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1 Executive summary

The OASIS project represents an ambitious attempt to combine broad low cost technical and infrastructural solutions to the varying ICT needs of schools both at managerial and pedagogic levels, combined with the development of new pedagogical approaches to better embed ICT usage within pedagogic practice. The underlying philosophy of the project is that schools have an increasing social function with regard to their pupils and that this social function can be more efficiently delivered by enhanced technical and pedagogical solutions. Solutions that were worked out against a background of increasing social complexity.

As with any ambitious project the results of the endeavours are invariably mixed with some notable successful results, some less successful and some surprising ones. One feature however does stand out and that is that schools, teachers, pupils, school principals and managers were totally engaged in the challenges that this project presented them. The one question that was posed almost universally at the end was will this project is all its aspects continue in some way? Our work may not be regarded as finished; rather this marks the beginning of a debate about the way forward.

OASIS means Open Architectures for Schools In Society. The 'Open Architectures' refer to new comprehensive combinations of open standards technologies with which schools can better satisfy the demands society puts upon them. The 'Schools in Society' refer to the position of the school within a wider range of learning opportunities in connection with actors and systems outside of school. The project tackles different challenges, of school interoperability, of school cost-effective operation and maintenance, and of the actual usages of technology based not only on quality traditional schooling, but also on novel applications. A set of pedagogical models has been assembled to help teachers use ICT in their classroom lessons according to modern pedagogical ideas. The models are all related to and based upon the constructivist learning theory, that states that learning is an active process in which learners create their own knowledge, by using information form various sources and combine this information into own knowledge structures. These sources can be the traditional textbooks and stories of the teacher, but also other sources like Internet, newspapers, and especially communication with peers, parents, experts, etcetera. The pedagogical models cannot be prescribed in terms of obligatory steps to follow. Rather the models were basis of pedagogical scenarios and classroom projects developed by teachers themselves, in most cases supported by the diverse members of the OASIS-consortium responsible for the pilots.

Both the range of technological building blocks for achieving effective and efficient infrastructures and the range of pedagogical building blocks for achieving innovative learning and teaching activities have been introduced, implemented, validated and evaluated in five diverse clusters of schools. The schools within one cluster are diverse as well. The five validation sites or pilots have been:

1. The Spanish pilot of CNICE, using various technological solutions
2. The Apple pilot, using wireless ubiquity and media-rich environments
3. The SUN pilot, using thin clients technology
4. The pilot of the Academy de Grenoble, focusing mainly on safety and on metadata
5. The EUN pilot, concentrating on collaborative learning

The complexity and diversity of the architectural, technical and pedagogical elements of the OASIS project have been validated and evaluated using a combination of methods. A common evaluation framework, taking into account pedagogical, organisational, economic,

technological and cultural-social dimensions, was combined with both a global overview, based on questionnaires, and an in-depth local view, based on interviews and observations.

The five validation sites are portrayed in Chapter 3 using the common evaluation framework per site, filling the different dimensions using qualitative input acquired. The results are five case studies providing an abundance of factual and qualitative information, which is typically 'situated' in nature. Comparison of the complete contexts is not at stake here: the validation has to be seen against the background of each 'ecology', with all its unique components.

The global evaluation compares the different dimensions between the validation sites, showing differences and similarities in many aspects. Results are reported on the degree of training necessary, ICT-usage in subject areas, frequency of usage, types of usage, etc. Also the changes in pedagogical approach is reported, both as direct consequence of the technology, and as a result of the pedagogical models introduced. Especially an increase of collaboration between teachers and between learners is reported, while learning becomes more learner-centred. Preparation of lessons does increase as well, however, which is an economical factor that needs to be accounted with. In general it was found that for teachers it is difficult to start using new information and communication technologies simultaneously with new pedagogical models, as it is hard to concentrate at the same time on two very different new aspects requiring a variety of teaching skills such as organisational, pedagogical as well as technical skills. Continuing pedagogical guidance and support is necessary, which was not always sufficiently implemented. But all in all, many interesting projects have been conducted, including new pedagogies and pedagogical change for both teachers and students.

The impact on organisational dimensions is not overwhelming, although improvements of rostering, tracking and some other administrative handling are noticed. The respondents have more confidence in teachers taking up several responsibilities rather than have students do this. Most needed is an ICT-coordinator responsible for coordination of ICT related programmes and technical maintenance, or having a teacher doing this. More training on the technology is needed.

With regard to financial gains, part of the economic factors, the expectancy is not very high in average, but direct responsible persons do see benefits. For all pilots the vast majority of the respondents are satisfied with the technological solution of that pilot, and almost all teachers are willing to adopt the technologies and spread it to colleagues. Concerning the quality and efficiency of the work of the teachers the answers are more diverse. Hardly anyone says it decreased, but the number of teachers reporting a lot of enhancement is small. But all technologies are thought to be easy to use by a majority of teachers (66%) and students (70%).

The cultural and social aspects are connected to making schools more interoperable with regard to the environment of the school. Although some contacts are reported with parents and the local community, these aspects have been realised to a limited extent. The current educational cultures in many European countries and schools seem not to expect schools to reach out of their own boundaries, let alone encourage them to interact with the local communities. Interestingly, interaction on the European and global level seems to be more of the mainstream than being active in the local community.

The recommendations include a fairly extensive collection of themes that should be regarded as essential while implementing ICTs in schools. Most prominently, the suitability of the POETC framework, the one that involves Pedagogical, Organisational, Economical, Technical as well as Cultural and Social aspects, for planning, implementing and evaluating the implementation of ICTs in school sector would be recommended.

2 Introduction

2.1 Overview of OASIS' objectives and products developed

2.1.1 The project's objectives

In today's society schools are faced with the difficult task not to merely support the development of traditional knowledge and practical skills of pupils and students, but also to develop other aspects of their cognitive and analytic skills. Today's working life and the complex society with ever-higher demands on all citizens creates a need for the school to help their students to develop higher order cognitive competencies, and social and communication skills. Information and communication technology (ICT) forms increasingly the medium for school to realise this endeavour, by creating new possibilities for communication, collaboration and knowledge building. Part of these possibilities involves the opening up of the school to surrounding community, and vice versa. A development of this kind will have beneficial effects on both the school and the surrounding neighbourhood, in terms of learning and in terms of social cohesion.

OASIS means Open Architectures for Schools In Society. The 'Open Architectures' refer to new comprehensive combinations of open standards technologies with which schools can better satisfy the demands society puts upon them. The 'Schools in Society' refer to the position of the school within a wider range of learning opportunities in connection with actors and systems outside of school.

The project has ambitious goals: it wants to keep the public school and the educational system as the leader of education for young people, not only in physical school buildings, but also at the Internet. For that it is necessary to pay attention to the socialisation role of the traditional schooling in particular, as one of the main capacities of the traditional public system, but also to pose the question how this capacity can be transferred towards the Internet as a competitive advantage for the public system. Last but not least the project looks at the concept of small school virtual community around the school portal as the main tool to support this approach.

> *"Oasis is about revolution, a figure to build the school of tomorrow in the face of commercial and political pressures."*

Some of the most pressing challenges to set up, operate and promote the use of the small school virtual community around the public school educational system are:

School Interoperability: how to enable different applications to share information data to promote interoperability between software applications from different vendors, and how enable the use at the school of different networks and communication services technologies, to promote interoperability between communication services and technologies from different operators (LAN, Cable networks, Radio networks, ADSL, FTH, etc.), in order to improve usability, accessibility, efficiency and reduce cost.

School Cost-effective Operation and Maintenance: how to define and implement administration procedures and tools driven to structured and effective service provisioning, in order to improve quality and reduce cost through specialised external hosting and service provisioning (Municipalities, etc.), with Cost-effective and User-friendly administration

solutions. This will provide quality services at reduced cost without expensive users development, training and self administration costs, so reducing the teachers efforts addressed to fix Hardware and Software infrastructures, and allowing them to concentrate in learning and practice how to better use ICT in education. Today, the large amount of those costs, and the complexity assuring quality of service, are the major factors against the integration of ICT in the school community, as well as achieving location independence and widening remote access to resources from the school and at home, that are background major objectives for the school virtual community.

The OASIS project has been defined to meet (among others) those major challenges. The project has a strong and complex, but very innovative technological side to it. An interoperability framework has been created, together with zone servers and school servers. All has been done with a cost effective open architecture. Furthermore, in five pilot sites, different technological set-ups were evaluated in large-scale evaluation pilot experiments. These pilots are described in chapter 3.

> *"Oasis is about communities of learning and the technical environment to achieve them."*
>
> *"At the end of the project, European schools will have access to the technical outcomes of the project, with several educational levels and different levels of integration of the technology in their curricula and different pedagogical models."*

2.1.2 Technological outcomes and concepts

This section describes the technologies that have been either initially or further developed within the OASIS projects or adapted to meet the aims and goals described in the previous paragraphs. The descriptions in this paragraph, however, are brief, and without too many technological details. Full descriptions of the technologies, together with the technical backgrounds, can be found in project deliverables focusing on each development issue individually.

While developing or adapting technological solutions to better fit into the school setting, the intention was also to advocate the pedagogical approaches that were developed by the OASIS project partners. From the viewpoint of the users, two different kinds of technologies have been developed:

A) The type of technology that is rather transparent to the end users, i.e. it is not seen by the teachers, but is absolutely necessary to implement the technological solutions. The cost effective maintenance and interoperability are of main importance among other things to mention.

These technological solutions also provide an easy and reliable system that reassures teachers that there will be no problems when integrating ICT in their classrooms. It is clear from the user feedback received throughout the pilot implementation that the lack of confidence in the school network operability is one of the most broadly reported hindrances among teachers to an effective use of the technologies in the classroom. Thus, the reassurance that classroom computers and internet services will be running during the session with pupils uninterruptedly is crucial for teachers when they decide to apply ICT to their practice.

B) The type of technology that teachers select to use to support a concrete learning activity. These are the technological tools and solutions that the teachers (and other users, like

pupils) can use to change the way that they are teaching and support their learning experience.

This distinction is important for the rest of this deliverable. When validating the OASIS technologies and their impact on teachers' pedagogical practices, both types of technologies have to be treated differently. The second kind of technology can be directly evaluated and validated by teachers, where for the first kind of technology, the transparent one, the adage is “when a teacher can say something about it, it is not a good sign“. This subject will be expanded in a later part of the deliverable.

For type A technologies, the OASIS project has developed and adapted several technological solutions. These are:

- School Server that assist in securing maintenance of school systems on a school level;
- Zonal Management Service (ZMS) that assists in securing maintenance of school systems on zonal level;
- SLIM/SLIS technologies for communication services, management and maintenance of the school networks.

For type B technology, the OASIS project has further developed and/or adapted the following applications:

- Virtual Workspace Environment (VWE), an electronic learning platform;
- Open Code Software Library (OCSL);
- *Cartable Electronique*, as a collaborative learning platform for Lower Secondary schools;
- LOG (Lycée Ouvert de Grenoble) for Upper Secondary schools;
- Media rich i-Books and ubiquity of access (Airport technology) to resources inside the school space;
- SUN thin client technology.

Additionally, the pilot participants have used other technologies, such as:

- ZOPE/PLONE;
- Future Learning Environment 3 (FLE 3);
- EUN Community.

All in all, several state-of-the-art technologies have been suited to better fit the school setting. These technologies bear potential promises to support some desired pedagogies within the field of education and bring cost-efficient and sustainable technological development closer to the reality of schools. Within the OASIS projects, the aims and means of these technological solutions have been validated and evaluated on the bases of their usefulness in schools around Europe.

2.1.2.1 Details of the technologies developed and employed

School Server

Many schools do not have IT administrators, at best the school staff plays the role, and do not have enough time to work on their pedagogical issues. These are the reasons of placing greater emphasis on reducing time, maintenance, and management costs on the technological solutions at school. That’s why the two most important goals in the School Server develop in OASIS are the low cost of acquisition and the minimal effort to administrate. But at the same time need some high requirements as scalability, security, and availability in order to be better able to support the school services.

All these has made the project to decide to have a “Linux based” platform, which can be manage remotely by a control administration organization, and following known standards (HTTP, HTML, XML, TCP/IP, SOAP, JMS, JAVA, HTTPS…) as much as possible.

The following list summarizes the main services to be provided by a School Server:

- Firewall and Antivirus.
- Intranet Network (Sharing resources: Printers,)
- DHCP server
- Public Portal (Internet).
- DNS server
- Internal Portal (Intranet)
- Web mail: External and Internal (Intranet).
- Internet Filter.
- Virtual Private Networks (VPN)
- Communities: Chat, Forums, FAQ, Download, …
- Public folders, Teachers Mailboxes y FTP.
- Security:
    - Backup Server (y fail-over)
    - Users backup and services.
    - Images and Protection HW/SW.
- POP mail (optional)
- Integration of others networks in the OASIS Intranet:
    - Departments, Teachers room.
    - Services: Library.
    - Secretariat, Management, Administration.

<u>Zone Management Server</u>

The ZMS is the approach chosen in the OASIS project for achieving the cost-effective solution of the management and support of ICT services and infrastructure in educational environments, thus allowing the construction of the educational community. The ZMS approach is targeted at providing remote ICT O&M and support to schools and school personnel in charge of ICT O&M tasks, thus allowing that at schools non-specialized personnel may perform these tasks with limited time dedication to these activities. Support for schools is provided using open standards and tools, whenever possible under public licensed and/or open sourced tools.

The OASIS School Community ICT management and administration system is based on a distributed networking system that consists of a Zone Management Server (ZMS), and one or more components organised into a zone. Different zones can be implemented based on the requirements of ownership, organisational structure, geographical proximity, security or

management. Within its covered zone, a Zone Management Server provides management and administration services to all the agents connected and registered in the zone. The aim of the ZMS approach in the OASIS project is to provide a cost-effective solution for the management and administration of ICT at schools, trying to reduce the Total Cost of Ownership whilst keeping a good Quality of Service.

The ZMS approach followed in the OASIS project has yielded the following outcomes:

- Concept and Architecture Definition of a "Zone Management Server" for Schools. An open architecture has been defined for the ZMS so that it relies on open standards and protocols, and is able to operate on the heterogeneous ICT infrastructure available at schools. Heterogeneity is managed through different technological backends. Services provided by the ZMS are:
    - Remote help desk.
    - Provision of assistance to the ZMS users.
    - Remote operation and maintenance of supported ICT at schools.
    - Remote contents configuration and maintenance.
    - Service provisioning.

  The ZMS architecture relies heavily on the "School Server" concept as defined in the OASIS project.

  An organizational model of the ZMS has been defined, with identification of the ZMS agents (participants in the model) and their interactions. Also, the roles and profiles of the ZMS personnel have been described.

- A Canonical Model of Managed ICT Objects in Schools Systems has been defined. This represents a technology independent Management Information Base for the OASIS environment, that is, the identification of the set of managed objects that are supported and the operations that can be done on them. This canonical model of the managed objects is then mapped to the different supported backends referred to before, taking into account the aim of using open, standardized technology whenever possible.
  The canonical model is based on the SLIM/SLIS model, and provides additional:
    - Support for multiple technologies.
    - Support of application servers.
    - Support of users' equipment at the schools.

- The ZMS architectural design is based on the following principles and guidelines:
    - Distribution of management tasks between school administrators and ZMS operators. This distribution has been designed so that school administrators only perform tasks that cannot be done from the ZMS at all, or when it is more efficient to do them from the school than from the ZMS, and provided that they do not demand significant technical skills from school administrators. Also, for management tasks requiring participation of both school administrators and ZMS operators, the workflow among them has been defined for each task where this interaction is necessary.
    - Definition of a set of detailed management procedures for the school and content administrators, and written taking into account that teachers usually will not have strong technical background. These procedures are associated to the different machines or contents they can apply to, and must be shown with all relevant configuration information (but *only* the actually relevant information) needed to

complete the procedure, including additional documentation and software tools. Access to this information is done through a secure HTTPS connection to keep data confidentiality.

- Definition of a set of management procedures for the ZMS operators. These procedures are written with lesser detail than those intended for the school administrators due to the stronger technical skills the ZMS personnel must have.
- The burden of maintenance procedures has been mostly removed from the school administrators and is done from the ZMS, using automated tasks whenever possible.
- A Contact Centre providing phone and e-mail interfaces (based on mailing lists) so that school administrators can request support from the ZMS, share experiences, and receive announcements from the ZMS.
- A web portal for assistance of the school administrators, where they can find:
  - Web pages with the set of management procedures for school administrators.
  - Documentation, manuals and FAQs related to the management tasks to be done.
  - E-mail, mailing list, and phone access information to the ZMS.
  - Access to a variety of cooperative work tools: mailing lists, chat, news, discussion forum, and the Community portal of School Administrators.
  - Training support. Includes material available online, and information on training sessions.
  - Links to downloadable tools used in school administration.
  - Information on news & events of interest for local administrators.
  - Help on the usage of the portal services.
- A portal for usage by the ZMS operators in their management tasks. This portal provides the ZMS operators with the whole set of management procedures. The ZMS operators can select the procedures by choosing first the school they want to manage, then the machine or application the procedure apply to, and finally the specific procedure. All configuration information for the school can be shown in order to assist in the execution of the procedure. Configuration and procedure edition tools are also available for the ZMS operators.
- A monitoring and control console for ZMS operators, with the set of tools that allow them to interact (manage and monitor) with the different technological platforms.
- A inter-school Community portal for OASIS users, where they have a set of Computer Supported Cooperative Work (CSCW) tools for interaction among them.

- The ZMS prototype developed, implemented and evaluated later in experimental pilots within the OASIS project, includes:
  - The school administrators, ZMS, and inter-school portals.
  - A contact centre based on e-mail and phone interfaces.
  - Multiplatform services and Backends, in general for:
    - Cobalt (Sun Microsystems) and Edulinux (CNICE) Linux School Servers,
    - Edulinux (CNICE) and Solaris (Sun Microsystems) Application Servers,
    - Windows 98SE, 2000 and XP Workstations, with support for both exclusive (i.e., only used in OASIS environments) and shared (i.e., used in other school specific environments) installations.
    - Mediarich I-books, server and wireless-LAN (Apple).
  - An emulated school infrastructure at the ZMS.

Following the architecture definition, the ZMS implementation has been done using open, standard technologies: IP, TCP, UDP, HTTP, SSH, SNMP, LDAP, and open source

software and tools whenever possible (Linux, Apache, MySQL, PHP, PHP-Nuke, VNC, OpenLDAP, etc.) for implementation of its components or those of supported services at schools. Nevertheless, for some technologies (LDAP for school user management) it has been necessary to make integration effort in order to achieve interoperability among different technological platforms in case of mixed environments.

The prototype implemented and tested did not included specific workflow tools due to the low workflow processing load.

- Concept of how to, and Definition of Tools for: Measurement and Reduction of TCO, and QoS Assurance.
  To assess the degree of achievement of the ZMS main targets, a methodology for evaluating the effort reduction provided by the ZMS approach has been developed. The methodology is based on the assumption that there is a total volume of management tasks/effort to be done, and calculate how much of this effort is left for the teachers. The calculations are done in terms of the ratio between the number of tasks to be done by teachers and the total number of tasks to be done (both by teachers and ZMS). Also, as no all tasks have the same workload, a similar calculation has been done with management task times.

  The resources (human and infrastructure) demanded by the ZMS approach are been measured during the experimental pilots and later generalized through several models.

  As for QoS evaluation, the following methodology has been proposed: first, the supported ICT services QoS is evaluated by monitoring availability and performance. On the other hand, the QoS of the support provided by the ZMS is estimated by processing ZMS contact records (e-mail and phone calls) to calculate attention times, waiting times and fix times.

- Testing platform on an Emulated School ICT infrastructure.
  The ZMS includes the concept of an emulated school infrastructure that provides a very useful platform for:
  - Testing and debugging modifications to existing management procedures.
  - Testing and debugging of new management procedures.
  - Testing the deployment of new services or applications.
  - Emulation of the conditions of a real school in case of problems that need to be debugged, without disturbing the real school.

<u>Virtual Workspace Environment</u>

VWE is a completely modularised VLE. The starting point is to apply the same concepts for the Virtual Learning Environment (VLE) as the "Learning Object" concepts is trying to apply for content - a model where several modules may be assembled to be used (and reused) in different pedagogical contexts, where they together form a larger entity. .

