put into perspective in relation to teaching practices. Further, ICT use must be placed in context in relation to subject areas and the vigorous promotion of cross-curricular approaches. This reflects the notion that ICT use does indeed permit a rethink of traditional boundaries as many projects bridge subject or traditional areas. This implies that there is in some degree an understanding that the knowledge, skills and expertise required have to be known before considering the relevance of a tool, application or innovative approach.

There is an aspect of e-learning addressed by some projects which is different – learning how to use e-commerce, e-democracy, e-governance, e-health care information etc. In this case there is no simulation involved; one is simply learning how to use the real systems.

However, as with the use of, for example, word processing, spreadsheets, databases and programming languages, there will probably be a demand for accreditation of skills, which in turn will lead to requirements to *'learn'* the less useful parts of these systems up to the same level as the really useful ones. On-line systems to simulate the real use of such systems and assess the user's skills in doing so will therefore develop alongside the 'real' hands-on learning of actual users. Schools may find this useful in filling in reports, on among other things, student's civic participation.

It remains then unclear as to what extent the use of ICT and virtual learning environments will affect the daily life of teachers and learners. Educational activities take place in a variety of settings, it has to be analyzed how far a traditional organizational structure, for example, has to be changed or adapted in order to allow effective teaching and learning. Presuming that statements which refer to an incompatibility of ICT-use with traditional education, (Hoda (1997), are incorrect, there still remains a requirement for consensus on how people learn in order to find sound strategies for ICT-implementation and for providing effective education in Virtual Learning Environment settings.

In a study about the evaluation of environments (Britain and Liber, 1999) define two crucial issues as needing to be delineated in the work developing Virtual Learning Environments (VLEs):

• VLEs should provide opportunities to improve the quality and variety of teaching and learning that are not being achieved using current methods.
• VLEs should reduce the administrative burden on teachers, thus allowing them to manage their workload more efficiently and to be able to give more time to individual students educational needs.

Considering these requirements as one of the starting points for the study about teaching and learning it becomes obvious that the approach for analyzing the process must reflect various other aspects other than just discussion of pedagogical techniques within Virtual Learning Environments.

Within an open learning environment, learning can be largely directed by the learners themselves and mentoring and tutoring, systems for supporting learning and study guidance, require special emphasis. Tutoring can mean support related to the learning process, study contents, tasks or technical problems. According to Daloz (1990) effective mentorship is akin to:

"guiding the student on a journey at the end of which the student is a different and more accomplished person. In a formal learning situation, mentoring functions can be understood as variously providing support, challenge and vision."

On-line mentoring of students and assisting them in the learning process implies a range of options in the sense of mentors knowing where different techniques are more effective and what disciplines or online experiences might benefit from online mentoring. Tools for providing both tutoring and mentoring must be adaptable for each purpose in Virtual Learning Environments.

Whatever kind of techniques are being used it becomes clear, that teachers and instructors need special training for online-education. They must be qualified in knowing how to

decrease anonymity and to establish the atmosphere of a learning community , how to motivate and keep the motivation of learners high; how to avoid student frustrations, how to establish and maintain interaction among students, between teacher and students and between the user and the system and how to moderate discussions. Sets of tools and "tricks" can be applied but these, nevertheless, must be taught to staff concerned to avoid any repetition of same mistakes, same explorations and in order improve the applied methods in detail.

In terms of socio- cultural considerations in the European context the fact that the USA is the leading nation in the world of ICT, which is to a great extent due to its large home market which is almost entirely American- English speaking, presents problems. The USA has a significant Spanish-speaking community but the members of this community who use ICTs are largely bilingual. The USA therefore can develop ICT products initially in English and satisfy the home market with access to global English-speaking communities, and can follow this by developing Spanish versions with equivalent global markets. By contrast, the EU is faced with the task of developing language-specific versions of educational software not just in the national languages but also in some other education-recognized languages. English and Spanish products face US competition in both the European and global markets while the global market for ICT products in French and Portuguese is currently relatively weak.

In the context of expanding lifelong education, opening the opportunities of e-learning to older people, for example, reflecting the need to acknowledge the logic of current European demographics, is particularly problematic as they may not have English even as a second language. This means that the inclusion of much undigested English into the computer-speak of the national languages is itself a barrier to their participation. Technical translation and educational translation and adaptation are expensive services while machine translation is still very inadequate. It is both expensive and inefficient to produce multiple versions of translations of operating systems. It therefore seems that a first step towards developing a European-wide e-learning culture, a point commented on by some of the reviewed projects, would be the development of a standard vocabulary and phrase-book of operating and navigating instructions for e-learning systems. The Commission's Action Plan recognizes this and that it is important not to develop technological solutions, software and contents in isolation from linguistic and cultural issues.