From a pedagogical point of view, the teacher gets a better control of the VLE, by creating a more flexible learning environment. We also want to make sure that the ICT tools used for learning are actually adapted/developed for use in learning. The flexibility is obtained when a VLE can be assembled to fit the needs of a specific pedagogical situation and functionality can be added or removed when needed. Another objective has been to change the focus in

e-learning from the delivery and production of content to the pedagogical on-line activities. As a metaphor, VWE may be compared to an Operating System (OS) for the web browser.

The VWE system architecture consists of a set of server-side services (similar to the OKI), the VWE-Kernel and VWE-tools. The services handle all common functionality in the VLE, such as communication, files, shared data etc. The Kernel is downloaded to the browser at runtime and handles all the communication between the tools (intra workspace) and the server side services. The kernel is a small starter (Java) Applet that also initiates VWE. The tools are software components that can implement add any kind of functionality to VWE. Some examples of tools are: html-editor, ChemML visualizer, communication (chat, e-conference etc), shared White Board, simulations, authoring tools, teacher/student portfolio or anything else that might be useful for education and learning. In the current version of VWE the tools are Java, both Applets and Java applications.

VWE make use of general technology standards as well as Learning Technology Standards. A couple of examples of standards that is used by VWE are: LDAP, SOAP, UDDI, IMS/LOM (metadata), IMS Content Packaging, RDF, SIF and others.

The choice of technology and standards are based on the aspiration to be open towards future development, other systems and to web technology in general.

Open Code Software Library

The "Open Code Software Library" (OCSL) is a web library of Open Software supported with harvesting and metadata tools cataloguing. It is devoted to developers of applications and tools for ICT based education at schools. A sub-component of it is a corner for small educational Java Applets (with educational material provided by teachers and in general not professional developers)

The OCSL includes cooperative working tools to support developers, teachers and users/providers interaction and help and training facilities in the use of the services.

All the services are accessible through a portal. These services include the display, list, navigation, search and management of information about Library objects. Library objects include software code components (to be downloaded from the OCSL by their users) and metadata documents describing software components located and stored elsewhere in Internet. OCSL follows ETB metadata set and vocabularies.

The OCSL is specially designed to help in the development of educational applications providing a software library with advanced information services to enhance the access to on-line software components and promote their use. Its contents are relevant for the School Community, application developers and teachers when preparing applications and supporting tools for schools (educational, administrative and management applications).
The technical approach focuses on providing an information infrastructure with coherent methods of content organization and access that facilitate the use of resources from different languages and cultures.

The OCSL approach followed in the OASIS project has generated the following outcomes:

- Architectural definition of the OCSL as a framework for publishing, promoting, reusing, disseminating and maintaining a collection of software resources. An architecture has

been defined for the OCSL Portal that is based on a multi-tiered distributed application model. Services and facilities are accessible through the OCSL Portal.

Services provided by the OCSL are the following:

- Authentication, registration and login of the OCSL users. It facilitates the access to all the OCSL services.
- Acquisition and storage of open/commercial software packages descriptions. This is a service where the OCSL retrieves automatically information on open and commercial educational software available in the Internet. The information obtained is structured and stored in the library.
- Acquisition and storage of educational Applets. It provides the tools to describe educational Applets using controlled terms of a Thesaurus for classification by subject.
- Cataloguing. Both the educational open/commercial software and the Applets are classified and catalogued using the EUN/ETB metadata set modelling and the XML standard.
- Search and download educational open/commercial software. Users can search through the catalogue, have direct access to either "freeware" resources or a "commercial channel", and download the catalogued open/commercial software.
- Search and download educational Applets. Users can search through the catalogue, perform a guided search and have direct access to "on-line" Applets, upload/download software or list resources.
- View and list detailed software resource descriptions.
- Cooperative work services. Different group of cooperative tools are available for each user role:
    - Shared workspace. It provides collaboration facilities. It stores objects for working in groups, with simple awareness functionality that allows users to form work-groups, arrange a common calendar or share documents.
    - Forum. This service provides a way to create online discussion groups
    - Chat. It provides a way of communicating in real time by text.
    - Mail list.
    - Conferencing. The functionality of this service is to provide to users the possibility to establish a videoconference or an audioconference.
    - E-magazine. The aim of this service is to allow to teachers the periodic publication of news that can be ordered by different categories.

- Organizational Model of the OCSL. In order to support the needs of particular group of users, several user roles have been defined as well as technical profiles for the OCSL operation, administration and maintenance.

  OCSL contents will be acquired and stored in different ways depending on target users. Also services are different depending on the user role.

  Two different user roles were defined:

  - "*Professional applications developers*": ICT professionals and/or ICT skilled people who will search and navigate the OCSL in order to find software packages with the aim of: 1) to develop new applications; 2) to install/configure/use them on their educational environment; 3) to integrate them on their specific educational environment.

- "*Teachers*": end users who will search and navigate the OCSL in order to find software (mainly Applets): 1) to be directly included into the educational materials they produce; 2) to be just displayed and used in the classroom.

- Definition of a data model, catalogue and metadata management tools. Metadata is what makes it possible to locate, provide access to, navigate and manage digital information through the OCSL catalogue. Metadata is the data that describes the content and attributes of a particular software package in the context of OCSL. Dublin Core Metadata Element Set is the standard used as well as the ETB Metadata Element Set[1] (ETB MES) in their obligatory elements. Metadata encoding is made using XML tags.

- Definition of procedures for content acquisition, content maintenance and control. OCSL contents are acquired and stored in different ways depending on target users:

  - For "professional developers", procedures and tools for automatic acquisition in the Internet (metadata harvester through a Mediation System) have been designed and implemented by the OCSL. The corresponding metadata descriptions and links to original web sites are generated in an automatic way.
  - Educational Applets and their metadata descriptions, as provided by teachers, university groups, etc are manually downloaded to the OCSL using a metadata editor. In some cases, teachers may decide to provide a link (URL) where the Applet is actually stored instead of download the Applet to the OCSL.

  Specific models and tools have been developed to maintain and keep control over links to external web sites. The OCSL Mediation System provides procedures for the following tasks:

  - Adding new contents to the OCSL by generation of a wrapper. Wrappers deal with the access to the heterogeneous provider interfaces and translate between HTML and the OCSL data format (in XML). Wrappers will access the web site of the resource provider, get the needed information through the HTML interface and store it in a database of converted resources.
  - Data model and format. The information extracted from different sources/providers is stored in the OCSL following a common data model and format, independently from the origin of the information.
  - Updating data from provider data sources. The wrappers are invoked periodically in order to keep the data in the OCSL updated. Any change on the provider data source will result in changes in the OCSL.

- The OCSL prototype developed, implemented and tested in the project, includes:

  - A catalogue of more than 3.000 software packages descriptions and links from 18 different sources. Sources include open software and shareware or commercial software as well.
  - A catalogue of more than 1.600 educational Applets descriptions and links as a set of comprehensible and valuable resources for teachers. The Applets are classified in two groups: "Download Applets", which are stand-alone Applets that the user can directly download and include into educational materials; "On-line Applets", which are Applets already integrated in pages or didactic units, and whose individual code is not directly available.

[1] ETB MES, http://www.eun.org/eun.org2/eun/en/etb/content.cfm?lang=en&ov=5874

- A facility to include resource evaluations by experts and resource comments by users. This mechanism allows qualitative information to be added by taking into account and publishing experts' opinions.
- A user interface with clearly separated areas to access facilities and services from links to other pieces of information (help, faq, contacts, etc.).
- A metadata editor to create the searchable catalogue of educational Applets.
- A mediator system for automatic acquisition of metadata to create the searchable catalogue of open and commercial educational software.

Following the architecture definition, the OCSL implementation has been done using open, standard technologies for web applications. Java was chosen as the programming language and Apache Tomcat as the servlet container used in the official Reference Implementation for Java Servlet and JavaServer Pages technologies. Also open source software and tools have been integrated whenever possible (Linux, MySQL, SWISH-E, etc.) for implementation of the OCSL modules. Concerning the data layer, XML is used to describe and store metadata documents and MySQL is used as relational database.

SLIS/SLIM

SLIS provides the traditional services of communication services on the Internet such as email server, web server, data bases with PHP, proxy, services of safety and statistics, directory, automatic update, etc. On the technical all these services comply with conventional standards used. The local ICT administrator will be able to manage all this through a web interface from the school network or even remotely even from home. A detailed table of all SLIS functions for the local ICT administrators is shown in three aspects: Managerial / Educational / Technical in the annex 8.1.

SLIM on the other hand provides the management layer. SLIM organises, at a regional level, the information systems useful for the deployment, the maintenance, the safety and the supervision of SLIS servers. It also allows the delegation of tasks to administrators as well as the organisation of the park of servers in managed groups and in a decentralised way.

Cartable Electronique (CE)

The Cartable Electronique[2], i.e. electronic portfolio is a full web platform based on Zope and XML which ensures its capability to interoperate with all types of applications such as SLIS LDAP or like all OASIS structured documents that are SIF or E_SIF based, to which it should apply its implemented workflow procedures. To access the CE, teachers and pupils need only a login and a password delivered by the local or central administrator. Each of them can be trained in only one day to its whole basic exploitation on the technical side.

Architecture SLIS / SLIM / Cartable Electronique

When the project of Cartable Electronique[3], i.e. electronic portfolio was set up in the academy of Grenoble (initiate by the University of Savoie) the co-operation between platforms SLIS and electronic portfolio platforms was installation around a common directory LDAP, which was fundamental level of interoperability that is necessary for the coherence and the integration of the services for teaching. The work on electronic portfolio is since framed by the national blueprint for virtual learning environments (Schéma directeur des

[2] http://www.pentila.org/
[3] http://www.pentila.org/

espaces numériques de travail[4]). SLIM, on the other hand, is a central platform for supervision and maintenance.

The diagrams shown in annexe 8.1 and 8.2 clarify the case encountered in a middle school of the department of Isère where the "cartable électronique" platform is implemented. This allows many pupils to be connected simultaneously when using a single ADSL connection.

SLIS and co-operative working
SLIS manages groups of users, who are directly used in CyberEcoles to share numerical resources. In the case of the "cartable électronique", these groups are transmitted to the platform thanks to the interoperability carried out on the level of LDAP directory.

Lycee Ouvert de Grenoble

This strand of work allowed the investigation into the transfer of teaching resources and collaboration with the University Joseph Fourier of Grenoble. The previous LOG platform used Lotus technology. During the OASIS project, the course content that had been already carried out in Lotus environment was transferred in order to be able to be used on the cartable électronique platform. They are now available in a standard form and can be more easily accessible by the pupils.

The collaboration with the University Joseph Fourier (Clip-arcade Team), within the framework of a DRT (Technological Diploma of Research) was based on the expression of needs for resources teaching by the tutors of the LOG in term of modelling and production of teaching objects with the choice of open standard XML. These issues are further elaborated in the project deliverable 5.4.-3.

Media Rich I-books and ubiquity of access

Apple donated a cart of 10 wireless iBook laptop computers, a wireless base station to be connected to the Internet via an Ethernet drop, a digital video camera capable of video and still images, and ongoing training from an Apple certified education and technology consultant. The teachers were trained, then spent the year working with students and peers in a seamlessly wired environment. The four pilot teachers collaborated to produce two digital videos (iMovies) that were shared among the classrooms via a website. In addition, other schools throughout Europe were invited to collaborate and share their iMovies on the website. Fifteen other schools posted movies.

The results were very promising as measured by interviews and surveys. Teachers found the iBooks very easy to use and reported that their own teaching was improved, that their students became more self-directed, and that their students became more motivated.

Because of the ease of use and positive impact on teaching and learning, this pilot expanded well beyond the initial four classrooms and included many teachers and students in each location. The collaboration among the schools and results of the pilot are further described in the project deliverable 3.2.

[4] http://www.educnet.education.fr/equip/sdet.htm

2.2 Pedagogical models

Within the OASIS project, a set of pedagogical models has been assembled to help teachers use ICT in their classroom lessons according to modern pedagogical ideas. The models are all related to and based upon the constructivist learning theory, that states that learning is an active process in which learners create their own knowledge, by using information form various sources and combine this information into own knowledge structures. These sources can be the traditional text books and stories of the teacher, but also other sources like Internet, news papers, communication with peers, parents, experts, etcetera. The social constructivists even claim that communication with others is essential for own learning (rather than absorbing knowledge from text books and the lessons from a teacher). Communication is of vital importance to the social constructivists.

Within the OASIS, three pedagogical models have been described and combined in order to equip teachers with enough means to design their own lesson plans according to the new pedagogical insights. These three models are the Computer Supported Collaborative Learning-theory (CSCL), the Problem based learning theories, and ideas around externalising the learning environment to outside classroom activities. The models have been described in deliverable 1.2.1 of the OASIS project, and will pass in review shortly here, bearing in mind that the focus is on the implementation of the models within the OASIS project.

2.2.1 Computer Supported Collaborative Learning

Even nowadays, most learning in the classroom is still centred around the teacher. Often the knowledge that the teacher is assumed to pass on to students is based on text books dedicated to sections of certain areas of a particular subject. It is considered to be expert knowledge which is swallowed up and regurgitated by students and is largely evaluated cumulatively which discourages better guidance through diverse individual learning processes.

With the advent of ICT and its resultant settings, which allow for action and thought within networks, different forms have started to emerge which provide more effective and efficient support for learning processes.

The constructivist model considers learning as an active process in which the student builds on his/her own previous knowledge in order to extend it. Consequently, the learner needs to be in control of his/her own learning processes and take responsibility for them. However, this does not mean that the role of the teacher becomes any less important. On the contrary, the teacher is responsible for organising conditions that promote effective learning. Thus, teaching becomes the creation, design and organisation of learning situations.

The teacher may combine the following activities. He/she:

- Converts academic knowledge into something accessible and comprehensible for the learner.
- Places the students in a context in which they can collaborate and partake in social interaction.
- Designs and distributes learning activities for learners.
- Directs and adjusts the learning process to suit each individual student.
- Assures that learning is taking place and that the level of knowledge obtained is in keeping with academic standards.

Teachers therefore face the challenge of involving students actively in meaningful projects and activities, which encourage discovery, experimentation, construction, collaboration and reflection on what they are learning.

It goes without saying that in the framework of the Oasis Project, as ambitious as it is, it is unrealistic to expect that in the time taken to develop the project the schools involved are able to use ICT to transform the general characteristics of their teaching and learning processes or the very organisation of the school to any great extent. However, as the aim was to support the changes incurred by the use of this kind of technology, the following aspects were taken into account:

The teacher was able to provide students with other sources of information apart from him/herself, which students could access telematically thus encouraging learner autonomy. Continuous controlled access to the Internet and to the school's own intranet was realised.

Furthermore series of group work activities were created which allowed collaborative work and learning using forums, e-mail and chat rooms. Consequently, both group and individual evaluation took place.

2.2.1.1 The aims of CSCL within the OASIS Project

Nowadays, schools are facing the ever more challenging task of developing the theoretical competence they have. The world of work and the society surrounding it expect schools to develop students' academic competence, social skills and communication. ICT can help schools to do this as they create new possibilities for collaborative work and communication and open the school up to the community around them. Such development not only revitalises schools but also the community in which they are situated.

Bearing the above points in mind, the OASIS Project aims to achieve *an educational process centred around the pupil.*

Consequently, instead of the pupil feeling like the object of education he/she takes the initiative to participate in the choice of content and learning processes used. He/she is responsible for his/her own learning and collaborates in the learning of his/her peers.

The immediate consequence of this change of role is that students must be more motivated when it comes to their own learning as they become, to a greater or lesser extent, responsible for the content of their learning and their own points of view should be respected.

Thus, learning becomes more active as the need to use the information received, through communication and by comparing it to other information, encourages the students to actively participate in different processes. This participation is also facilitated through the design of the digital material used.

For example, pupils are supplied with websites of interest on a particular topic that they are going to work on, so that they can extract what they consider to be the most important or suitable information. Furthermore, students could also find other sites of interest for the chosen subject and compare the quality of the content with that of the one suggested to them. All of this needs to be supervised by the teacher whose main goal is to direct and tailor the research to the students' needs to keep them focused on the topic in question.

This type of work could be carried out in groups of 2/3 students. The students should consequently develop, sign and display their work in the collaborative work tool on the School Server such as 'Plone' or a similar tool.

Once a project has been completed, pupils should return to the sites they visited and analyse them critically from a scientific and didactic point of view. Each group of students should

comment on the quality of the sites and give their opinion as to whether or not they should be included in the database of websites of interest for future reference. They should also decide if they could form part of a webquest together with the rest of the work that has been developed on a particular theme.

2.2.1.2 A social dimension to learning

Ways of working with peers are developed in both the local environment and with students in other schools, regions or countries through digital communication technological services.

Thus, one of the immediate consequences is an increase in students' tolerance and respect both for their peers' opinions and cultural differences with other social groups. By sharing different opinions pupils can understand and accept the opinions of others without necessarily regarding them as completely different.

Furthermore, the fact that they must contribute their learning to the rest of the group promotes a greater depth of understanding and responsibility towards learning, as all students must explain what they have learned and sign their contribution.

It is therefore advisable that the websites mentioned in the previous section are not just in the mother tongue, but also written in other languages (English or French for example). Furthermore, e-mail can be used allowing our students to exchange opinions with students from other schools, countries or cultures. Consequently, as well as working with other languages, the form and content of what is taught in the school can be compared to that what is taught elsewhere.

2.2.1.3 Two specific forms of CSCL

Within the OASIS project, two specific models for using CSCL have been provided to teachers. The first is the Progressive Inquiry Method (PIM), in which groups of pupils work collaboratively on a certain topic, while following the essential elements of scientific inquiry. These elements are: creating the context; setting up research questions; constructing working theories; critical evaluation; searching for deepening knowledge; generating subordinate questions; constructing new working theories (though not necessarily in this order).

The other model is a concrete and simple approach for applying CSCL in the classroom, the Jigsaw model. The jigsaw-model is based on shared responsibilities in a group. In this model a classroom of pupils is devised into smaller groups, and each group has to learn a specific part of a bigger task. Each individual has to become an expert in the task at hand. After learning this expert task, the groups mix in such a way that each group now has one expert of all the different tasks. These groups now will have to learn the whole big picture. Thus the goal of each pupil now is to teach the other members of his new group the task he is an expert in.

An extensive description of PIM and the jigsaw model can be found in deliverable 1.2.1 of the OASIS project.

2.2.2 Problem-based Learning

Closely related to CSCL is Problem-based Learning: Problem-based learning is a practice based pedagogical model, which encourages students to develop their knowledge by working on real-life situations and problems.

In general, a problem is made up of the entire situation it is found within, and includes at the very least, the following characteristics:

- Scientific techniques are required to solve it
- An aim or purpose which should be achieved is included
- A series of obstacles which must be overcome in order to achieve this aim is included
- Deliberation is required, as those tackling the problem will not have algorithms available to solve it.

Furthermore, when working with problems, the following points should always be taken into account:

- Many problems do not have a solution or, on the contrary, they may have several solutions.
- Problems are not "cases". A case is no more than the description of a particular situation whose aim is to form part of the application that students have learned from a textbook.
- Problems are not "exercises" or questions prepared by the teacher.
- Problems should be selected in such a way that the knowledge required to solve them is realistically available to those who are going to solve them.

2.2.2.1 The process of problem solving

Students learn within the group (or alone) to divide the problem into sub-problems, form hypotheses, check them, activate previous knowledge and reflect it in their work. In general, the process can be divided into the following stages:

- Understanding the explanation of the problem.
- Forming questions to be answered.
- Designing a plan to solve the problem.
- Carrying out the plan.
- Evaluating the solution obtained.
- Developing new theories.
- Sharing information.

Now, in order to carry out the work a teacher is needed to guide the student or the group through the task. The teacher should help the group to reconstruct the problem in such a way that the students learn the relevant concepts, principles and tasks. The teacher plays the role of facilitator; he/she is a mediator rather than a lecturer. Likewise, he/she should help the group to reject false concepts or assumptions and incorrect ways of reasoning. (See deliverable 1.2.1 for more details on problem-based learning).

2.2.3 Externalising the learning environment

ICT in general and communication tools in particular mean that the medium used for information and training does not necessarily need to belong to the very classroom where the pupils are studying or the school they attend. At present, the Internet provides an inexhaustible and invaluable source of information and teaching resources. However, this should not be the only source. Students can consult more human sources such as experts in the field, scientists, musicians etc. ICT can help students to access these sources of information.

What is learned in the classroom can be used to compare and contrast knowledge and evaluate it in a broader context beyond the classroom. Students therefore realise that what they learn at school is also relevant outside school and relevant to their lives. They learn about life.

The above leads us to an important point of the Oasis project, which is the notion that schools are responsible for forming part of the environment they are situated in. Schools should therefore, and increasingly do, form part of the local community.

Within the OASIS project, teachers are encouraged, insofar as it is possible, to try to set up projects that are 'larger than the classroom or the school'. In other words, teachers are encouraged to seek actors outside the schools to do projects with. Actors outside the school can be experts, parents, people in the local community, other schools etcetera.

2.2.3.1 Contact with experts

The Internet makes communication with people outside the classroom possible. Thus, as well as going to the library and/or reading books on a particular subject, students can contact experts in the field who may be able to offer a more interactive focus and help students understand the topic in more depth.

Although this contact could involve the individual student or teacher who arranges specific times for contact to be made, it could also be integrated into the planning of different departments in a more structured way and on a more regular basis.

2.2.3.2 Contact with parents

Communication by Internet means that parents can get in contact with the class in much the same way as subject experts can, i.e. both quickly and without too much interruption as could be caused by their physical presence in the classroom. Thus, situations can be set up where parents can actually contribute to the learning process. Projects could be designed which would allow parents to play an active role in the learning process.

Another area, which arises, is the possibility of parental access to the material used by their children both at school and in the set homework tasks and encourages them to help pupils carry out these tasks.

2.2.3.3 Contact with other schools

There are many examples available which illustrate the ways in which contact between students and teachers in a school and students and teachers of other schools has had a positive effect on both the learning process and the development of educational communities which stretch beyond individual classrooms or schools.

For example, an appropriate area of study, which could be worked on by students from different schools, especially in this day and age, would be that of a cultural exchange. It could be both educational and interesting to set up relations between schools with a high percentage of foreign students, as they would lend themselves to this cultural exchange. They would be able to detect problems, which arise and face them through tolerance and respect for "each other". E-mail and, better still, forums would be suitable tools for exchanging these kinds of opinions.

Likewise, it may also be worthwhile setting up a chat room where students could ask students from other cultures questions. However, as we mentioned earlier, this kind of activity should be carefully organised beforehand, those involved should be identified clearly

using their name and surname and the whole activity should be strictly supervised by a teacher.

2.2.3.4 The school and its neighbourhood

By considering the school as part of the greater community surrounding it could encourage interaction with parents and other schools as well as with other institutions such as community centres, police stations, fire departments and libraries. In a broader context, contact could be made with experts in many fields of interest who could share their experience with students.

The idea, which is central to the collaborative learning models proposed by the OASIS Project, is to establish contact between schools and other members of the community, thus placing the school in a broader context and involving the local community in activities that are of benefit to both the school and community surrounding it.

2.3 Five validation sites

The technologies and the pedagogical models developed within the OASIS project have been tested within five validation sites, also called pilots:

1. The Spanish pilot CNICE, using various technological solutions
2. The Apple pilot, using wireless ubiquity and media-rich environments
3. The SUN pilot, using thin clients technology
4. The pilot of the Academy de Grenoble, focusing mainly on safety and on metadata
5. The EUN pilot, concentrating on collaborative learning

The pilots are diverse in the technologies they are using, but all pilots used the pedagogical models described in the previous paragraph to do classroom projects with teachers and students. All five pilots are described in more detail in chapter 3.

	CNICE	**Apple**	**SUN**	**Grenoble**	**EUN**
Oasis project elements					
Resource library	X			X	X
Zone management server (ZMS)	X	X	X	X	X
SIF implementation/showcase	X	X	X	X	
School server (including those connected to an oasis ZMS)	X	X	X	X	X
VWE	X		X		
SUN thin client	X		X		X
Apple wireless	X	X	X	X	X
Other tools necessary for CSCL (for internal use only)	X	X	X	X	X

Table 1: Use of various technologies in the five pilots

2.4 Methodology of validation and evaluation

The complexity and diversity of the architectural, technical and pedagogical elements of the OASIS project are such that a concise and consistent plan for evaluation is necessary in order to fully analyse and appreciate the educational impact of these elements.

The fact that the five pilots are very diverse in nature made it difficult to come up with one method of evaluation and validation that would be valid for all pilots. On the other hand, it would be very useful to be able to draw some 'larger' conclusions that go over the boundaries of a single pilot site. In order to meet this objective, two routes are followed. The first one is the use of a common evaluation framework used by all pilot sites. This is the POETC framework and will be discussed in the next paragraph. The second route is the combination of a global overview on one hand balanced by an in-depth local view on the other hand. It can be best seen as a 'glocal' approach (global-local). The local evaluation describes each pilot individually in a more qualitative way, while the global evaluation focuses on a few important questions and evaluates each pilot with the same questionnaire, specifically designed for this purpose.

2.4.1 Validation and Evaluation Framework POETC

The complexity and richness of the data obtained by the five pilots require an analytic and reporting framework to provide a systematic picture of the results pertinent to many aspects of the education process.

The framework adopted for this purpose is the POETC framework developed within the VALNET project, an accompanying measure to the IST programme to which OASIS belongs, the "Schools of Tomorrow" programme.

This framework has 5 dimensions:

<u>Pedagogical Dimension</u>
The pedagogical dimension covers aspects directly linked to pedagogical practice. Areas covered by this dimension are teaching methods, learner grouping, teacher development, curriculum development, timetabling, deployment of teaching and support staff

<u>Organisational dimension</u>

The organisational dimension deals with the impact on the organisational aspect of the school. Areas covered by this dimension are institutional development and innovation projects, change models, reducing bureaucracy and paperwork, virtual and actual integrated / ubiquitous learning environments, home-school links.

<u>Economic dimension</u>

The economic dimension discusses the impact on school funding and budget planning. Areas covered by this dimension are cost-effectiveness, impact measurement, return on investment, financial models, innovative services, e-commerce for education, funding models (e.g. leasing, outsourcing).

Technological dimension

The technological dimension covers the technological aspects. Areas covered by this dimension are communications, intranet, school on-line presence, mobile and wireless devices, effectiveness of broadband technologies.

Cultural/Social dimension

The cultural/social dimension deals with the links and contributions of the wider community. Areas covered by this dimension are multi-lingual, cultural 'localisation', educational terminology, local educational practices, pedagogical culture of both school, region and country, linguistic and cultural policy, trans-national user groups, trans-national linguistic approaches, transferable services products approaches and practices

The research questions dealing with the glocal approach are answered within the scope of the five dimensions of the POETC framework. More information on the POETC framework can be found in the VALNET publications which are available through the ValNet website at http://valnet.eun.org, choose WP2: Validation Methodology.

In table 2, an overview is given of the dimensions that are covered in each of the 5 pilots. As can be observed from the table, each dimension is well covered, although pedagogical and technological aspects are more emphasized. Furthermore, it becomes clear that each pilot has his own special focus, which emphasizes the variety within the OASIS project. It is this variety that results in rich data validating the dimensions from different angles.

POETC DIMENSIONS	**CNICE**	**Apple**	**SUN**	**Grenoble**	**EUN**
PEDAGOGICAL	XX	XX	X	XX	XX
ORGANISATIONAL	X	X	X	XX	X
ECONOMIC	XX	X	XX	X	X
TECHNOLOGICAL	X	XX	XX	X	XX
CULTURAL/SOCIAL	X	X	-	X	X

Table 2: Matrix of the POETC Dimensions covered in the 5 Pilots (A double X indicates double importance)

Each pilot produced a detailed description of each cell of the POETC framework. For each dimension, a qualitative description is given of the following aspects:

1) What was successful?
- What were the successful aspects of the pilot concerning the POETC dimension?
- What are conditions that contribute to the success of these aspects (in order to be able to adopt this approach in other sites)?

2) What was less successful?
- Which aspects of the pilot were not successful concerning the POETC dimension?
- Why were these aspects not successful?
- Is it possible that these aspects can be successful?
- If not, why not?
- If yes, how? Which are the conditions that have to be altered?

These descriptions can be found in other deliverables of the OASIS project (5.x.-3), but the main findings are described in the following chapter, where a complete but concise description of each pilot is given, including the results.

2.4.2 The Global Approach

The main research question addressed by the global approach is:

Are the technical solutions, as used within the five validation sites, effective for improving education and learning with regard to the following three aspects:

- Are the users satisfied by the functionality provided by the technical solutions?
- Does the usage of the technical solutions support the quality and efficiency of the work of the users? Which indications can be found for that?
- Are the technical solutions easy-to-use from the viewpoint of the pupils and teachers (user-friendliness)? What kind of support would the users need in order to be able to use the technical solutions in an effective way?

These three aspects were explained in more detail in paragraph 5.2 of the deliverable 1.2.1[5] of the OASIS project.

The emphasis is to get a global overview across each of the pilot studies to get a broad view of the reaction of the various target audiences to the elements of the OASIS project being tested at this stage. The answers to the research questions are described within the POETC framework.

The methodology for getting an overview was in developing the traditional tool of a questionnaire survey, all the same for all pilot studies, which was put on-line to facilitate both the ease of answering and the analysis of results. By its nature this type of global overview gives broad quantitative information, which, while useful in itself, limits the degree to which the 'why' questions of a more in depth study are addressed.

Therefore this ' global' approach was combined with a 'local' approach : within each pilot study there was a systematic capturing of opinion, attitude and feeling of the impact that various elements of the OASIS project had on the provision and delivery of education.

2.4.3 Local Approach

Within this 'local approach' the other research questions posed within deliverable 1.2.1 "Preliminary collaborative Learning Models" were addressed. These questions addressed pedagogical issues and issues that concern the combination of technology and pedagogy:

- Could teachers easily adopt the pedagogical models and scenarios?
- Did the provision of the models and scenario's lead to projects in which real collaborative learning took place?
- Did the pupils understand the idea of collaboration in the models, and did collaboration within the projects really emerge?
- For which types of classroom activities were the technical solutions particularly good? Which extensions or enhancements might be required to extend their application area?
- What is the added value of the technical solutions in supporting communication and collaboration as described in the Computer Supported Collaborative Learning models?
- To what extent did the technological solutions foster community building, inside the school, and to what extent did they foster relationships between school and neighbourhood?

[5] Deliverable 1.2.1 "Preliminary collaborative Learning Models" produced by WP 1.2

The methodological approach is multi-faceted and includes the research instruments as indicated in paragraph 5.3 of deliverable 1.2.1 “Preliminary collaborative Learning Models”:

- Personal interviews
- Reflective Notes
- Multimedia Observation
- Selected Case Studies

It must be noted that while all these instruments were used during the pilots, not necessarily all the instruments were used by all the pilots. Rather each pilot chose the instruments most relevant to their work. The answers to the research questions are described within the POETC framework.

3 The Validation sites

3.1 The Spanish Pilot

3.1.1 Pilot objectives and their relation to the global objectives

The Spanish pilot was designed to introduce ICT in the classroom and in the day-to-day classroom practice, and also to bring new pedagogical models into the classroom. In addition to these two objectives, also establishing meaningful connections between the two dimensions, ICT as such and pedagogical models, was an aim of this pilot.
In total, 134 teachers were involved in the Spanish pilot, resulting in a rich experimentation site, where teachers of various levels could get acquainted with new ICT-tools and new pedagogical models on many degrees, depending on their own level previous to the pilot.

In the Spanish pilot, five different technologies have been tested:
- The Zone Management Server (ZMS)
- The SchoolServer (Sserver)
- Open Code Software Library (OCSL)
- The Virtual Workspace Environment (VWE)
- The SunRay thin client (SR)

From the pedagogical models of the OASIS project, Computer Supported Collaborative Learning (CSCL), Problem Solving based Learning Model and the integration of the school in the local community have been used.

Previous research on the level of ICT-related expertise among the teachers who were to participate in the pilot, revealed that some of them had quite some ICT-experience, some had some expertise in the use of technologies but not in their educational use, and some had no knowledge in this area at all. In order to address these differences, a fine-tuned design of resources for teacher training has been developed and carried out in order to be able to address these different needs.

The first contact of the teachers with the OASIS project had to come from a multiple perspective: firstly the learning activities that can be enhanced through ICT had to be reviewed, together with the functionality of the technologies selected to support each kind of activity. Secondly, the communication and information technologies were presented, each described in a pedagogical context, with concrete examples of applications to learning activities. These two approaches were assembled in concrete experimentation plans offered to teachers as examples in which pedagogical models, technologies designed, and available contents are used to build a proposal.

The technology that had to be validated in the pilot was technology that aimed to facilitate communication and maintenance services on a school level and on a zonal level.

3.1.2 Main features of the pilot

3.1.2.1 Platform for collaborative learning

Because of the fact that the main pedagogical approach in OASIS was collaborative learning, a specific platform for collaborative learning has been offered by the Ministry of

Education to all the schools in the pilot: ZOPE-PLONE. This platform has been selected among the different platforms available in the market because:

- PLONE is a tool simple to use for teachers, once the different roles necessary for the development of collaborative learning activities have been designed and implemented.
- The hierarchy of folders and administration and access levels allows the interconnection between the different educational projects and participants of different nature in a well-structured manner.
- It is open code software, available for every school or regional educational institution that wants to install it.

The main function of the ZOPE PLONE platform is to provide the space for different classrooms, in the same school or not, to share the documents of the learning project in which they collaborate. At the same time any document can be broadly disseminated, declaring it publicly accessible.

The "roles" designed with the Zope-tool allow different validation levels and the publication within the different areas of collaborative work. The materials published in an area can be declared public, with general access, or restricted to a subset of users. The platform permits the structure of information in areas by subject, level, groups of classrooms participating in a learning project, etc. The collaborative projects with other pupils can take place:

- In the same classroom
- In the same school
- In the same locality
- In the same region
- In the same country
- In other countries

All these levels of collaboration were foreseen. A crucial factor in this scheme of collaborative learning was the easy and secure selection of twinning schools by teachers. The pilot coordination provides sources for the teachers to easily select other school groups in Europe to collaborate with.

The main sources initially offered were the other schools participating in the same pilot and in other OASIS pilots, and in the EUN "Partners Finding Forum", and the European Network of Innovative Schools (ENIS). Interdisciplinary design has been encouraged in the training sessions so that the projects would make use of ICT across several subjects.

3.1.2.2 School equipment and communications

The participation form that was sent to the schools established the minimum mandatory pedagogical requirements, as well as technological conditions for the participation in the pilot in terms of equipment, connectivity, teacher training, existence of network administrators, and weekly hours of computer labs/classrooms with computers devoted specifically to the OASIS experimentation.

The minimum requirements included:

- One PC-like computer available for the School Server and Applications Server or if possible two PC-like computers, one acting as School Server and the other as Applications Server;
- One to two hours/per week of computer lab available for the group the teacher has chosen to take part in the experimentation.

3.1.2.3 Selection of the pilot schools and organisation

The pilot schools were selected according to certain criteria, based on indicators in three areas (for more background information, see deliverable D5.1.3):

Area 1: Equipment and connectivity.
All the schools in the project had ADSL Internet connection, LAN and a good pupil per computer rate. This was no surprise given the institutional investment in equipment in the last years. Nevertheless the availability of equipment was sometimes an issue since not all the computer labs in school were available to all pupils, which means that some labs were particularly crowded, without free hours available for the occasional teacher-users. However, for all the teachers participating in the project about one to two hours/ per week in the computer lab was reserved throughout the whole school year. This was facilitated by the headmasters in order to be able to participate in the OASIS project.

Area 2: Teacher training.
According to the figures obtained from the surveys that the participating teachers filled in, from the interviews with them and from the face-to-face experiences during the training sessions, the vast majority of the participant teachers showed a medium to low level of ICT skills.

Area 3: Integrating ICT into the school curriculum and culture.
Only very few teachers had previous experience in integrating ICT in their everyday teaching.

3.1.2.4 The teacher training

The *pedagogical* dimensions of the teacher training included the following:

- Initial session of face-to-face training on the objectives and aims of the project.
- A two month online course on the project pedagogy and the use of digital content for the specific subject matter. The aim of the online ICT course was to provide the participating teachers with quality support for the duration of the project through the assistance of online tutors. Besides, taking part in online instructions appeared the best way for those teachers that were not fluent in 'their use' to familiarize themselves with the use of ICT. Also it provided them with a relevant learning experience 'through ICT'.
- Intermediate face-to-face sessions in each school to solve doubts and consolidate distance learning. It was considered especially adequate for those teachers who were having difficulties with the initial use of the distance training tools.
- Online support from a tutor for the rest of the experimentation, including the pedagogical assistance for the design and planning of the experimentation plan in their group. Writing their own projects or experimentation plan was considered to be a benchmark in the whole process since it involved a lot of careful design, planning and evaluation on the teacher side, according to the pedagogical principles of ICT-integration expressed in the pedagogical model.
- A hands-on half a day session per province to show the application of the technological services deployed at each school (intranet, forum, chat, web email, web publishing, etc.)
- A one day training session in the Ministry for teachers acting as OASIS coordinators in each school, aimed at enlarging the perspective of their role in the project.

The *Technical* dimensions of training were the following:

The ZMS provides services to four key elements of the OASIS Architecture: School Server, Application Servers and Workstations, and a large number of basic services, each one in several technologies and different equipment types as resumed in the table. For the ZMS, two different profiles of users have been defined. Both were trained in lectures that were adapted to the two profiles:

- Local Systems Administrators of Pilot 1 and Pilot 2 schools.
- Users of Pilot 1 schools (Coordinators, teachers and students) .

The training for the system administrator focused on management of the ZMS. The technical training courses for users (Coordinators, teachers and students) consisted of training on services provided by the School server, and the ZMS: Webmail, Chat, Forums, publishing Web pages on the Intranet, Internet Portals and Publics folders in Intranet.

3.1.3 Pilot participants

In the Spanish pilot, 19 secondary schools were involved, distributed over 4 provinces. Together in total 134 teachers participated, 19 coordinators and 36 network-administrators. The average size of the classrooms was between 25 and 30 students. The students were in between 13 and 18 years old.

The schools used different equipment and communication technologies.

Sixty percent of the participating teachers had more than 15 years of teaching experience. Ninety percent of the teachers had computers at home, while 60% had Internet access.

Each participating teacher has been involved in the experimentation within a single classroom. There were one or two ICT OASIS Administrators per school (often the same as the ICT school coordinator but not necessarily), and one Project Coordinator per school, acting as liaison with the Ministry of Education. The coordinator had to be either teacher or network administrator.

The subjects involved in the experimentation were: Spanish language, History, English as second language, Chemistry, Physics and Mathematics.

3.1.4 Overview of local evaluation, success and failure factors

At the time of writing of this report, only conclusions of visits to the schools and the impressions of the distance tutors, collected in their meetings with the pedagogical staff are available. (For a complete evaluation report of the Spanish pilot, please refer to the final version of deliverable 5.1.3).

3.1.4.1 The pedagogical dimension

Teachers carrying out the experimentation with their pupils in the different subjects were in general very satisfied and excited with the computer lab sessions, even though they experienced technical problems with the machines or the programs, caused them to feel down at some moments. This situation varied a lot from school to school.

They report that the pupils were very motivated and enthusiastic, but it has been difficult to get them in the mindset that going to computer room was also another class and that the

computer was a tool to learn since they are used to see the computer as a tool for leisure. Pupils think that what they learn is useful and they prefer this to do in the normal class.

Several sessions with the pupils were devoted to become familiar with the tools. Pupils were always excited about attending computer lab sessions. Sometimes teachers are not sure about the efficiency in terms of learning.

The teachers recognised that it is very important to have a detailed plan for the computer lab sessions with the pupils; so good preparation for this kind of education is very necessary. All teachers say that working according to OASIS premises implied more work for the teachers, since they needed more time to prepare. Also they thought that their participation should have been compensated with less teaching hours.