A crucial aspect to the ease of availability and reading of information is in relation to meta-data and CEN and the standardization bodies have identified the need for a focal point in Europe on Dublin Core metadata standardization to be more generally applied. Some of the projects reviewed indicated a sharp awareness of the complexities of the standardization process but there was the feeling that more significant assistance should be given to projects on how to take full advantage of current developments. It was clearly felt that the results of research and practitioner projects can be valuable to standardizers, and, conversely, these projects need to have state-of-the-art information on standards development programmes.

The standards programme for eEurope will facilitate the adoption of the research results and provide feedback about their acceptance and problems in their use. There are close links between standardization and research. In the field of information and communication

technologies, many of the projects deal with issues such as inter-operability of technologies, harmonization of electronic communications and so on. Project results clearly can be valuable to standardizers but conversely projects need to have state-of-the-art information on standards development programmes. This is essential in terms of sustainability and scalability potentials.

Many of the projects reflected an awareness of the need to locate innovative technology developments with applications and services in addressing socio-economic issues, which goes beyond adhering to the transversal requirements of the particular programmes from which they received funding. The development of open standards and open source software to ensure interoperability of solutions and further innovation was clearly motivating some projects but this also served to remind us again of the uneven development in implementation and access that operates across the Community, for a variety of reasons.

It is unclear at the present time what indications there are that the new technology wave imminent can be embedded within current institutional and organizational structures and as well deal with the need for new conceptual and methodological paradigms required in teaching and learning, referred to above.. It is worth reminding ourselves that rapid progress is underway in developing user friendly interfaces which are intuitive, can interpret all our senses such as speech, vision and touch and that understand our gestures and various languages which will be coupled with powerful and flexible knowledge technologies that are semantic-based and context-aware.

As has been noted above the irresistible process in place of where burgeoning technology, the art of teaching and the needs of learners are converging but are doing so against a background of decreased budgets in education and the yet ever-present need for funding. In this regard the issue of appropriate economic structures for funding, investment and sustainability of innovation is crucial. Internet access costs, originally identified as a major hurdle to ICT innovative learning are going down. The marginal costs of internet access for a PC owner have become smaller but remain significantly higher than in the USA: they are also much higher for broadband internet access. There appears to be no prospect of a feasible pay-as-you-go-per-use payment model for e-learning because there is no overall successful model of micro-payment on the internet. This constrains the possible models of financing of e-learning systems. They must either be free to the end user, sold as a complete package, or subsumed within some fee for a larger service.

The simplest model is free provision to the end user by the originator through their own web site. In this case continued financial support for some degree of promotion of the service would also usually be required to ensure take-up. If software is provided free to other organizations by the originator some degree of regulation to ensure that the service is passed on free to the end-user might be required. One area of possible growth in free-to-end-user e-learning may be the web sites of national employment services. Universities and other public bodies may make their stand-alone software freely available but will not be able to provide supported tutor-based, mentor-based or forum-style learning systems available on the same basis.

Commercialization of e-learning services seems to require either that the e-learning is sold

as a stand-alone package to the end user or that modules or instalments are sold to the providers of e-learning portals or more general multi-use portals who recover their costs by some combination of advertising and subscription charges.

The extreme fluidity of the market in web access portals will probably lead to the concentration of commercial e-learning in two kinds of service: provider portals such as America On-Line and Microsoft MSN on the one hand and specialist commercial Human Resources companies on the other. The former would bundle the cost with their overall subscription or would regard it as a loss-leader to attract or keep market share. HR companies would need to target their market very precisely and/or integrate e-learning into personal development and firm-specific competency systems in order to keep their market share.

The developers of e-learning software and systems might consider these options at the very beginning of their project and some of the reviewed projects have clearly done so. If they envisage free-to-end-user delivery however, they should specify what kind of body will provide the ongoing support for hosting, accessing and promoting the service. If they envisage commercialization they should specify whether they are aiming at schools and colleges, HR firms, or the general public, as individual purchasers or via portals, and they should be required to conduct targeted market research in line with these projections.