Usually low achieving pupils have improved their performance, and in some cases teachers said that the good results were realised because of their increased motivation and interest through the sessions in the computer lab. Even less motivated pupils, who usually perform poorly, were doing exercises on the computer and did a reasonable good job in comparison with what the teachers are used from them. The teaching in the computer lab proved to be particularly efficient for those pupils in special groups needing special attention because their lagging behind.

The number of pupils in one group ranged from 11 to 30 and teachers considered that there shouldn't be more than 2 pupils per computer, which was not always the case for some of the participant teachers. When 2 pupils work on the same computer it turned out to be useful that they take turns in the use of the keyboard and the mouse, this in order to avoid that one of them adopt a passive attitude. There was no agreement regarding whether one student per computer or 2 students per computer is the ideal learning setting.

Teachers had different opinions on the question whether brilliant pupils benefit the same way.

In terms of the pace, compared with other classrooms from the same teacher, the OASIS classrooms are a bit slower, but not too much. However, teachers showed particularly concerns by this difference.

The teachers' assumption that their pupils were computer 'experts' is not realistic; most of them didn't know how to use a word processor properly. Beside that, some pupils don't have a computer at home and even is they have they don't have an Internet connection. This was a major obstacle for the use of the collaborative platforms after school hours, as working from the school was the only option for many of them.

Teachers had the opinion that the collaborative platform and the telematic services of the ZMS were very interesting, but they were not used extensively, since they were ready for use a bit late, and the teachers cared more about carrying out the experimentation projects they had scheduled.

Online tutors have guided the online training as well as the classroom sessions. From their interaction with the participating teachers their most relevant concerns were that teachers sometimes made unrealistic work plans involving ICT-usage. This was even despite the fact that teachers realised that the computer lab sessions with their pupils needed to be carefully prepared, since they were not used to manage the time in this new teaching environment.

When it came to judging what the pupils learned, the online teachers were a bit doubtful since the classes covered less content than in standard teaching. Also in many occasions the evaluation was carried out with traditional tests or exams. The online tutor made the remark that if digital contents are to make an impact in teaching, the evaluation and assessment should be integrated in the technology as well. Furthermore, teachers should be supported to envision different ways of evaluating their pupils. This will also prevent teachers and educators from a common mistake: to measure the learning of a group using ICT against another group not using ICT with traditional exams that not take into account ICT nor the subsidiary learning that take place by its very use.

The previous experiences with ICT made a difference among the participant teachers but once the classroom sessions started all teachers felt much rewarded, no matter what difficulties they had experienced to get to that point.

3.1.4.2 The organisational dimension

Headmasters expressed that making room in the timetable for the OASIS projects was not easy as they had only one or two computer labs in their schools. They all considered OASIS to be an interesting project and commented that teachers of other disciplines, like Biology, French and Technology had wanted to enter the project as well. Without exception, they were concerned about the continuity of the project next year and its extension to other subjects, because they wanted the effort made this year to pay off. They all considered the provision of resources necessary, meaning both the number of computers, as well as reducing the teaching hours of those teachers participating in the project, especially the ICT coordinators.

The number of participating teachers in each subject was limited from three to one according to the available hours within the computer room. In some schools there was a lottery among the teachers interested in participating. In contrary, in other schools only a few teachers dared to enter the project, according to the headmaster because some teachers were still insecure about using ICT, as they did not consider themselves prepared enough in terms of technical skills.

In the schools in Burgos the project started in mid December, when the school year was well underway and right before the first term exams, causing dropout of many teachers, despite the initial enthusiasm. Also difficulties stabilising the timetable for the computer room were more severe here since they were already partly booked by that time.

In terms of ICT management the School administrators have evaluated very positively the services provided by the ZMS. Furthermore, the school administrators training in concepts about the management model provided by the ZMS should be reinforced in order to make smoother for them to start working in such an environment. Their very high interest generated a high demand that should be satisfied providing them with more training in concepts related to the model and operations of the ICT they work with.

The ZMS approach yields significant effort reduction in the overall time to be designated by the school administrator in management tasks to operate the TIC of and school environment (as defined by OASIS), as described in the economical section.

The organization and scheduling of deployment activities is a very critical item within the set of management tasks done by the ZMS. A special situation that had to address the ZMS as the classrooms and infrastructures where part of the general resources of the school and even the personal workstations are been shared with other users and educational activities.

The ZMS has developed shared deployment procedures taking into account this "coexistence", and this has provided additional benefits. So the ZMS can be installed progressively without the need to start from zero, reducing the impact on already ongoing schools services or parallel activities.

3.1.4.3 The economical dimension

Cost-effectiveness of the technical solution proposed by OASIS as the school ICT architecture and implemented in the pilot, as been evaluated. The architecture is made of school ICT systems connected to an Intranet (school server, application servers, workstations, etc), with access to Internet, and remotely connected to a Management System that provides services for the geographical area, with the ZMS as the hub resource and contact centre.

The choice debated in meetings with educational authorities was among a private company operating the zone server, a service provided by a local University department or the service offered from a technical team installed in the premises of the regional educational authority.

In the case of the service provided by a private company, also different levels of service are possible. The level tested in the pilot is that of maximum workload on the side of the company, which not only assists the school network in the initial configuration of the network and the services, but also carries out the procedures, from the operators of the ZMS, to provide each of the services for the school community. As an example of this, when a teacher wants to open a service of forum or chat for a determinate period, the service is not provided by the classroom teacher herself or the school administrator, but the teacher contact the ZMS operator with the details of the service required and the ZMS opens the service in the School Server, in remote mode. It excludes the need of a thorough technical training and an important weekly dedication from administrators. On the negative side is that the know how on the operation is out of the school and even out of the scope of the regional education authority. Also the cost of the service provided by the ZMS is higher than the cost Spanish schools are willing to pay.

A first estimation from SIRE for a large enough numbers of schools, based on figures of resources, costs and QoS described later in this section, establishes the cost of the service in around 6,000 euro per year and school. Region political decision makers may balance this cost against that of purchasing five to six more computers per school and year, and the power of the corresponding political communication. It is related with the current trend in the Commission to diminish the relevance of quantitative indicators to assess on the integration of ICT in schools, as the dissemination of these indicators may lead decision makers to devote a large majority of economical resources available to improve these indicators, mainly hardware and communications for the schools.

Some other possible models have been discussed with smaller levels of participation of the Zone Server in the administration of the school services, thus with a more reduced direct cost, but with the need of better trained and more dedicated local school administrators. The cost is charged then in the teacher training and the reduction of weekly class hours for the administrators. The average cost for a Spanish Secondary teacher reduction of three class hours per week is around 5,500 euro per year. The requirement of most OASIS administrators for this school year to go on acting as administrators is this three hour reduction, counting with the support of the ZMS they had the last school year. If the services provided by ZMS are to be reduced to shorten its cost, teachers acting as administrators of the school network in a more autonomous mode, would require around 6 hours per week.

Some other regions in Spain have a help desk in the Region Council of Education to technologically support the school ICT coordinators (with network administration functions). A ZMS can be installed in this service, operated by the staff of the Council of Education. Small regions prefer not to have a large permanent technical staff. The functions of this staff can be combined with the higher level technical advice provided by a University Department or a private company, which could also train help desk operators, train school administrators and install and maintain the software for the ZMS and the school servers. This balance between the cost assigned to an external entity and the cost of permanent staff hired by the Education institutions, is an important part of the decision to be taken. Still many education institutions in Europe decide that no cost has to be associated to the maintenance of the school network and technological services to support innovation. They have the assumption that teachers will devote enough time after their lessons, to meet this need. It normally implies an ineffective expenditure in hardware and communications that are operational a reduced percentage of the school week. It has been proposed in the DG Education and Culture to establish an indicator related to the number of hours-computer per week effectively available, instead of the number of computers in the school.

The economical dimension in the use of a Zone Management Server (ZMS) has been estimated in the experimental Spanish pilots with Linux schools servers (Sun Cobalt Qube and Spanish Ministry Edulinux, and with Solaris applications servers (SUN) and Linux applications servers (Edulinux of Spanish Ministry), in a scenario with the following complexity: 21 classrooms y 18 centres, 18 school servers, 21 application servers, 294 workstations of different profiles, more than 2.000 user accounts, 44 Virtual Private Networks providing access by Internet, and 30 ICT school administrators.
The following results have been obtained:

a. Total Cost of Ownership (TCO) Evaluation Issues

With the aim of TCO reduction with provision of QoS, the ZMS approach yields significant effort reduction in the overall volume of management tasks to be done in the OASIS environment by school administrators. To assess the degree of achievement of this target, the ZMS uses several metrics:

- The ratio of number of procedures to be done by school administrators to the total number of procedures to be done for every school in the Zone. This ratio should take into account the frequency of invocations of the procedures. From the experimentation performed this yields a ratio of about 5% (the school administrator has to do only 5% of the management tasks).
- The ratio of time dedicated by the school administrator to perform management procedures, to the total management time to be done; taking into account the specific tasks, and the different skills between school administrators and ZMS operators. From the experimentation performed it yields 25% (the school administrator has to spend only the 25% of the total time necessary without the ZMS support).

These figures show that, considering the whole set of management tasks to be done in the environment deployed at the pilots, the effort left for school administrators is a small amount of the total workload.

Other factors to be considered in the TCO evaluation for the ZMS deal with the required resources. Such factors are:

- Hardware.

  The measurements done during the pilot experimentation show that, for the size of the Zone managed during experimentation (~20 schools), the infrastructure required

for building the physical ZMS platform is not "demanding":

- As for the computer infrastructure (portal server, database server, backups and monitoring), current state-of-the-art PC can provide CPU and disk resources able to cope with the demanded workload.
- As for the communication network bandwidth, a premium ADSL interface for the ZMS is necessary.
- The measurements performed during experimentation have provided valuable inputs for dimensioning the ZMS resources if the size of the supported zone changes significantly.

- Human resources.

  A model for dimensioning the human resources required by the ZMS to provide service with a given quality level has been defined. The model specifies the waiting time for events processing as the QoS measurement; it considers three possible priorities of events to be managed. The parameters of this model include the average events arrival rate and average events service time (that is, the average workload), and the quality levels to be achieved for each priority.

  the workload parameters for the managed Zone. They give an event rate of 9,61 events per hour in the busy hour, with an average service time of 28,5 minutes. With these inputs it can be shown that no less than five operators are required to cope with the offered workload (~20 schools). Waiting time limits of 1, 8 and 24 hours imposed for each priority, the model yields that these restrictions are honoured with six operators.

b. Quality of Service (QoS) Evaluation Issues

As for the provided QoS for ICT at schools, the implemented ZMS has been able to keep an:

- average availability of 99,36% for the school servers in schools,
- average availability of 99,7% for application servers, and an
- average workstation utilisation of 80% of the deployed computers every day.

School administrators have evaluated support from the ZMS as quick, fast and with correct answers to the doubts and problems.

Another performed QoS measurements relate to the TTR (time to repair) for the different events. They have been done by processing the message and call records at the ZMS to evaluate the attention and response times. The figures obtained of TTR show the viability of the service with the resources involved and the convergence with the resources model as presented before.

3.1.4.4 The technical dimension

School administrators were concerned by the overload of work in setting up the computer room for the project, more than they initially thought, mainly due to the need of start by installing the OASIS architecture before to connect to the ZMS and provide management and support services. In most cases this was to be done reconfiguring already existing equipments, at the same time that pupils and teacher had access to the workstations to proceed with their regular activities. They had to work after school hours when the computer labs were not in use. Also the installation and configuration of all programmes had to be done while keeping the lab working for every day usage.

In all cases they reported that the ZMS provided quick, fast and correct answers to the doubts and problems. The shared installation procedure was considered to be a good

solution, though, which made all the configuration procedures faster. They missed a more in-depth training about the ZMS, in order to realise a good understanding of everything that is going on. Now their role was very procedure-oriented without knowing the internal 'why' and 'how'.
In general they did not consider themselves to be able to work on their own. The communication services were ready when the experimentation started. They showed their concerns about next year: availability of technical support for the school intranet, their role as ICT-coordinator, the continuation of services, etc.

They also mentioned that the computer labs some times don't have enough machines or they are worn out due to the intense use. Teachers from different subjects with different installation needs mean a difficult optimal maintenance.

All of them asked for a continuation of the project for next school year, as the participation was an interesting experience, and as they expect a pay off out of the infrastructure and invested effort made by the teachers and the school.

Some issues that can be drawn from the ZMS approach are summarized below:

- An implementation of a ZMS based on the architectural design provided for management of ICT infrastructure and services in a school environment have been implemented and successfully tested supporting the ICT infrastructure of up to 18 schools.
  School administrators have evaluated positively the services received from the ZMS (good quality of attention, good support) for the ICT technology management (systems, networks, services, application),. and have been able to achieve their management tasks, thus providing validation for the ZMS approach.

- The organization and scheduling of deployment activities is a very critical item within the set of management tasks. The ZMS has developed shared deployment procedures taking into account this "coexistence", and this has provided additional benefits, e.g., for speeding up installation tasks by taking advantage of an already installed software or operating system and not disturbing other activities.

- The school administrators training in concepts about the management model provided by the ZMS (distribution of management tasks among the ZMS and the school administrators) should be reinforced in order to make smoother for them to start working in such an environment.

- School administrators have been able to perform their management tasks successfully, but they miss a better understanding of what is going on when doing these tasks. Thus, their motivation can be increased by providing them with more training in concepts related to the model and operations of the ICT they work with.
  They already receive a basic networking training, but other concepts they deal with in their management work are centralized user management technologies (LDAP) and centralised resource management technologies (domains). A basic training, focused on the models for these technologies, can provide them with an insight of many of their operations, and thus increase their motivation when doing it and satisfy the demand

- With the aim of TCO reduction with provision of QoS, the ZMS approach yields significant effort reduction in the overall volume of management tasks to be done in the OASIS environment by school administrators, As for the provided QoS, the implemented ZMS has been able to keep an average a very good availability higher

than the 99,00% for the school servers that are the key elements, and of 80% for users workstations. Exact figures and more detailed description can be seen in the economical dimension section.

The OCSL architecture and concepts has been implemented as a web Portal and provides services since the final phase of the project. Links are been included in the Internet portal of the Spanish pilot schools. It is being proven to be relevant for the School Community. EUN web site has collaborated to the promotion of the OSCL providing room for the OCSL services.

Some issues that can be drawn from the OCSL approach are summarized below:

- Organising, indexing and cataloguing educational software resources are critical tasks. In particular, automatic content acquisition should be accompanied of a careful analysis and filter from a human expert to decide about quality and adequacy of harvested resources found in external sources. As this procedure may be unaffordable for the maintenance of the OCSL, this problem was considered in the design of the OCSL and effective solution based on "wrappers" technology have been implemented to minimize the human intervention.

- During last months improvements are introduced following the received feedback from users and the recommendations of the reviewers, resulting in a new OCSL with new function and enhanced performances, and the OCSL has been made available too through the EUN site. Among the improvements: a new user interface (with additional explanation of its aims, contents, user roles and guidance). Moreover, a quantitative summary of the contents is shown directly on the home page; it includes several terms of the catalogue displayed with the number of the resources available, the user may decide to browse directly and go to get the results of the chosen term.

- Qualitative information on educational software resources should be explicitly available. A mechanism has been included in the OCSL. It includes resource evaluations by experts and resource comments by users. The mechanism allows qualitative information to be added mainly by taking into account experts' opinions.

- The real added value of the OCSL is to have a comprehensible and valuable set of resources with searching facilities through a broad, and standards based, catalogue. On the Professional part, for the professional developer users, sources were discovered appropriated for the scope of OASIS and the School Community and they were carefully selected using quality criteria more than quantity. Nevertheless, the number of resources has reached near 3000 entries. Sources including shareware or commercial software were specially considered to complement the OCSL contents.

  Similarly, on the Teacher's Corner part, Applets descriptions and links were found and introduced in the OCSL. The number of Applets increased up to 1600.

3.1.4.5 <u>The Cultural/social dimension</u>

Parents' involvement in the project has been more reduced than projected. They have been informed that their children were participating in a European project, and they received the necessary information as to approve the provision of an e-mail account for their children.

The connection in collaborative education projects between European classrooms has been carried out in areas of social science more than in Mathematics or Physics. In English as a Foreign Language, ten European countries have been involved in trans-national projects, with the classrooms of Castilla and Leon. Pupils of the Spanish pilot have

contacted their fellow pupils in other European schools to interchange information on the conditions of life in their environments.

Though e-mail has been the tool more used, also forums have been used to contact with experts who could give an external viewpoint of the objects under study. In the subject matter of History, teachers of University of Castilla and Leon have participated in a forum with pupils of Secondary Education.

Also from the viewpoint of the school as a socialisation institution, there has been an interesting finding in the behaviour of pupils more reluctant to cooperate with their fellow pupils. Having to work generally in pairs on the same computer, the strategies developed by teachers grouping the students have been diverse to achieve adequate pairs of pupils. These pairs have not been permanent all during the experimentation.
It has been detected a better collaboration among pupils in technological aspects inside the classroom, acting the pupils with better technological background as in the support to the less experienced.

Initially some of the experimentation plans drafted by teachers proposed a closer participation of the local environment of the school, but finally teachers have not arrived to implement all the features envisaged. One of the difficulties found by teachers is the distance with most parents. One of the proposals to OASIS teachers that have not been achieved is the presentation to groups of parents of the new pedagogy and the applications used. Teachers were quite reluctant to present the project and the applications to parents without an absolute security in their expertise. Some teachers have accepted this dissemination among families of school activities for the next school year, when they feel more confident technologically, as they are really afraid of being criticized by parents. This need of attracting families to the school activities and their children's education is the main conclusion learned.
One of the OASIS elements that have produced a better inclusion of the parents in the school activities has been the generation of a school portal, where the school offered information and services for all the school community.

The quality of many plans and reports is remarkable, in which we can see the teaching experience of most participants. It has to be reminded that a 60% of the teachers selected for the pilot had more than 15 years of teaching experience. Most of the remarks from the reports match those collected by the pedagogical staff in their visits to the schools during the experimentation. There are some new issues as well, however:

- The detailed evaluation activities carried out by the teachers with their pupils. Few have put the main weight of the evaluation results in a written exam. Rather they have used the continuous observation of the pupils' behaviour in the group work, the results of exercises with the computer, their participation in the communication activities;
- The results of the pupils' assessments, with different impressions of their teachers, depending on the education level (age) and their previous qualification level;
- The satisfaction of the pupils with the experience; they are almost unanimously satisfied with the collaborative work, but less with the use of the technology to learn. A part of the pupils, a bigger percentage among the best pupils and among the older ones, are not sure that they learn better with computers. The technological tools that are considered as the best by pupils are the search of information on the Internet and the use of e-mail.
- The small involvement and interest of the families in the experimentation. Teachers think that the involvement of families was one of the tasks that they have not had the time to accomplish.
- The different pace in the advance through the curriculum, but not as different as many had thought at the beginning.

3.1.5 Issues raising from the implementation

From the Spanish pilot, it has become clear that the implementation of technology in Spanish school has been quite successful, as there have been many projects and the quality of many project plans and project reports is remarkable. Most of the remarks from the reports match those collected by the pedagogical staff in their visits to the schools during the experimentation. There are some new issues as well, however:

- Pupils are very satisfied with the experience; they are almost unanimously satisfied with the collaborative work, but less with the use of the technology to learn. A part of the pupils (mainly among the best pupils and among the older ones) are not sure that they learn better with computers. The technological tools that are considered as the best by pupils are the search of information on the Internet and the use of e-mail. This might have something to do with the "historical" way of getting knowledge they have had, and, very important, in the issue that the evaluation does not change, so, in many cases, the use of technology slows down the speed of preparation of examinations.
- The involvement and interest of the pupils' families in the experimentation was very low. Teachers think that the involvement of families was one of the tasks that they have not been able to accomplish due to time constraints.
- The classes that used computers had a different (slower) pace of advancing through the curriculum, but not as different as many had thought at the beginning.

A general remark presented in the reports is the need of support from the educational authorities to maintain the school technological services. There is a general agreement among the teachers that the methodology proposed has the potentiality to improve the learning processes. OASIS administrators and teachers strongly require the schools to have an allocation of the necessary resources for the maintenance of the services. Probably a main outcome of this study is the call to the education authorities to balance the technology budgets, devoting a part of the purchase cost to a better maintenance.

3.2 The Apple Pilot

3.2.1 Pilot objectives and their relation to the global objectives

What happens to teachers, classrooms, and students when laptop computers are available throughout the school day, when each student can get online quickly and easily, when their computer has the capability to easily make digital movies, and they can move to any part of the school with their computers? These are some of the questions that were addressed in the Apple pilot.

Apple selected approximately 20 schools throughout Europe (France, UK, Switzerland, Germany, Belgium etc) using wireless technology in the classroom, of which 9 participated in the global evaluation and validation. Four schools were also involved in the local 'in-depth' evaluation. These are the pilot schools that are directly involved in OASIS as they benefit from equipment through the budget. The 4 OASIS schools participated in all aspects of the OASIS project. These schools are based in

- Madrid (Spain)
- Grenoble (France)
- Tübingen (Germany)
- Oostaker (Belgium)

All schools have had experience with mobility (using wireless technology) and demonstrated the pedagogical and financial added value of using wireless technology as well as proof of how this wireless environment works in an open architecture (example SUN for Spain and SLIS for Grenoble). Schools were a mixture of primary and secondary schools. All used their portables in a media rich learning environment.

The sights, sounds, and interactive media that engage and motivate today's digital generation are often missing from the classroom. Digital media can truly enhance learning and fun, providing a more compelling and effective learning environment for today's pupils. Technology today is giving pupils more ways than ever before to research, collaborate, communicate, express their ideas, and share what they have learned. Even children who may not be as articulate in the written word find new ways for effective communication with digital media technology and easy-to-use applications

Integrating digital media can increase the relevance of school for pupils living in today's media-rich environment. It also gives pupils of all backgrounds, experiences, and capabilities, new ways of communicating and expressing themselves. Pupils work with pleasure on their projects because each assignment gives them a voice and a means of self-expression.

With the Wireless Mobile Classroom, all the necessary technology is stored on a portable cart. An AirPort Base Station keeps the lab's iBook computers connected wirelessly up to 150 feet away and when the base station is connected to an existing Ethernet port, pupils have instant access to the school's network and the Internet. Another great advantage is that all portables can be charged at the same time, simply by plugging a single electrical unit into the wall.
To integrate Media rich Learning in the classroom, a mixture of DV camcorders, a digital camera, a scanner, headphones and microphones enables teachers and pupils to integrate images and sounds from virtually any source into projects, presentations, and lesson plans and easily integrate digital media content into the classroom.

The relation between technology, learning and interaction spaces, like the portal, and the educational vision can be seen as follows.
Pupil access to technology is no longer limited to a single computer lab or classroom. Now teachers have the flexibility to turn any corner of the building into a powerful learning centre. And because the portable iBooks are on a mobile cart, teachers and pupils in different classrooms can share them to maximise use and limit costs. Another advantage is security. The solid construction of the lab and the locking doors ensure that the iBooks will be perfectly safe when they are not used. Furthermore, the Wireless Mobile Classroom reduces wiring costs and installation time. It is not necessary anymore to tear down walls and reconfigure buildings, or to invest in a dedicated computer lab. The aim is to have a cost-effective solution for placing multiple computers in a classroom.

There are several possibilities for relationships between the schools and the local community. School projects and results can easily be shared with parents, other schools or members of the local community by through iDisk, a server space with pre-designed features that allows pupils and teachers to store their projects on a server. Teachers can also benefit from the interactive platform ALI (Apple Learning Interchange) to exchange and store lesson plans.

It is also possible to create relationships between schools, teachers and learners at European scale. School projects can easily be shared with other schools in Europe, either in an open and structured way through portals such as EUN (European Schoolnet) or between 2 schools directly. To benefit from real broadband Media Rich Learning across the border, servers allowing for streaming video, on top of the standard server features are a must.

3.2.2 Main features of the pilot

In the Apple pilot wireless laptops in four classrooms were used, located in four different countries (Belgium, France, Germany, and Spain). In each case, the pilot teacher was relatively new to using technology with students and reported some prior use in a lab situation with desktop PC's. For all the pilot classrooms, this was a first experience with laptops, with wireless, and (except for Germany) with the Macintosh platform. Three of the pilots involved primary schools, and one involved a secondary school. For three of the pilots (France, Belgium, and Spain), the computers were given to one teacher with a second partner teacher as a collaborator. The German pilot was distinctly different. Here, the set of iBooks were given to one professor at the University of Tuebingen. There, they were used in several studies of technology integration practices. For the purposes of OASIS, the pilot teacher worked with an after school program for 9-year-olds on a weekly basis to create the projects. In addition, a middle school science teacher made good use of the iBooks for several months.

In each case, the pilot teachers received three visits from the trainer/manager of the Apple pilot. Three of the schools sent teachers to a training workshop in England in April 2003 where they learned how to work with their laptops and how to create iMovies using digital video cameras. Again, the German pilot was a bit different, sending a junior research student to the training. He brought back an understanding of the Mac environment and the use of iMovie. The pilot teachers collaborated face-to-face to develop the cross-borders project design.

Beginning in September 2003, the pilot teachers worked with their students to create an iMovie that introduced their school to the other pilot classrooms. These movies were posted in December and January to a website created by the trainer/manager (http://homepage.mac.com/kmlengel1/oasis/oasis.swf). Additional schools were invited to

join the video project and, to date, 15 other schools have posted introductory movies from across Europe.

Beginning in December 2003, all pilot classrooms were invited to complete an online survey created by EUN to measure the impact of using wireless technologies in their schools and classrooms.

In the spring of 2004, pilot classrooms worked on a second iMovie that reflected their students' response to the question, "How will the new Europe impact us?" At this writing, not all of the second movies are completed. These videos are to be posted to the project website as they become available. Pilot teachers were also to participate in the European Spring Day project sponsored by EUN. All were registered. To date, it is not clear how many, if any, responded to the project.

In March of 2004, the trainer/manager of the Apple pilot paid a final visit to each of the pilot sites to conduct video interviews of school leaders and pilot teachers. She also videotaped students using the iBooks in a variety of settings.

The technology used included classroom sets of 10 iBooks on a charging cart, Apple Airport base stations connected to high-speed Internet access points, and a digital video camera. All of these tools were supplied by the OASIS 5.2 budget.

3.2.3 Pilot participants

4 schools (Primary and Secondary) in the 4 following countries:

- Spain/Region Madrid: 28 teachers, 750 students, 1 administrator (half the teachers in this secondary school including English, Maths, French, Geography,
History, Spanish Language and Literature, Spanish Language for Foreigners,
Music, Theatre Workshop and Hairdressing)
- France/Region Grenoble: 4 teachers, 150 students and 1 administrator (half the teachers and half the students)
- Germany/Region Tübingen: 5 teachers, 249 students, and 3 administrators (eleven different classrooms, each in a different school – one primary after school program, one middle school science teachers, and nine experimental classrooms)
- Belgium/Region Flanders: 35 teachers, 400 students, 5 administrators (every teachers and every student in this primary school)

In the end, each of the schools went beyond the original classroom to impact more teachers, students and administrators. Because the laptops were on a cart and the airport base station sent its signal over 46 meters (150 feet), all of the schools took advantage of them. In both the Belgian and Spanish pilot schools, the participating teachers conducted extensive after-school training for their peers to help them become knowledgeable in using media-rich lessons with the iBooks.
So, the participants, while beginning with a common task of attempting to use the iBooks to support their individual curriculum, went in very different directions based on their schools' needs.

3.2.4 Overview of local evaluation, success and failure factors

A full description of the ways that the data was gathered can be found in the separate deliverable D 5.2.3 of the OASIS project. Here, only the outcomes of the evaluation and validation will be discussed in brief.

3.2.4.1 Pedagogical issues

The results of the Apple pilot are very promising. With not much major skills required prior to the project, teachers and students adapted a new way of learning that is satisfying for both of them.
The learning in the pilots has become more collaborative. The teachers use more constructivist practices, and are not afraid to let students work on their own while searching on the Internet. Even better, teachers make use of the expertise of students!
It was found that students were collaborating best in dyads or small groups behind the laptops.

Teachers report that they had learned a great deal in the last 12 months in terms of their own professional development. In all cases, the teachers have shared their experiences with colleagues.

In the Spanish pilot, the pilot teachers had run after-school sessions for other teachers that were highly attended, causing more teachers to sign out the laptop cart for their use.

In all pilots, the use of the laptops expanded beyond the pilot and the pilot classroom. Many experiences where shared internationally. All teachers have moved beyond the scope of their project.

For example, in the Belgian school, the laptops had travelled to a nearby senior centre, where students interviewed senior citizens and demonstrate websites of World War II. In Germany, the pilot teacher taught an after school program to young children who used the video camera and iMovie to tell the story of international cooking styles. The same teacher brought the video camera and laptops to the mayor's office to interview her on the future of Europe.

The motivation and enthusiasm of students increased in the pilots. Attendance went up, behavioural problems went down, and students were very excited to be using these new tools in their classrooms. In every classroom, the pilot teachers were able to point out normally hyperactive students who were engaged and well behaved when using the laptops.

3.2.4.2 Organisational issues

The teachers in the pilots report that they were very happy with the organisation within the classroom. Using the laptops and wireless technology offers a very flexible solution of organising your classroom set-up.
One unexpected outcome of the pilot was the involvement of other teachers. The word quickly spread that the laptops were very powerful curriculum tools, motivating for the students, and, in the words of the Belgian pilot teacher, "They just work". In each pilot the other teachers in the schools were informed and taught how to use the laptops as well, either formally or informally.

This posed another problem however: the laptops had to be shared, as they were used very intensively. Therefore, schedules had to be made, especially when a school had more than one location, or when a school had multiple floors, but no elevator (and thus the cart

with the laptops had to stay on one floor). Also finding out the place with the best wireless access had to be figured out. But in all schools, solutions to these problems were found.

3.2.4.3 Economical issues

All schools in the pilot, the pilot teachers and administrators saw the installation of wireless networks and laptop carts as economically more desirable than computer labs with desktop machines. This result is backed up by the finding that some pilot schools tried (and succeeded) to find additional budget to purchase more laptops or even an additional cart.

However, all projects report that the teacher preparation time increases. Although they report that this is not a limiting factor for the use of ICT, it is still something that has to be taken into account. Furthermore, teachers need training, but in this pilot, this turned out to be a non-issue, as teachers trained each other and collaborated online.

3.2.4.4 Technical issues

In every pilot, the Macintosh platform was new to the school, the wireless base station had to be connected to an existing network, and there needed to be some new learning done by the ICT responsible person to get it all set up. Although in the pilots everything worked smoothly, this can be a challenging issue, especially when a teacher himself is the ICT responsible of a school.
But as said, the integration of the iBook laptops with the existing ICT technologies and practices did not pose any (major) problems.

3.2.4.5 Cultural and Social issues

It turns out that the creation of iMovies is a great way of sharing your ideas with others. Within the pilots, both teachers and students communicated much with other schools (both local and national, as international), but also with other groups in their environment.

In the German pilot, the teacher worked with his class to interview the mayor of their own in relation to the cross-borders New Europe project. The mayor was amazed at the sophistication of the 9-year-olds' use of the computers and movie equipment. The students showed her a movie they had constructed and she was quite impressed. Later the same group held a parents' meeting where they shared their New Europe video.

As said, trans-national collaboration was a focus of the project and the pilot schools introduced themselves to each other and shared their ideas for the new Europe with each other. The facility with which the iBooks handled email, Internet searching, and video editing enabled this cross-borders' collaboration.
Increased collaboration could be enhanced with the incorporation of live video conferencing for each school. Currently, all pilots own the tools for this. The missing piece is the network firewalls.

3.2.5 Issues emanating from the implementation

The wireless technology combined with the iBooks works in a real setting. For all of the pilot schools, having the iBooks available and portable meant a marked increase in the use of the Internet within the normal class lesson. In all cases, the teachers had to figure out how to make the best use of the iBooks throughout the day. So, some scheduling and general organizational changes needed to be made.

There were changes in teaching and learning with the advent of real and regular use of technology within the curriculum. The huge increase in available resources from the Internet made it possible for students to broaden and extend their studies in all subjects.

In all cases, teachers reported that the ability to use the Internet with their students with regularity made a change in their own pedagogical practice. They found that their lessons were richer, that their planning changed to accommodate the new resources, and that they could no longer predict how much information their students would discover. In the cases of the Belgian and German pilots, the teachers began describing student learning in constructivist terms.

All teachers reported that students became more self-directed and more motivated. They found that students helped each other with technical questions, which also demonstrated increased independence. The directly attributed these changes to the students' having access to the iBooks on a regular basis. The students needed little intervention or help from the teacher to use the iBooks, particularly when working on the Internet.

Are the pedagogical approaches easy to adapt for use in other countries and cultures? The answer to this question is yes. Designing web activities is not difficult. Every language group has student-appropriate search engines that make searching for information efficient and safe.

The main issue of this pilot (and probably in general) is the training of the teachers. The initial plan was to install the networks and iBooks and to have the trainer/manager visit the schools one at a time for initial training. This would have made their collaboration a challenge. When the trainer/manager found out that there was going to be an Apple Institute in England in April of 2003, she arranged for all pilot teachers to attend with her. The collaboration and planning during that week among the pilot teachers laid the foundation for their work together in the ensuing year. Even after the pilot year was complete, the collaboration continued as the French pilot teacher virtually coached the Belgian teacher in creating claymation movies. It turned out that teachers could create self-support groups very easily, once they have gathered for one time or a few times in a shared training session.

3.3 Pilot 3: SUN Microsystems

3.3.1 Pilot objectives and their relation to the global objectives

In the implementation plan it was identified that one of the interesting elements of research, was the behaviour of teachers having to deal with both environments, Windows and SOLARIS, inside the project. Teachers working in Sun classrooms already had PC technology in their computers in the Department, in the school library, in the teachers' room and at home. Nevertheless, to increase the complexity of the experimentation, it was required from educational authorities that schools participating in 5.3 would also have another computer lab in OASIS with Edulinux as Application server and Windows technology environment. Of course, this technology was not imposed from the project, but the computer labs in Castilla y León are generally working under Windows operating systems.

3.3.2 Main features of the pilot

This lead to a bigger technical complexity, as the school network managed through the ZMS and School Server (in these three cases always Cobalt Qube), had not only PCs of different generations and different releases of Windows OS, but also a different technology and user interfaces. This technology is a thin client technology, called SunRay. It has different file systems, access policies and different general communication client applications. From this perspective it was to be researched if the teachers were to refuse the different technology or accept advantages and difficulties. This idea came from observing the situation initially appeared in schools of some regions having adopted Linux OS and joined the free software philosophy, after having begun to work with pupils in Windows computer labs. The first reaction from some teachers in those schools had been to reject the new/different technology. The main features of the pilot, therefore, were how to deal with the technical complexities and the reaction of teachers to these complexities.

3.3.3 Pilot participants

The schools selected from Spain are three secondary schools:

- Ávila: IES Alonso de Madrigal
- Segovia (Cuellar): IES Marques de Lozoya
- Burgos: IES Pintor Luis Saez.

Additionally, amongst the 27 schools that participated in the EUN pilot, 2 specific UK schools were selected to be part of the Sun pilot.

The reasoning behind this selection was based on several factors, amongst which the most prominent were the following:

1. Most used language should be other than Spanish, to demonstrate the ability of the central services (ZMS) to handle non-Spanish environments
2. Schools should have different ICT background and experiences, in order to validate the services with many different profiles of users

To achieve these objectives, the 2 following UK schools were selected:

- Hornsey School
- Cottingham High School - Cottingham, East Riding of Yorkshire

3.3.4 Overview of local evaluation, success and failure factors

Within this 'local approach' the other research questions posed were addressed. These questions address pedagogical issues and the issues that concern the combination of technology and pedagogy.

3.3.4.1 Personal Teacher Interview

In three of the schools, a set of visits of an external evaluation team of the University of Salamanca, was envisaged. A selection of the teachers was interviewed, either on an individual basis or on group interviews, when more in-depth information is judged to be necessary. The information gathered may be regarded as partly complementary to the information obtained from the global questionnaire, but with a more qualitative character.

3.3.4.2 The follow up of the experimentation by the tutors

The teachers participating in the experimentation have counted all through with the support via e-mail of the tutor who has provided the first insight into the pedagogy of the project and the resources online available. The tutors met periodically with the pedagogical staff of OASIS and report on the progress. These follow up and support was completed with a forum maintained for every OASIS teacher, where any question or doubt arisen was answered by peers or by the project staff. Technical issues were normally redirected to DIT or SIRE and pedagogical ones were answered by the staff of the Ministry.

3.3.4.3 Reflective Notes

These were written reflections of teachers about pupil activities in their classroom. These notes have two functions: it gives the researchers insight in the classroom activities, and the reflection is a learning moment for the teachers. The notes, written in an informal way following a few guidelines, were not to impose too much on the teachers' time, hence they were written in Spanish and only a summary in English was submitted for research purposes. These notes were included in the report of each teacher at the end of the experimentation. The tutor of each teacher on one side and the staff of the CNICE compared the report of the actual experience with the project designed by the teacher previous to the beginning of the practice in the classroom. The tutors qualified the reports by their interest in terms of the research. After this first selection, the pedagogical staff of the project identified those reports worth to be translated into English and broadly disseminated as achieved classroom experiences.

3.3.4.4 Selected case studies

Some of the schools were objects of interesting case studies. These case studies give a broad situated overview of the pilot site. One of the schools selected is the school having participated in the pre-pilot (IES Rey Fernando VI). The special interest in this case is the possible continuity of the innovation once the close support from the project has ceased. Another of the schools identified for this study will be among those which share the pilots 5.1 and 5.3, because of the special complexity, technical and organisational appeared in them.

The final report of each pilot was produced with an agreed common number of issues, so that the final evaluation report of the project is coherent. Nevertheless, as well as besides the common evaluation tools, each site may have specific ones, each pilot can also have specific elements in its final report. For the three Spanish schools of the SUN pilot, the follow up and evaluation elements are the same as the pilot of the Ministry of Education (5.1).

3.3.4.5 Views from the participant schools

The classroom sessions or the so-called *experimentation* started at different dates, due to the different types of technical difficulties that appeared in the schools. As a result, the technical set up of the computer labs was ready at dates ranging from mid October 2003 to

April 2004. In some cases some teachers started using CD ROMS when the School Sever was not yet ready in order not to delay their planning stated in their projects.

The schools with a SUN thin clients computer lab followed a different schedule. Beginning March the configuration of the SUN Blade servers was upgraded in order to cope with the demanding Java Applets (Descartes 3) and Flash animations included in the web pages the teachers were using. An extra processor was added to the server and the RAM memory was extended from 2 to 3 Gb.

The experimentation sessions in general started with basic functionalities ready but without being the whole set of the designed technological services available.

Interviews were carried out at each school with the subject teachers, ICT coordinators, headmasters and OASIS teacher acting as coordinator at the school. The results are the following:

- **Headmasters** express that having only one or two computer labs a school, making room in the timetable for the OASIS projects was not easy. They all consider OASIS an interesting project and commented that Biology, French and Technology had wanted to enter the project as well. Without exception, they were concerned about the continuity of the project next year and its extension to other subjects, because they want the effort made this year to pay off. They all consider necessary the provision of the necessary resources, meaning both the number of computers, as well as reducing the teaching hours of those teachers participating in the project, especially the ICT coordinators.

The number of participant teachers in each subject was limited from three to one according to the hours of computer room available. In some schools the participation was determined by a lottery among the interested teachers. By the contrary, in other schools only a few teachers dared to enter the project, according to the headmaster because some teachers are still insecure about using ICT since they not consider themselves technically prepared enough.

In the schools in Burgos, the project started in mid December, once the school year had started, and right before the first term exams, this caused that despite the initial enthusiasm many teachers dropped out the project. Also difficulties establishing the timetable for the computer room were more severe since they were already partly booked by that time.

- **ICT coordinators** were concerned by the overload of work that implied the setting up of the computer room for the project, more than they initially thought, given the remote administration provided by the ZMS. They had to work after hours when the computer labs were not being used. Also setting and configuring all programs had to be done while keeping the lab working for every day use.