It is well illustrated within most of the reviewed projects that new cost analysis models are needed which would indicate with some surety the real costs of e-learning for the benefit of policy makers, course providers, students and users. Whilst within open and distance learning there is a long tradition of costing underpinned by the desire to reach more learners, it has been noted that the educational climate is such that the cost efficiency of traditional classroom based education, traditional distance learning and the newer networked paradigms needs to be established. Costs are difficult to quantify as there is often disagreement about which costs should be taken into account, reliable data is unavailable because it is not collected in a systematic manner, recorded costs are unstable and evolving and some data is perceived as confidential and may not be made publicly available. Ash and Bacsich have identified a significant barrier in addition that different and previous costing approaches use different vocabularies and these need to be standardized before they can be analyzed. Costing activities have a central role in the planning and development of educational systems and so financial and costing schema needed to be partnered to planning documents for effectiveness and sustainability Across Europe there is little evidence in the literature that this is fully recognized. Ash and Bacsich suggest a three phase model and associated financial schema which includes a stakeholder dimension.

Planning & Development	*Developing/innovating an idea* *Writing up business/action plan* *Purchasing & evaluating existing material or developing your own*
Production & Delivery	*Curriculum delivery* *Progress monitoring* *Marking & feedback*
Evaluation & Maintenance	*Quality assurance exercises* *Replacement & updating of materials* *Evaluation against aims outlined in action/business plan*

Stakeholder dimension

Expenditure dimension	Institution	Student/User	Staff	Total
Staff Costs	*Salaries, wages, pensions etc*	*Opportunity cost of learning not earning*	*Opportunity cost of not doing a better job*	
Depreciation	*Buildings, computing provision*	*Own home computer and accessories*	*Own home computer and accessories*	
Expenses	*Subsistence, registration*	*IT consumables, connection charges*	*Expenses incurred*	
Overhead	*Software licences*	*Additional insurance*	*Additional energy requirements*	
Total				

Only some of the reviewed projects indicated a full awareness of the need for new economic modeling for detailed cost analysis of various technology/pedagogy interfaces although it is clear that the development and implementation of automated courseware production systems, automated pedagogical advice systems and automated business systems can potentially deliver huge economies of scale and associated costs effectiveness.

The DELPHI review has shown that in many projects the use of ICT in education and training can result in increased flexibility between working life and study by bringing learning opportunities to the work place and by bringing working life closer to school. A prerequisite of open learning systems is, however, that educational policy and stakeholders such as educational institutions, libraries and other information sources, as well as industry and commerce begin to perceive education from the viewpoint of lifelong learning. This requires collaboration and networking between the various parties which can be directed and facilitated by national political and policy processes.

As European projects differ in goals, contents and methodology, generalization is difficult in terms of impact in regard to certain relevant aspects connected with technology, education and learning. Even when the objectives and outcomes are similar indicating that general conclusions might be derived, there is a lack of initiatives and structures synthesizing relevant outcomes in order to generate new information concerning the research required to facilitate applying ICT in innovative education and the imperatives determining policy formulation. The next section will specify possible indicators derived from the project reviews.

4 Policy recommendations and conclusions for further discussion

The review has revealed that the dimensions examined –pedagogy, institutional / organizational change and socio-economic aspects, hold strong interdependencies suggesting that policy formulation (and innovation implementation) has to treat emerging new forms of education from a holistic perspective at all levels of education.

The review process, even of a limited and disparate range of projects, has revealed valuable information as to the "ingredients" of new forms of teaching and learning and suggests that there are a multiplicity of issues that have not been addressed .

The DELPHI Consortium recognizes that even though the review process might have omitted parameters and issues dealt with in the case projects that could have revealed valuable information regarding the rethinking of teaching/learning in the digital age, certain key areas of concern have emerged.

Areas for Policy Considerations

The Delphi process has elucidated seven key areas for policy consideration:

1. Teacher Training

As the role of the teacher and instructor in ICT based educational settings is different from that of the conventional settings, consideration needs to be given to the "appropriate" training of teachers. This has strong implications for Teacher Training Institutions as their curricula need adjustments so as to be supportive to the complementary role of the teacher to the existence of technology in the school/learning institution

2. Infrastructure Arrangements

The arrangement of computers influences the interaction process (teacher-learner, learner-teacher) and this finding suggests that the educational planner –whether school administrator or State official, - defines and conceptualizes first the desired interaction model and accordingly arrange the available infrastructure.

3. Harmonization of Actor's attitudes

It appears that the sustainability of an introduced innovation in learning (ICT based) is dependent on the attitude of a variety of educational actors. The current state of affairs where instructors/teachers stand at either side of the spectrum – technophobia or technophilia - creates tensions that can be avoided with appropriate planning that involves

all of the educational actors. Notions such as knowledge sharing, knowledge production and continuous discourse between the actors make that necessary. Incentives appear to be needed for all actors to operate under the same wavelength.

4. Assessment

Assessment of learning outcomes appears to have received a rather low priority in the list of the educational technology supporters. Parameters, such as the development of collaborative skills, recognition and acceptance of the "different", need to be considered besides the prescribed learning outcomes.