In all cases they report that the ZMS provided quick, fast and correct answers to the doubts and problems (better by phone than by email). They think that the technical solution provided by the ZMS was designed as if only OASIS teachers would be using the computer lab (EduLinux install, formatting of hard drives, etc.) The *shared* install procedure is considered though a good solution and made all the configuration procedures faster. They miss a more in depth training about the ZMS to come up with the understanding of all what is going on, they thing their role was very procedure oriented without knowing the internals. In general they don't consider themselves able to work on their own. The communication services were ready when the experimentation had already started. They show their concern about next year: availability of technical support for the school intranet, their role as ICT coordinator, the continuation of services.

They also mention that the computer labs sometimes don't have enough machines or they are worn out due to the intense use. Teachers from different subjects with different installation needs mean a difficult optimal maintenance.

All of them ask for a continuation of the project for next school year, having been the participation an interesting experience, they expect a pay off out of the infrastructure and invested effort made by the teachers and the school.

- **Teachers** carrying out the experimentation with their pupils in the different subjects are in general very satisfied and excited with the computer lab sessions, even though they have experienced technical problems with the machines or the programs, caused them to feel down at some moments. This situation varies a lot from school to school.

They report that the pupils were very motivated and enthusiastic but it has been difficult to get them in the mindset that going to computer room was also another class and that the computer was a tool to learn since they are used to seeing the computer as a tool for leisure. Pupils think that what they learn is useful and they prefer this to the normal class.

Several sessions with the pupils were devoted to become familiar with the tools. Pupils always are excited about attending computer lab sessions to the point they don't want to miss them by having exams scheduled on those days. Some times teachers are not sure about the efficiency in terms of learning. Nevertheless they think that forced the pupil to work and the work is more under control and they get to know better what the student understand.

In all cases they understood that a detailed plan for the computer lab sessions with the pupils was necessary.

Pupils with some learning and motivational difficulties have improved their performance, and in some cases teachers say the good results are because their motivation and interest increased through the sessions in the computer lab. Even the less motivated pupils that usually perform poorly are doing exercises on the computer and do a reasonable good job for what the teachers are used to from them. The teaching in the computer lab has proven to be particularly efficient for those pupils in special groups that need special attention because their lagging behind. The number of pupils in one group ranged from 11 to 30 and teachers consider that there shouldn't be more than 2 pupils per computer, which was not always the case for some of the participant teachers. When 2 pupils were working on the same computer, in order to avoid that one of them adopted a passive attitude, it turn out to be useful that they took turns in the use of the keyboard and the mouse. There is no agreement regarding whether one student per computer or 2 students per computer is the ideal learning setting. However, not all agree upon whether brilliant pupils benefit the same way.

All say that working according to OASIS premises implies more work for the teachers since they need more time to prepare and also consider that their participation should have been compensated with less teaching hours.

The teacher's assumption that their pupils were computer 'experts' is not real, most of them don't know how to use properly a word processor. Besides some don't have a computer at home and even having a computer they don't have and Internet connection, this being a major obstacle to the use of the collaborative platforms after school hours, being working from the school the only option for many of them.

Teachers think that the collaborative platform and the telematic services of the ZMS are

very interesting but they have not been used extensively since they were ready for use a bit late and the teachers cared more on the carrying out the experimentation projects they scheduled.

Parents' involvement in the project was almost nonexistent apart from knowing that their children were participating in a European Project.

- **Views from the tutors** Online tutors have accompanied the online training as well as the experimentation or classroom sessions. From their interaction with the teachers participating their most relevant concerns are:

- Teachers sometimes made unrealistic working plans when ICT are involved. They also realise the computer lab sessions with their pupils need to be carefully prepared since they are not used to managing the time in the new teaching environment.

- When it comes to judging what the pupils have learned they are a bit doubtful since they have covered less contents than in standard teaching and in many occasions the evaluation is carried out with traditional tests or exams, therefore in order to digital contents to make an impact in teaching they should integrate evaluation that could help teachers to envision ways of evaluating their pupils. This will also prevent teachers and educators from a common mistake: to measure learning of a group using ICT against another group not using them with traditional exams that do not take into account ICT nor the subsidiary learning that takes place by its very use.

- The previous experience with ICT has made a difference among the participant teachers but once the classroom sessions started all teachers felt very rewarded no matter what difficulties they had experienced to get to that point.

3.3.4.6 Conclusions: SunRay thin client model vs. windows desktop

One of the findings expected from the coexistence, in the three Spanish schools, of SUN and Windows classrooms, receiving remote service from the ZMS, has been but partially reached. It was researched the behaviour of teachers sharing different interfaces and client applications in the same school. Teachers assigned to classrooms with SUN thin client technology in Spain had to use a different environment in the teachers' room, their office, the computer at home (Windows) and in the Computer classroom (SUN). This behaviour should give an idea of their flexibility in accepting both technologies in the same working environment, with the corresponding drawbacks or advantages. The result of the research is detailed in the report of the pilots 5.1-3 and 5.3-3, but here we must describe the actual conditions of the experimentation. It is important to remark that the average ICT expertise of most teachers of these three schools was medium-low.

In the three schools in Spain, at the beginning of the experimentation the school heads tried to use only the SUN classroom for the OASIS experimentation. The project insisted on the convenience for the research to have in the experimentation two classrooms with different technologies. This unexpected need to negotiate with the schools produced a certain delay in the availability of the technological services in some of the Windows classrooms.

In some aspects the reality was more complex than projected. One of the administrators and coordinator of a school, besides participating in the configuration of both classrooms, SUN and Windows, had always been a Mac user, not accustomed to Windows environments. He began acting as administrator and coordinator of his school, besides classroom teacher in Mathematics and he finished his tasks in the project as administrator and coordinator. On the side of the classroom teachers, though there had been initially a distribution of subject matters, some for the Windows and some for the SUN classroom, several teachers shared both classrooms. The main criterion was first classroom ready first to use. In some cases, teachers of English used the Windows classroom to access the contents facilitated by the Ministry (MALTED), and the SUN classroom for communication

services, to contact with other schools in collaborative learning projects. Only one or two extra sessions of training in the SUN interface and file system were necessary for teachers and pupils.

The feared reluctance of "Windows" users to accept to work with pupils in the SUN classroom did not turn up. Pupils who have had to work alternatively with both technologies do not remark any extra difficulty in it. The transparency of the technology standard is reflected in the classroom teachers' final reports, in which very rarely comments on the technology used can be found. The emphasis is always in the services and the pedagogy they support.

3.3.5 The conclusions of the staff's reports

One of the outcomes to outline in this pilot is the collection of experimentation plans drafted (61 received and validated by tutors) by teachers and the final reports (34 received by 25 May). What can be extracted is the quality of many, in which we can see the teaching experience of most participants. It has already been stated that a 60% of the teachers selected for the pilot had more than 15 years of teaching experience. Most of the remarks observed in the reports read match those collected by the pedagogical staff in their visits to the schools during the experimentation. New issues are:

- The detailed evaluation activities carried out by the teachers with their pupils. Few have put the main weight of the evaluation results in a written exam. Rather they have used the continuous observation of the pupils' behaviour in the group work, the results of exercises with the computer, their participation in the communication activities
- The results of the pupils' assessments, with different impressions on their teachers, depending on the education level (age) and their previous qualification level.
- The satisfaction of the pupils with the experience: It is almost unanimous the satisfaction on the collaborative work, but not that much the satisfaction with the use of the technology to learn. A part of the pupils, bigger percentage among the best pupils and among the older, are not sure that they learn better with computers. The best considered technological tools by pupils are the search of information on the Internet and the use of e-mail.
- The increased implication/interest of families in the experimentation. Teachers think that this implication of families has been one of the tasks that they have not had the time to accomplish.
- The different pace in the advance through the curriculum, but not as different as many had thought at the beginning.
- Using the thin client technology provided by Sun has not been complicated. The front end provided by the device was not seen as an obstacle, as most usual applications were available in both a traditional PC environment and with the SunRay technology.
- The thin clients were not used to their full extent, with the ability to switch the user sessions instantaneously.
- From service standpoint, the users have not felt any restriction linked to the thin client technology, and the response times and service levels were identical if not better than traditional PCs.
- Mainly the ICT coordinators have used the ZMS basic features, as an online support resource. This shows how much isolated ICT coordinators are in need of these centralised support services.
- The school server has not been judged or evaluated by the reports, and this is actually a very good sign that all underlying services provided by the Cobalt Qube have been provided seamlessly and without a noticeable problem. No performance or service

interruption was noticed. This underlying technology is probably providing the widest range of services of the whole Oasis architecture to all the Oasis project users, and this without any comment or issue. It is simply there!

The use of the communication tools, provided that they have been available well advanced the experimentation period, has been reduced. Many think that much more pedagogical benefit can be taken out of their use with a longer period of experimentation.

A general remark presented in the reports is the need of support from the educational authorities to maintain the school technological services. There is a general agreement among the teachers that the methodology proposed has the potentiality to improve the learning processes. OASIS administrators and teachers strongly require the schools to have allocated the necessary resources for the maintenance of the services. Probably a main outcome of this study is the call to the education authorities to balance the technology budgets, devoting a part of the purchase cost to a better maintenance. This matches one of the issues discussed in the EC DGEAC work group of recommendations for the Programme Education and Training 2010. It has been proposed there to issue an indicator to measure, more than the computers available in the school, the hours of computer actually operational in the week. Already the indicators obtained in the Eurobarometers study how many schools have email for teachers and for pupils, how many have an intranet, and a school portal. It is still necessary the research on how effectively are the technological services available for teachers without a certain technological background.

3.3.6 Issues emanating from the implementation

The following section contains the most remarkable conclusions from school reports, about the technology used to carry out Oasis project, that is, the School Server, the thin client technology (Sun Ray), and the support from ZMS.

3.3.6.1 The thin client technology, the SunRay

Although the thin client technology was never seen before by most teachers and ICT coordinators, after losing the “fear to the unknown”, they report no problem in using it, as the desktop and applications installed are similar to the windows style.
What makes Sun Rays attractive for schools is the reduction in management time. There is an amount of time to spend by the ICT staff in managing 10 PC's and keeping them updated to protect against viruses.
Translated to SunRay thin client technology there is only one computer to manage and no known viruses for Unix operating systems. Related to management, there can be a cost reduction in terms of software licensing, as a packet of software is installed once in the server, but used concurrently by the Sun Ray appliances. Schools do not report these advantages as they are still learning how to administer a Unix server.
Most teachers’ comments are about the delay in the scheduled program, but the system needed a fine-tuning.
An initial low system response time was detected when using Java Applets and Flash animations, included in educational software like “Descartes” or “Newton” provided by MECD. After some study, the Sun Ray server was upgraded with another CPU and 1 GB more of memory to assure the quality of service under such software.
No further comments on serviceability and availability were encountered.

One of the UK pilot schools achieved a stunning result, by implementing themselves the configurations (See connection guide in annexes). While we had scheduled some training, the school did not want to wait until the training is given. The users have received a quick connection guide, and after a very short while, all pupils were able to take advantage of the SunRay thin client technology.

Lastly, it was also noted that because there are no moving parts in a SunRay, a classroom is much quieter than a traditional PC classroom. The sound level is very low, and no fan noise is there to disturb the users.

3.3.6.2 The School server, serving schools with web services

The School Server (Sun Cobalt Qube 3) is the core of the Oasis project technology. Although the end user does not directly use it, it provides many important background services in terms of communication and security.

It acts as a gateway and offers security protection against e-mail viruses and intrusive attacks to the school network. There is no report or comment from any school, about any virus or security breach, detected during the experimentation period.

The use of Open Source software, like the Linux Operating System, which has a low TCO, is stable, reliable and extremely powerful. It allows the School Server to demonstrate that it can handle all the services required efficiently, and it has not shown any disruption of service or server downtime.

Teachers have not directly evaluated the School Server, which means that the services were running transparently for them without any problem.
Linux and the services offered by the School Server, have a GPL license (General Public License, free), that together with its low cost and the amount of services it holds (cost / effectiveness rate), makes possible an important reduction in the Total Cost of Ownership, typical in Linux/Unix systems.
One feature that most ICT staff find valuable is the web interface to manage the Sun Cobalt server, as is intuitive, easy, and no Linux knowledge is required to configure a School Server with a few clicks.

3.3.6.3 The School server connected to the ZMS

Although reports don't show it, because teachers were not aware of the technological architecture they were using, there is a “background” work in terms of managing the School Server, that frees ICT coordinators from keeping the School Server updated with the latest packages, monitor services, etc.

What most teachers agree, is that the support given by the ZMS was necessary, and helped to solve the numerous initial problems. They also complained about too many new technologies with little teacher training, and felt they didn't have totally under control the technical aspects when starting to work with students.
The training mentioned does not refer to basic computer literacy, but more specifically about certain tools and applications, and in particular about the educational use that can be made of them.

As a general rule, schools are grateful for what the ZMS did to help them, and hope the support will last next year.

Also to be mentioned, the ZMS was operated in the local language of the school (i.e. Spanish and English) and this was appreciated by the school IT coordinators.

3.3.6.4 Overall conclusion

The use of Open Source software and well-known standards assures the software portability between servers and clients, and also the compatibility with different hardware platforms. As an example, the technological architecture implemented showed to be flexible when adapting to pre-existing school infrastructure and finding solutions for the inherent environment, like the web filter to avoid access to websites with harmful content.

What must be also mentioned is the big amount of software installed, and the total cost of software licensing, while in other operating systems could be rather high, in the frame of Oasis project is zero.

Oasis project has contributed to the effort of bringing Open Source software closer to educational community, which is a key to make sure that the use of Open Source systems and standard-based technologies will grow in the near future.

The innovative features created by the association on the School server and the Zone Management server (ZMS) are the biggest and best kept secret of the project. The fact that a technology is being used transparently by users, without any complaint, and with no reported serviceability and availability is probably the greatest outcome of this technical work package.
We sincerely hope that despite the fact that this technology would now need to be upgraded, we definitely think that the WP4 has delivered a breakthrough in educational technology, allowing users to benefit transparently of many collaborative services while decreasing the complexity and time consuming tasks of setting and managing all these services.

3.4 Pilot 4: University of Grenoble

3.4.1 Pilot objectives and their relation to the global objectives

The pilot 4 organised and managed by the University of Grenoble aimed to integrate and validate the proposed pedagogical models to the technological services that were offered either by the project or by external providers to the project. Objectives of the pilot were the following:

Safety

With the SLIS server and its development inside the OASIS framework, the pilot 4 aimed to re-evaluate the degree of security both in the pedagogical and organisational practices. This could be also considered as a continuation of another EU-funded project that the partner participated called Dot.Safe.

Metadata

Binding WP 1.2 and WP 2 together to combine their added-value to serve better teachers in their pedagogical processes in terms of integrated services: both of the pedagogical models and the common metadata models have been integrated in a unique form allowing to them to built and manage any project, local or international, alone or twin. Based on the principle of 1 metadata = 1 indicator, and according with the NAME document principles, the same tool would be able to provide a real time analyser of global/local pedagogical developments through Europe to central administrations.

3.4.2 Main features of the pilot

The main features of the pilot 4 comprises of the pedagogical integration with the ICTs, information and staff training, co-operation with the central administration as well as the local communities with the support of the committed academic projects which are the followings: electronic portfolio, LOG, SLIS. The details of these solutions are available in the chapter 2.1.2.

3.4.2.1 Training

Teachers and administrators training was conducted between May-June 2003, whereas the SLIS B2I module in September/October 2003.

The teacher training focused on the content and the platform:

- Practical use,
- Pedagogical development possibilities,
- How to create and manage documents inside the platform,
- How to create groups,
- How to organise exchanges between groups inside and outside the platform,
- How to benefit of workflow processing.

The administrator (experts/engineers) training focused on the following:

- Learning of platform server and its link with SLIS.

3.4.2.2 Tasks performed

- Migration of the LOG proprietary platform to the Cartable Electronique that is of an open architecture,

- Definition of the common data framework for Pilot Project Management including WP 1.2 and WP 2 added-values,
- Study of the implementation of Descartes and Malted applications even though the translation in the French version is not realised.

Pilot projects and the agenda for the experimentation:

- September to November, for each project:
- State_Of_The_Art (if done do better, if not create),
- Brainstorming (what, what for and planning),
- Traditional_Learning (definition of necessary part of),
- Collaborative_Work (idem),
- Negotiated_Agreement (if case).
- November to April:
- Realisation of activities planned,
- Assessment_Group (for final report).
- Description of the experimentation.

The experimentation consists to improve:

- Qualitative added-value of the SLIS + WP 1.2 + WP 2 pedagogical integration in terms of educational, social and economic developments (satisfaction for pupils and their parents, teachers and agents, central administration and local authorities, industrial partners and editors),
- Continuity of service from primary to secondary level and further with university (in case of Cartable Electronique which has been already implemented in the University)
- Continuity of service from classical classroom to specialised one such as hospitalised pupils accessing learning opportunities via videoconference, etc.
- Concerning the OASIS approach combining interoperability and data re-utilisation (WP 1.2 combined with WP2 inside WP 5.4). The possibility for evaluation to thus becomes strictly contemporary to the production at all its stages (instead of succeeding it and to be separate from it).

Subject areas that the pilot focused on:

- All the 12 classical subjects for both primary and secondary schools
- The social/European citizenship area (through European debates for example),
- The B2i (for Brevet informatique et internet): our national declination of ECDL (European Computer Driving License) is now integrated to the SLIS, so that any project can be matched with its mandatory skills, making easier the pedagogical integration of this basic for any teacher or team of teachers.
- Interdisciplinarity: According with the pedagogical models provided by the OASIS project team, and because interdisciplinarity is the basis of any European citizenship, we have specially insisted on the opportunity to share knowledge, and to open up activities on the society surrounding schools.

Collaborative projects comprised the following methods:

In the same classroom (all three: CyberEcoles, Cartable électronique, LOG)
In the same school (CyberEcoles, Cartable électronique)
In the same locality (CyberEcoles in Grenoble)
In the same region (Cartable électronique in two departments Isère and Savoie)
In the same country (LOG with other schools with similar project)
In other countries (all three in language teaching, LOG specially WKTO6)

Pilot 4 reaches out of the school boundaries:
Implication of national and regional Education authorities, of the school head, school council, school staff in the project of the
Participation of OASIS representatives in the inside of French Ministry committees that are dedicated to interoperability and security in primary and secondary education.
Implication and funding of our local authorities (Conseils généraux et Communes).

3.4.3 Pilot participants

Number of schools: **31**

That represents 415 classes for 8600 pupils in absolute, but for the evaluation = 50 Classes for approximately 1250 pupils.

Detailed by level and platform:

- 10 primary schools called “CyberEcoles”
- 10 lower-secondary called “Colleges Cartable Electronique”
- 11 upper-secondary called “LOG” (Lycée Ouvert de Grenoble)

Number of teachers (average): 1 team of 12 teachers involved by school (to insure coherence for at less one level),

Ratio pupils per teacher (average): 1 teacher for 12 pupils.

Geographic distribution: strictly academic (5 French departments), except national or international projects involved by the "Cartable Electronique" practices.

The “CyberEcoles” in more details:

- Size of the schools/classrooms: 120 Classes and 2400 Pupils
- Number of administrators/ICT coordinators: 1 for 10 schools
- Number of pupils/classroom: 20/1
- Educational levels/ages of the pupils: age area = 8-10th

The “Collèges Cartable Electronique” in more details:

- Size of the schools/classrooms: 26 Classes of 25 Pupils (on total of 225 Classes and 5296 Pupils)

[6]LOG project in secondary school L'Oiselet : http://www.ac-grenoble.fr/wkto/

- Number of administrators/ICT coordinators: 1 administrator/ICT coordinator by school, 1 pedagogical coordinator, and ½ local authority employment for technical maintenance.
- Number of pupils/classroom: 30/1
- Educational levels/ages of the pupils: 12-14th

The "LOG" in more details:

- Size of the schools/classrooms: 11 LOG schools including three in hospital and 920 Pupils (on total of 70 Classes of 30 Pupils).
- Number of administrators/ICT coordinators: 1 administrator only for the whole LOG(s), but each tutor has the competences of a ICT coordinator.
- Number of pupils/classroom: 10/1 (for 8 LOG) 30/1 (for 3 others)
- Educational levels/ages of the pupils: 16-18th
- The list of the upper secondary schools "LOG" is provided in the deliverable 5.4.-3m in the annex 4.

3.4.3.1 Procedure for the selection of the pilot schools:

- The whole sample is already familiar with the SLIS server.
- The whole sample covers the French educational target areas.
- In pedagogical and citizenship or social terms, the whole sample tries to cover the hole pedagogical target developments
- Teacher training, existence of local ICT coordinators and central network administrators.

Conditions for the participation in the pilot:

- Equipment for CyberEcole: minimum of 4 computers at the bottom of the dedicated classroom to insure research or solving problems each time it is necessary, 1 SLIS server.
- Exception: for 1 CyberSchool, + 1 Classmobile + Rich Media tools provided both by Apple and the CARMI Pédagogie.
- Equipment for cartable électronique: 1 ou 2 dedicated classroom and 1 laptop by each pupil and 1 by each teacher and 1 by each management staff (= 30 to 40 laptop/classes) for dedicated project activities, 1 SLIS, 1 "cartable électronique" plateform.
- Equipment for LOG: 1 laptop by pupils enrolled, SLIS, collaborative learning plateform (Lotus Learning Space or "cartable électronique »).

3.4.4 Overview of local evaluation, success and failure factors

SLIM organises, at a regional level, the information systems useful for the deployment, the maintenance, the safety and the supervision of SLIS servers, and allows the delegation of tasks to administrators of various levels and the organization of the park of servers in managed groups and in a decentralised way. SLIM accompanies the evolutions of the SLIS functionalities and takes into account the technological changes, currently the evolution of the connection of the school establishments towards faster connections.

One of the significant points to consider in articulation SLIS/SLIM is the way in which is carried out the allocation of the functions necessary for the correct operation of the infrastructures to facilitate the uses. It is articulated around a separation between two concepts concerning the administration of the services:

- The functional administration, which relates to the educational and organisational aspects on the school level, is under the responsibility of each school. It can be implemented either by one of its personnel, the local ICT organiser in general, or to delegate it to an outside contributor depending the needs and local requirements.
- The technical administration, which relates to the system, its evolution, and safety is centralised, in general at the academic level currently. This aspect is treated through SLIM by several teams.
- This dichotomy is logical and effective and it constitutes a factor of success in the case of significant sized deployments. This organisation presents a very interesting economical aspect.
- Moreover, the managerial aspect is also present, because all the useful data are accessible and can quickly be provided according to the needs. For sophisticated needs, advanced SQL requests can be done via SLIM. The concept SLIS / SLIM is based on the same principle as the organisation School Server / Zone Management Server tested in Spain (cf WP 4.2).

3.4.4.1 SLIS and interoperability

The interoperability is recognised in France as in Europe as an essential condition for the success and penetration of the virtual working environments. With regard to SLIS, this topic is present since always, registered in fact in the S2i2e national French reference frame, quote the following aspects:

- Compatibility with the principal operating systems of the stations and the software of communication, in spite of difficulties during the evolutions of versions of operating systems, which requires permanent efforts from the development team, so the teaching users can see their right to the teaching choice then best respected,
- Permanent concern for respect of standards (RFC),
- LDAP directory present in SLIS: it is in conformity with the RFC 23077 what ensures the possibility of interoperability between several servers in the case or the functions are distributed. This co-operation in particular was studied and implemented by a common work with other teams proposing of the tools bringing of other functions, particularly quote the SambaEdu8 project, which proposes a file server for the educational uses already well deployed. SambaEdu is developed by the CRDP of Caen. The “electronic portfolio” also uses this directory, and in this case, it is made available to software managing the schooling, in particular for the publication towards the families of the pupil’s report card, the service being proposed by commercial companies.

We could note that, in the current phase, interoperability requires a constant work, each realisation with a new partner requires an effort of co-operation which is not always obvious.

[7]RFC 2307 - An Approach for Using LDAP as a Network Information Service - http://www.faqs.org/rfcs/rfc2307.html
[8]http://wawadeb.crdp.ac-caen.fr/se3/

In this field the most important remains to be achieved, i.e. to carry out interoperability on the level of the teaching documents and pedagogical applications. The solution is known, it is based on XML technologies, this subject being well treated in the OASIS project. With regards to SLIS, in order to develop competences of the academic teams on XML, it was decided to use it for the drafting of documentation, again in collaboration with the SambaEdu team.

3.4.4.2 SLIS and safety

For educational teams: This topic is perceived of particular significance, with regards to the responsibilities for the various actors of the educational teams : teachers, heads of schools, ICT administrators of the services in middle and high schools (AIPRT) and in primary schools (IAI). In addition, the reactivity of the device for updates makes it possible to very quickly distribute the corrective measures of safety, and this without intervention of the ICT administrators of the sites.

A good safety, in all its aspects is a factor essential to the dissemination of uses ICT for teaching, so that the professor can devote himself entirely to pedagogy and the pupils.

- European project .SAFE

The awareness raining of the teachers to these problems was the central topic of the European project called .SAFE (dot safe)[9].

- National project on safety

SLIS is in accordance with the recommendations of the national project[12], while proposing to the teaching staffs and to the school heads, the tools for control allowing them to exert their responsibilities with respect to the children and of the families.

- For pupils

All the aspects of the filtering of the sites, beyond the simple filtering of Internet sites, can be used within the framework of B2ì and with reflection about citizenship. Beyond this specific aspect of the filtering of the sites, the development team of SLIS grants much importance about safety.

3.4.4.3 SLIS and collaborative education

- B2i and citizenship

In addition to the fact that SLIS aims to place at the disposal of the services of communication thus providing modern tools for varied activities of teaching, this project can intervene more directly in pedagogy within the framework of B2i (Brevet informatique et internet, IT and Internet Certificate)10, in particular on the aspect "training of the future citizen “to the reasoned uses of communication and information technologies.

The awareness raising of the teachers to the problem of safety with respect to Internet within the educational framework was the subject of ".SAFE" project, with in particular the edition of the DVD "Internet citizen and Education »11.

During OASIS, the evolution of the teaching practices towards more autonomy, more communication and more co-operation, especially in the three examined projects (CyberEcoles, electronic portfolio and LOG), was supported by the good level of safety brought by SLIS and SLIM.

[9] http://dotsafe.eun.org
[10] http://www.educnet.education.fr/eng/plan/b2i.htm (in English)
[11] .SAFE : Safer Awareness For E-learning, European Schoolnet, DGIS N°27266

Pupils' Autonomy

Moreover, "B2iSLIS"is a service of management allowing the follow-up of the items acquired by the pupils, their validation by the teachers and the delivery of the certificate is available like modulates complementary to SLIS. This service on line takes part in the acquisition of the autonomy of the pupils in the ICT field.

3.5 Pilot 5: European Schoolnet

3.5.1 Pilot objectives and their relation to the global objectives

The OASIS pilot 5.5 was organised by European Schoolnet (EUN) to appraise teachers' responses to the pedagogical approaches that have been developed and adapted as part of the OASIS project by the University of Amsterdam.

The pilot took place in the European context, where twenty-seven participants from ten different European countries participated in the validation of a number of pedagogical approaches and pedagogical scenarios that were developed within the OASIS project. The OASIS project focus is to provide cost-efficient and enhanced ICT services for schools, while on a broader plane, the project addresses the issues of a fast, industrialised society lacking the community feeling and the socialisation process. The latter is deemed important for educating children, thus part of pedagogical scenarios that are introduced in details in the deliverable 1.2 (Del 1.2).

The Oasis pedagogical approaches are specifically designed to promote teaching techniques, which are rooted in socio-constructivist and collaborative theories of learning, utilising the tools of modern technology. Hence, Computer Supported Collaborative Learning (CSCL), Jigsaw, Progressive Inquiry Model (PIM) for collaborative knowledge building, and Problem Based Learning were among approaches that contributed greatly to Oasis pedagogical scenario. The idea behind these approaches is to support pupils' collaborative knowledge building with the use of ICT, as well as enable teachers to integrate the tools of technology into a style of pedagogy based on developing pupils as independent learners.

Of the various pedagogical approaches available in the deliverable 1.2, the pilot 5.5 organised by European Schoolnet focused mostly on the Progressive Inquiry Model (PIM) and the Jigsaw method. This was due the fact that the training was provided only for a period of two days, which limited the possibilities to train teachers for a wider variety of pedagogical approaches. Secondly, the analysis made of teachers' competencies prior to the training showed that some of the pedagogical approaches mentioned in the deliverable 1.2 were also widely used by the participants. When asked," In what way are ICT used?" (see the figure "How ICT are used?" below), 16/25 respondents mentioned using Project Based Learning and Collaborative learning approaches when using ICT

3.5.2 Main features of the pilot

3.5.2.1 Setting-up of Pedagogical Projects

The idea was that each pilot participant would design their own project utilising the pedagogical approach that they felt comfortable with after the training session. The goal was that each teacher would adapt the pedagogical project to their own school environment and culture, and run the project in their schools in co-operation either with some teachers in their own school or with some other local schools. Hence, each pilot project, although utilising the same pedagogical approach, took very different form of implementation.

3.5.2.2 Teachers Training

The timeline for the pilot 5.5 was 6 months starting late September 2003. In late September 2003, the participants were invited to take part in a training workshop in Brussels for 2 days. The goal of this pilot was to introduce new pedagogical approaches to participants. As for the teacher-training workshop, the goals are the following:

- To familiarise the teachers with the overall Oasis project
- To train teachers to use the chosen pedagogical methods
- To make an individual planning for a project that they would run in their schools during the pilot, i.e. between September and February 2004.

Teachers were free to choose the theme of their project according to their own preference and suitability to lessons that they do with students, provided it fulfilled the core elements involved in the CSCL models; collaboration between pupils; use of technology for research, presentation and communication; involvement of the school and local community.

During this workshop the main focus was to demonstrate how teachers could use the pedagogical models such as Progressive Inquiry Model (PIM), and Jigsaw in the context of the theme chosen, and how the use of ICT could support this goal. Issues relating to connecting with people around schools were also discussed; for example, how one could involve parents, experts, elderly people of the community, some commerce or businesses from the town etc. in an educational project.

It was emphasised that dissolving the strict boundaries of schools in their move outwards towards local and regional communities, and other schools in Oasis-pilot and beyond is one of the main tendency of the pedagogical approaches suggested for this Pilot.

The methods of data collection were discussed and explained and each participant had a form to fill in describing the pilot project clearly and in a uniform way. This form included information about the number of students and teachers involved in the pilot, as well as information about the subject and outcomes of the pilot project.[12]

3.5.2.3 Pedagogical Support and Reflective Chatting

A special aspect in the pilot 5.5 was the pedagogical support that is offered to teachers during the pilot. The idea was to support teachers all the way through their pilot and specially be there to help them to cope with some of the emerging issues during the start of the pilot when they introduced new pedagogical methods in class and when they encountered moments of disbelief in their pedagogical practices due to new ways of teaching.

The Reflective Chatting was designed for this purpose. It was held five times in the interval of two weeks starting from November when most of the teachers were supposed to start their pilots. In the beginning of each Reflective Chat an issue was introduced, and teachers were supposed to reflect on it in asynchronous manner during the week or even later, since each thread is always available for continuation.

The Reflective Chatting took place in a virtual collaborative environment called FLE3 (http://fle.eun.org/PuntoEdu) that was set up for pilot participants to use during the pilot for their internal communication.

Each chat started with an issue that project organisers came up with, each issue intended to reflect some of the possible bottlenecks of the implementation of projects that teachers might encounter.

The broad issues of the Reflective Chatting were based on the following topics:

[12] An example of a pilot project form is available in the appendix II.

- How to implement Progressive Inquiry Model
- How to introduce PIM to pupils
- How to make the school-community link flourish
- Observation on your students
- Observations on yourself
- Free Comment

Reflective Notes
Each participant was asked to write personal Reflective Notes during the pilot. Participants could write these notes in their own language. In the end of the pilot they are to provide a summary of their notes in English to pilot organisers.

The themes for Reflective Notes cover the following areas:
- Observation about student behaviour and motivation
- Observation on participants own thoughts, ideas and feelings about the process,
- Motivation ups-and-downs.
- To document the moments of fun, frustration enjoyment and learning.
- Issues that arise during the process, participant's reaction to the issue/ reflection on participant's own reaction.
- What were successful aspects of the activity for you from pedagogical point of view?
- What were successful aspects of the activity for you from technical point of view? Why?
- What were less successful or difficult aspects of the activity for you from pedagogical point of view? What were less successful or difficult aspects of the activity for you from technical point of view? Why?
- How would you like the process to proceed? How have you thought to guide the process further? Why?
- What kind of questions you would like to have answered? What kind of issues you are wondering about at the moment?

3.5.2.4 Technological Solutions
In the pilot 5.5 the participating teachers and schools were asked to use the technology that they are familiar with in their everyday teaching to support the implementation of the pedagogical project in their school. The intention was not to validate the use of some given technology or software application, but the pedagogical model and how its implementation was helped or hindered by the use of technology.

As the geographical spread of the pilot schools covered the whole of Europe, it can be stated that the variety of technical set-ups in schools was diverse. There were no formal technical pre-standards set for the admission to the pilot, but their own assessment of suitability and willingness to participate.

About half of the participants desired to use the learning environments and other educational software that they were comfortable in using for the implementation of the pilot. This consisted of a variety of means such as virtual learning platforms, mindmapping tools, communication tools like e-mailing, chats, forums, creating Power Point Presentations, web journals, and websites, using digital video, scanners and digital cameras, and, of course, using Internet for searches.

The focus and the scope of the pilot 5.5 was on training to use the pedagogical approaches that can be applied independently of any software applications. However, during the training session for the participating teachers, the use of some educational applications was demonstrated and they were also offered to be used by teachers whenever desired. European Schoolnet provided two collaborative learning platforms to be used by teachers

in the pilot, one being the EUN Community, a EUN proprietary solution offered for all the teachers in Europe, and the other one FLE3, a collaborative knowledge building environment that was also used in the pilot for internal training purposes. Some of the participants opted for these solutions, either because they didn't have better solutions in hand at home, or that they saw this as a good opportunity to try these new tools in their teaching. It is good to note that the VWE, the virtual working environment developed in the OASIS project, wasn't chosen as an option at the beginning of the pilot, as it was considered not to be mature enough to be implemented within the objectives of this pilot.

3.5.3 Pilot participants

Schools were selected following an open call for participation between the European Network of Innovative Schools (ENIS), and other school networks known to the EUN.[13] There were initially 26 schools from 9 countries, and 1 extra school from Spain joined as a 'virtual 'participant at a slightly later date.

- **The Northern dimension**: Finland and Sweden represent 6 schools
- **The Southern dimension**: Spain, Portugal and Italy represent 9 schools
- **The Central- Eastern dimension**: Hungary, Lithuania and Romania represent 6 schools
- **The Western dimension**: UK and Belgium 5 schools

In terms of technical provision there was also a varied picture. It may be said that the number of computers was not necessarily relative to the size of school, with quite varied computer/student ratios, clustering between 10 – 100 computers which the larger schools mainly in the 31 – 60 range.
The average calculated in a very gross scale was 16 pupils per computer. However, there was a big variety ranging from the lowest ratio being 3.6 pupils per computer and the highest ratio 34.4.

In terms of usage of virtual learning environments (VLEs), less than half of the participating schools used virtual learning environments (VLE) or any web-based collaborative platform. 10 schools out of 26 participating schools listed a VLE that is used in their school.

Profile of Participants

The pilot comprised of 27 participating individuals, teachers, school principals and ICT specialist, ICT co-ordinators and administrators. Initially there were 26 participants directly involved and later an additional teacher from Spain requested to join the pilot as a 'virtual' participant.

Most of teachers are in the science, mathematics, and languages subject areas, as well as teachers in informatics and ICT. Out of the 27 participants most are working at secondary and primary level. Some of the participating schools are combined primary-secondary, whereas some have additionally pre-school and special education. Two of the participants are head masters and one of them is an ICT co-ordinator of a network of schools. Some of the teachers also have experience in the adult education, special education and in-service training sectors.

The level of experience in teaching was high with the majority of the teachers' experienced ICT user in educational context; more than half (64%) of them have been using ICT for 6 or more years in an educational context. However, there is a fairly large gap, 5 teachers (20%) say they have been using ICT only for less than a year in education, whereas 4 (16%) are about average users with about 4 years of experience.

[13] See appendix IV for description of criteria for selection.

3.5.4 Overview of local evaluation, success and failure factors

In the OASIS pilot 5.5, where the focus was on the pedagogical approach and how the ICT can support the pedagogy, the evaluation results suggest that the shift was in favour of the pedagogy. Evaluators suggest that the intensive 2-day training in the use of the given pedagogical model (Progressive Inquiry Model and Jigsaw-model) gave a solid starting point for teachers to begin experimenting with a new pedagogical practice. To ensure the continuity of the implementation of the given pedagogical approach, the on-going pedagogical support that was given in a form of asynchronous chat through the pilot period, was an important factor. It helped to keep teachers focused on the pedagogy and helped them to stabilise the shift towards the new practice. The personal motivation among the OASIS pilot teachers was very high, which supposedly contributed to the more favourable outcome.

Furthermore, when implementing new pedagogical approaches time invested in training plays an important role; the new methods need time to mature as well as take personal forms and ways. As the researchers Hakkarainen, Lonka and Lipponen (2004) observe in their latest book, the Progressive Inquiry Model could be understood as a pedagogical way of perceiving learning rather than as a strict model to follow by step-by-step. In addition, they emphasise that it is important to understand the underlying philosophy, which can lead to a new way of learning. This also seemed to be the case within the pilot participants; the learning process is long and the learning curve fairly steep, the pilot was in many cases perceived as a starting point for a new personal learning experience. Thus, the on-going pedagogical support and network fostering can be deemed as important for the long-term adoption of pedagogical practices.

The two points, face-to-face training and the on-going virtual support seemed to be of key importance for the success of introducing a new pedagogical practice and having it “rooted” in the teaching culture (of course in the pilot of only about five months it is hard to evaluate the real long term results). Although 75% of the participants estimated afterwards that they got enough pedagogical training, it may be concluded that a longer introduction and planning phase could be beneficial for implementing new pedagogical projects in schools. Also, induction to the use of collaborative platforms, in this case, the FLE3, and the EUN community platform, and their different underlying pedagogical approaches is needed in order to build absolute confidence in the users as to their implementation. It would also be beneficial to separate the training of the pedagogical approach and a software application of it, as doing both simultaneously, in some cases, was more confusing than beneficial to some of the participants. The same could also be recommended for pupils.

The importance of the teachers' community is emphasised when it comes to the supportive actions and scaffolding of teachers when they doubt their professional skills and identity. This often happens when a new pedagogical practice is undertaken, and when some “teething” problems appear. The fact that the participants of this pilot were able to form a group, a loose community to identify themselves as OASIS teachers, contributed enormously to the success of the wanted pedagogical shift. This community feeling combined with the bi-monthly reflective chatting allowed them to ask questions related to difficulties that they experienced and, most importantly, to read about the similar experiences that the other participants had. Teachers reported this sharing of experiences that took place during about two months period, was an important and valuable experience for them.

The use of reflective chat within the context of this pilot has provided us with many fascinating comments from the teachers involved in the process. We have observed that

they have used the platform to variously describe, share, mentor, organise, muse and reflect on their approaches to teaching and on their own development as teachers.

Later in focus interviews, it became clear that all the participants (both active and passive ones) who took part in the chat sessions regularly or occasionally found it helpful and somewhat relieving to read about other experiences that were similar to ones that they were going through. Also, some stated that in the course of the pilot, they thought that only they were having these difficulties, and they became doubtful about their skills and commitment to the pilot. But when reading about other people having the same feelings, it became easier to bear and also, some of the suggestions given to a specific problem of some else's were found useful to many. Thus, the community support of other teachers is of an enormous importance in building up pedagogical professional skills and, in larger terms, to become a self-reflective professional. Also instruments, such as writing personal reflective notes throughout the pilot period, can be recommended to support the professional growth.

The importance of group support and dynamics was recognised in the pilot, although not enough time was allocated to study it in more details and depth. In many studies it is recognised that the community of teachers can have a very positive impact, but building it up is very difficult. In the case of OASIS pilot, only less than half of the teachers were contributing to the reflective chat, whereas clearly more than half were passive followers of the chat and read many of the contributions. Also, many teachers reported difficulties in involving their colleagues in this type of work and questions rose on how to motivate pupils after the initial enthusiasm had faded, when they are already familiar with the approaches and it is time to carry out the labour intensive part of their study.