5. Restructuring of the traditional institution

This is stronger for the higher educational sector – a sector that has received attention, but little has been done for the school sector. An island of innovation does not facilitate the creation of an ICT based culture. All school actors need to be helped (perhaps via initiatives) to establish a dialogue amongst themselves (or be guided towards it) where considered are the roles these play (with emphasis on the power shift that comes from different role playing).

6. Organizational Planning

The undertaking of innovation in learning whether ICT based or e-learning appears to be in need of organizational planning. Such planning can start from an ICT/e-learning development plan which ought to encompass aspects of collaboration of actors, time schedules, arrangements for participation, financial issues, accreditation, security et al. Particular attention should be given to cost effectiveness of the initiative and indications of its sustainability and scalability. New economic models are urgently required

7. Socio-cultural Issues

Although the promotion of ICT in education and its spin-off notion of e-learning is done in the name of providing equal opportunities to all, as technology from a technical perspective is capable of giving equal access to all, the cluster of projects reviewed do not provide strong evidence to this effect. It appears that the socio-economic parameters of and for ICT based/e-learning have not adequately been researched so as to provide an evidence base of its role in the structuring of our learning systems. (This might be a deficiency in the methodology of this project.) This is perhaps the area that the policy makers ought to consider the most in the formulation of a research policy regarding e-learning.

The ***learning society*** has been discussed in terms of innovation and competence building with social cohesion (Lundvall and Johnson). Innovation is viewed as the key process that characterizes a knowledge economy when understood from a dynamic perspective, while competence is the foundation from which innovation emerges and allows many innovations to be applied. Contributions occur to both the "generation" of innovations (on the supply side) and to the "utilization" of innovations (on the consumption side). Learning is

reflected in improved skills in people and in the generation, diffusion, application and usage of new ideas. Learning thus can be an unintended consequence of experience and augmentation of scale, as formalized at the single entity, regional or national level. Learning to manage a large portfolio of loosely unrelated knowledge accessing distributed knowledge and leveraging it all in a rapid and interconnected manner into new learning products and solutions is a major challenge for all sectors of society.

The knowledge base is becoming deeper in cognitive dimensions and much more complex and requires a diverse competence base not all internal to a specific entity. In this regard, among other things, the process by which knowledge is created within innovative groups will mean that constellations or bundling of new skills will emerge with different distributions of explicit and tacit knowledge and different patterns of distribution of knowledge and skills between different individuals in different environments (Polanyi 1958 and 1966, Nonaka and Takeuchi and Boisot). This will interact with the fact that different systems of governance will often dictate that different patterns of tacit knowledge emerge in, to take extreme examples, large bureaucratic organizations as opposed to small market-oriented organizations. This applies equally within education as in other sectors.

There is need for a diversification of actions in education to support the creation and diffusion of distributed knowledge bases. This is particularly appropriate in the context of the digital divide for *catching up* countries and regions so that growth and innovation spread will not just be based on the creation of new sectors but on the internal transformation of sectors that already exist – by exploiting their distributed knowledge bases through adequate incentives and institutions. With the co-evolution of technology and education and utilizing what are the outcomes of our analyses it seems not inappropriate to recommend that overall new **development models** need to be defined, researched and applied which recognize that among their component parts are required:

a) radical redefinition and diversification of teaching methods and training of teachers

b) stronger understandings of how to create institutional strategies within educational entities and the skills to effect that

c) embedded effective cost analyses of technology/pedagogy interfaces

d) mechanisms that inform on state-of-the-art developments particularly in standardization and generic education and training vocabularies

These component parts, as in any development models, are crucially dependent on shared knowledge and experience. This carries implications for the emergence of truly effective trans European "knowledge pools" and further for the design and processes through which researchers and practitioners seek support from funding entities to research, test and apply their innovative ideas.

The review processes have revealed a set of indicators that require the attention of the education planners and education actors in general and suggest that the new forms of

educational provisions –whether viewed from a user or provider perspective, require a rethinking of what teaching and learning now constitutes. The indicators identified may play a benchmark role in the conceptualization, structuring and operationalizing of what we term in the broadest sense, e-learning. The results of this analysis indicate that fundamental changes emerge in the transfer of knowledge at all levels whether school-based, in higher education or in adult learning. The transversal nature of the indicators of change – whether these address the issue of roles or organizational conditions, invite the policy maker to, upon a reflection of what was to what is and what will it be, articulate policy(ies) that can be supportive of ways in which to maximize the effective transfer of knowledge to the wider possible populations.

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