As the demand for learning to become more learner centred, it should be important to mention that a great motivator for OASIS teachers was what they saw happening in their pupils and students. Most of them reported very positive reactions in the way students behaved during the lessons were new pedagogical approaches were used, they were highly motivated to work once they had become familiar with the new way proposed by the teacher. It is clear that the involvement of the active members of the group has been a positive and enriching, if sometimes also a frustrating experience for them.

What is noteworthy in this pilot is that some participating teachers expressed that although the first implementation of the pedagogical approach was not that successful; they recognise that it is a start of the learning experience for them, too, to master the given pedagogical practice better.

It was also observed that to successfully implement the pedagogies introduced in the project it was not indispensable to use ICT but that using ICT added a richness of possibility and expansion of principal that would not be possible without it.

A teacher from Portugal wrote: *"Although PIM can be achieved without the support of ICT it's for me very clear that ICT provides countless possibilities transforming one demanding task in a simple operation adding quality and clarity to the learning process."*
Another Portuguese teacher commented: *"The most critical aspect to develop PIM is not Technical, but pedagogical. There was a wide range of available tools to use. Any communication platform would have done the job."*

Importance of national curriculum and school educational culture (management)
If one takes the comments classified under the Cultural/Social dimension of the POETC framework, together with some of the postings referring to the way in which national

curriculum and school timetabling can really impose a barrier to the implementation of these pedagogical approaches and the adoption of ICT enhanced collaborative knowledge building to the daily practice of teachers, it may be argued that the culture of both the school and the national educational policy plays a significant role. For example national policy with regard to curriculum, assessment has a major impact on teacher's perceptions of what they can do or not do within their teaching, as well as influencing the attitude of students, (and their parents) particularly in the latter stages of upper secondary education. Since assessment methodology plays such an enormous role in the judging the success of the delivery of the educational service, it may be said that there is an urgent need to find new ways of assessing the development and achievement of students under the CSCL and project-based approach to pedagogy.

Indeed, some European countries have already perceived this and have integrated this thinking into the national strategic plans. For example Finland in their most recent National Plan '*Education, Training and Research in the Information Society. A national Strategy for 2000-2004'* and now the new National Plan for 2004-2006, aim their strategy at 'reshaping the role of learning within, and outside the school system." A similar approach was taken in Sweden where the National Plan it is (2000) placed the emphasis on the social aspects of learning. It approached the development of ICT skills and practice by integrating the socio-cultural and constructivist views of learning into the school curricula. *"Learning in groups is important. The knowledge acquired by different individuals becomes an asset to group work*".[14]

Also, thought has to be given to time investment. Are the results worth the investment? If one balances the observed increase in student motivation in almost ever instance and the teacher belief that a more profound type of learning is taking place with skills other than traditional academic being developed, then the answer must be in the affirmative. But, new methods of assessment other than the traditional measures of academic performance have to be considered.

Among the active participants, the technical barriers were not the most significant ones but rather the challenges posed through none cooperative peers and systems, and cultural contextual issues. It seems that the participants accept that there will be problems with the technology, but find it much harder to accept the non-cooperation of their colleagues, or the rigid approaches of their educational systems.

In some parts of the Europe, however, technical infrastructure still remains a barrier either through poor server connections, slow Internet access, availability of non-fee-based software, problems with implementation, or just the use of old machines. However, the innovation of actions taken in many cases provided solutions for these schools. This makes a strong case for more development based on open source model and making the software available for schools under fair licensing terms. Also, the availability of software that is dedicated for educational purposes should be available for all schools in fair terms of licensing. Additionally, the educational application services (use of EUN community tool and FLE3 application) provided by European Schoolnet was much appreciated by the participants of the pilot. The similar kind of services should become more available for school on national and regional bases, as it would save the schools time and money from installing, maintaining and hosting application. Local services in this area would also provide some new employment possibilities by selling services for educational establishments.

[14] Further information on the ICT educational policies of various European countries is available on the European Schoolnet at http: http://insight.eun.org/policy

In the case of the pilot 5.5, some language barriers may account in some way for the low level of involvement or drop out of some small amount of the participants. Thus, it could be recommended that training of teachers on the use of learner centred pedagogical models supported by the use of ICT should be received in their native language and as part of the initial teacher training programmes or on-going in-service training for teachers.

Both the PIM and Jigsaw methods are fundamental elements of project based learning and Computer Supported Collaborative Learning. However, these pedagogical practices do not seem to be a major part of secondary school mainstream pedagogical examination subjects in some of the countries represented in the project, and many of the teachers struggled to get sufficient time with their students to adequately apply the techniques within the school curriculum. In those schools where senior management supported the project or national curriculum required some collaborative projects, it was infinitely easier as adequate time was allowed to the teachers to develop their work. It seems rather clear that when teachers are encouraged by their management and, in some counties' cases, national curriculum required the implementation of new pedagogical practices, the conditions for success were better than in the opposite case. However, some of the pilot projects were very successful without external support by superiors, in these cases they relied on the pioneering spirit of the individual teacher. Thus, it should become a primary priority of every European educational authority to create incentive for teachers to commence new innovative ways of working and teaching, and not to be punished by huge time, cultural and social constraints.

3.5.5 Issues raising from the implementation

3.5.5.1 Pedagogical FAQs

An idea emerged from the pilot experience: to establish a database of pedagogical Frequently Asked Questions for implementing Progressive Inquiry Model. This database would consist of two types of questions: ones would be "re-phrased" problems based on frequently asked questions during the OASIS pilot and some other PIM training experiences. These would have answers given by both experts and practitioners, as well as teachers based on their contextualised answers. The second category of questions would be open, i.e. anyone could post a question, and there would be some experts and practitioners answering. All the FAQs would be left "open" so that any thread could be continued. If the users' community would take up the idea, the database could consist of many languages.

3.5.5.2 Combining the PIM and Jigsaw

As the pilot analyses revealed, the Jigsaw method seemed to be very much favoured by the practitioners; they found it rather easy to implement in their teaching and also learners seemed to be much in favour of it, as it let them take different roles and also to become an expert and/or a teacher to other people in the group. It is noteworthy to mention that teachers implemented the Jigsaw model both with and without using ICTs. They, in many cases, emphasised that learning to use the pedagogical approach itself was important in the beginning and that it was not necessary to use the ICTs at the learning stage yet, but only later when the approach is cleared.

What comes to the implementation of the Progressive Inquiry Model, it seemed that it had fairly many different adaptations in classrooms, all ranging from more simplistic way of implementing it to the full-scale implementation when learners had become more comfortable with the way of working. Many teachers underlined that learning to use the PIM

was not always easy. For some of them it seemed to be even confusing to start using a software application and learn a new pedagogical practice simultaneously.

Two things rose from the above observation; firstly, it would be essential to have a software application to help teachers to organise Jigsaw learning and teaching situations and groups, also to make the material and documentation available to the each stage of the exercise, as well as students tracking of competition of the exercises. Secondly, a new, more refined model could be derived from the two models where elements from both would be blended in. A software application to support this should be made available, too.

For example, the current version of FLE3 could have an additional Jigsaw-plug-in module that would allow teachers to organise learners according to the Jigsaw model: in a mother group and expert groups. Subsequently, the learning would take place following the Progressive Inquiry Model and each expert group would collect their material in the FLE3 knowledge building part. Later, when all the learners would go back to their mother groups to teach the others, they would be able to use the material that is organised by knowledge types and would be available in the Knowledge building.

4 The global outcomes

4.1 Set-up and participants

For the global evaluation approach, a questionnaire was developed in order to be able to answer the research questions. The questionnaire was the same for all countries, and can be found in appendix 1.

The questionnaire has been distributed among teachers within four pilots. For three pilots (Apple Wireless Ubiquity, Academy de Grenoble and EUN), the teachers filled in the questionnaire in the English language. For the CNICE pilot, the questionnaire was translated in Spanish. Furthermore, the questionnaire was shortened, as the responsible persons of the Spanish pilot filled in the general questions (like “how many students are there in your school”) for them. This information was retrieved from other research instruments used within the local approach of this pilot.

The SUN pilot, however, had different setting up: the pilot was integrated within the CNICE pilot and the EUN pilot (see table 3) so that the selected schools received the specific SUN equipment and training. These teachers did not receive an extra questionnaire concerning their participation in the SUN pilot. This will have some implications on the analysis of the data, as will be described below.

Also, apart from the official setting of the Apple pilot in which a number of schools received Apple equipments and training, there was a number of schools who used Apple technologies already prior to the pilots. As seen in table 1, there was an additional three teachers in the pilot of Academy de Grenoble, and two teachers in the pilot of EUN also using Apple technologies, but they didn’t receive any training or additional equipments, thus were not part of the local Apple evaluation.

	CNICE	**Apple**	**Grenoble**	**EUN**	**Total**
Number of Teachers	87	12	26	21	**146**
Number of Schools	18	9	26	21	**74**
Using SUN	14	-	-	2	**16**
Using Apple	-	12	3	2	**17**

Table 3: Number of respondents per pilot

What can be observed from table 3, is the fact that in the Spanish pilot, many teachers per school have filled in the questionnaire (an average of 4.83), where the other three pilots have in most cases only one questionnaire per school (with two exceptions in the case of the Apple pilot, where one school is represented by two teachers in the questionnaire and one school is represented by three teachers, also, in the EUN pilot there is one school with two respondents).

For most analyses done here, averages are calculated. This means that no special calculations have been done to correct for this unbalance among the pilots.

In the introduction text to the questionnaire table 4 was shown, followed with the sentence (in a bold font):

"Please make sure that you know in which pilot you are participating, before you start the questionnaire! In this questionnaire, many times a reference is made to the technological solution. Please check above to see what the technological solution is in your pilot."

Name of the pilot	Technology used
CNICE	Oasis Architecture
Apple Wireless Ubiquity	Apple Wireless Classroom, media rich learning material
Academy Grenoble	SLIS, SLIM
EUN	Various types of software used in school, including Open Source CSCL software

Table 4: Table in instruction text for the questionnaire, indicating what technology is used in the various pilots.

Thus, the participants filled in the questionnaire, while thinking of the technological solution of their own pilot. The SUN pilot presents an exception, since its nature was slightly different from other pilots. SUN equipment was implemented in chosen schools (6) and those pilots were embedded within the CNICE and EUN pilots. So, in the analysis concerning SUN, it is assumed that the participants were also keeping the SUN technology in mind when replying the questionnaire.

4.2 Demographics: Participants in the global questionnaire

The participants that filled in the questionnaire were mostly teachers, but other roles at the schools are also represented (see table 5). Many times, participants fulfil more than one role at a school meaning that many of the participants had a double role in their working environment. That results to the total figures that are sometimes greater than the number of participants.

	CNICE	Apple	Grenoble	EUN	Total
Teacher	67	10	6	19	**102**
School Principal		2	23	2	**27**
ICT-responsible	27	5	4	8	**44**
Coordinator[1]	16	1		4	**21**
Other[2]		1	1	4	**6**

Table 5: Roles at school of the respondents that filled in the questionnaire

[1]Coordinator of extra curricular/international activities
[2]Other, namely Deputy/Assistant principal, Librarian, project coordinator, DEEMO site coordinator, Philosophy ICT coordinator, Coordinator of e-learning.

As can be observed from table 6, the participating teachers are distributed all over Europe. Of course, CNICE and Academy de Grenoble only have participants from one country, but the other pilots selected teachers from different countries, covering many regions of Europe.

	CNICE	Apple	Grenoble	EUN	Total
Belgium		2		2	4
Finland				3	3
France			26		26
Germany		5			5
Hungary				1	1
Italy				3	3
Lithuania				2	2
Portugal				3	3
Romania				2	2
Spain	87	2		1	90
Sweden				1	1
UK				3	3
Other		3			3

Table 6: Number of respondents per country

In table 7, we see that all Spanish schools are secondary education schools. The other pilots have selected their participants in all forms of education, but the emphasis is on secondary education. The size of the schools can be found in table 8.
We can also observe that most of the responding teachers have their schools located in inner-urban areas (table 9). For Spain, also a considerable number of schools are located in small towns and in rural areas. For EUN, most schools are located in small towns and rural areas.

	CNICE	Apple	Grenoble	EUN	Total
Pre-school Education			2		**2**
Primary Education		6	6	6	**18**
Secondary Education	87	5	18	14	**124**
Higher Education				1	**1**
Vocational Training		1			**1**

Table 7: Type of schools

Number of pupils	CNICE	Apple	Grenoble	EUN	Total
<100			2	1	**3**
100-299	4	5	8	4	**21**
300-599	23	5	7	6	**41**
600-899	34		5	3	**42**
900-1199	26	1	1	4	**32**
1200-1499			1	2	**3**
>1500		1	2	1	**4**

Table 8: Number of students at the participating schools

	CNICE	Apple	Grenoble	EUN	Total
Inner-Urban	57	5	17	5	**84**
Sub-urban		4	2	2	**8**
Small town	12	2	4	7	**25**
Rural	18	1	3	7	**29**

Table 9: Location of schools

In table 10 and 11, we can see that in all pilots, there are many experienced teachers, and also many teachers that have been using ICT already for some years. In the Spanish pilot, there is also a considerable group of teachers that has less than one-year experience with ICT (34%).

	CNICE	Apple	Grenoble	EUN	Total
< 5	2		1		**3**
5-10	8		4	4	**16**
11-15	11	1	1	4	**17**
16-20	25	6	1	4	**36**
> 20	41	5	19	9	**74**

Table 10: How many years have you been working in education?

	CNICE	Apple	Grenoble	EUN	Total
< 1	28	1		2	**31**
2	9	2	1	2	**14**
4	17	1	7	3	**28**
6	4	1	1	1	**7**
> 6	24	7	17	13	**61**

Table 11: How many years have you been using ICT in education?

4.3 Pedagogical dimensions

4.3.1 Technical and pedagogical training received

A considerable number of the participants didn't receive any training on the technology (9.7%) or training for the pedagogical models (11.3%). In table 12, we can see from the 'no' columns a large part of the participants didn't consider the training attended was sufficient. But for the majority, both the technology training and the training on pedagogical models were sufficient. The figures for the CNICE pilot and the EUN pilot are more positive than the figures for the other two pilots, where relatively more negative sounds are heard. Especially training for the pedagogical models was not sufficient for the Grenoble pilot, and the Apple pilot seems to lack a good provision of training on both subjects.

	Sufficient training?	CNICE	Apple	Grenoble	EUN	Total
Technology Training	**Yes**	47	3	12	15	77
	No	36	4	11	3	54
	No training attended	3	5	3	3	14
Training for the pedagogical models	**Yes**	52	4	9	16	81
	No	22	4	14	5	45
	No training attended	9	4	3		16

Table 12: Answers to the questions whether respondents received sufficient training

Furthermore, in table 13, one can observe that many participants think that they would have benefited from more training. They identified lack of both trainings as a barrier for effectively using the technical solution (the scale: 0 =not at all, 1 = a little and 2 =a lot). In the case of technical training, in the average, all participants said that the lack of training was "a little" barrier (1.03) for the effective use of technological solution. In the case of pedagogical training, the average was between "not at all" and "a little (0,66).

When looked at this figure per pilot, it can be observed that participants in the CNICE and Grenoble pilots would have benefited of more training (both averages are greater than 1), whereas the participants in the Apple and EUN pilots were slightly more content with the technical training. Concerning the need for pedagogical training, the participants considered the lack of it less a barrier for the effective use of the solution. The participants in the Grenoble pilot, however, could have benefited from some more pedagogical training (average 1.27 said that lack of it was "a little" barrier).

	CNICE			Apple			Grenoble			EUN			Total		
	Mean	N	SD	**Mean**	N	SD	**Mean**	N	SD	**Mean**	N	SD	**Mean**	N	SD
Lack of technical training	***1,06***	85	0,56	***0,92***	12	0,79	***1,19***	26	0,85	***0,81***	21	0,75	***1,03***	144	0,67
Lack of pedagogical training	***0,47***	81	0,57	***0,75***	12	0,75	***1,27***	26	0,92	***0,62***	21	0,67	***0,66***	140	0,74

Table 13: Barriers for effective use of the technological solution

The figures indicate means on a three-point scale (0 = not at all, 1 = a little, 2 = a lot), Number of respondents and Standard Deviation.

4.3.2 Impact on teaching

4.3.2.1 What are ICTs used in classrooms for?

Table 14 displays the subject groups in which the technological solutions are used. On average, the spread between the subjects is quite traditional, technical solutions and ICTs in general are usually used in teaching science subjects such as biology, natural sciences, mathematics, geography and so on. Foreign language teaching involves usually integrated technical solutions as well.

The table reveals noteworthy differences between pilots which can be partly explained by the nature of the pilot, for example that the Apple pilot was very focused on media education. However, it is interesting to see that the teachers in the CNICE pilot seemed to use the technological solutions for fewer subjects than the participants in the other pilots. In the case of CNICE, the most taught subject is the informatics/ICT. This could indicate that teachers and pupils in CNICE pilot needed a lot of initiation to start using the ICTs

themselves, whereas in the other pilots ICTs were used to teach subject areas. This correlates with the knowledge about the experience that participants have in using ICTs in education, the CNICE teachers were on the average less experienced than participants in other pilots (however, there was also a large group of teachers with more than 6 years of experience in using ICTs in education).

This kind of distribution between pilots may reflect the availability of computers within the school organisation, but the global questionnaire did not gather any information on this subject.

It might be that teachers who have more experience in using ICTs in education (see the table 11: How many years have you been using ICT in education) also apply them in more subject areas in their teaching practices.

	CNICE		**Apple**		**Grenoble**		**EUN**	
	N	**%**	**N**	**%**	**N**	**%**	**N**	**%**
Art			5	55,56	11	42,31	4	19,05
Biology			3	33,33	13	50,00	7	33,33
Chemistry	12	13,79	1	11,11	5	19,23	2	9,52
Citizenship			3	33,33	5	19,23	4	19,05
Culture			6	66,67	3	11,54	4	19,05
Economics			2	22,22	2	7,69		
Environmental educ.			2	22,22	6	23,08	6	28,57
Ethics			3	33,33	1	3,85		
Foreign languages	16	18,39	5	55,56	16	61,54	13	61,90
Geography	4	4,60	6	66,67	23	88,46	8	38,10
History	6	6,90	5	55,56	22	84,62	3	14,29
Home Economics								
Informatics/ICT	32	36,78	6	66,67	7	26,92	12	57,14
Language and literature	10	11,49	3	33,33	19	73,08	5	23,81
Mathematics	8	9,20	5	55,56	23	88,46	5	23,81
Media education			4	44,44	3	11,54	4	19,05
Music			2	22,22	12	46,15	4	19,05
Natural sciences			4	44,44	16	61,54	6	28,57
Philosophy					4	15,38		
Physical education					5	19,23		
Physics	12	13,79	1	11,11	10	38,46	4	19,05
Politics								
Psychology								
Religion			3	33,33			1	4,76
Social sciences			2	22,22	2	7,69	1	4,76
Social studies			2	22,22	1	3,85	3	14,29
Special education			1	11,11	1	3,85	1	4,76

Table 14: Overview of the subject groups in which the technological solutions are used

In table 15 we can see that survey participants estimate that their pupils use the technological solutions on a weekly bases. In most of the cases, more than half of the pupils are using the technological solution at least once or 2 to 4 times a week.

In the CNICE pilot about 98% of the respondents claim that their students worked at least once a week with the technological solution.
For the Apple pilot all pupils worked with the technological solution at least once a week, and 66,7% even more than once a week. All the pupils of the Grenoble pilot worked at least once a week with the technological solution, and 26,9% even multiple times a day. In the EUN pilot only 76% of the pupils use the technology at least once a week. The pupils of 4 respondents use the technology a few times a month, while in one case the pupils work only once a month with the technology.

	CNICE		**Apple**		**Grenoble**		**EUN**	
Frequency of usage	**N**	**%**	**N**	**%**	**N**	**%**	**N**	**%**
2-4 times a day	-	-	-	-	7	26,9	-	-
At least once a day	5	7,1	1	11,1	5	19,2	-	-
2-4 times a week	31	44,3	5	55,6	12	46,2	6	28,6
Once a week	32	45,7	3	33,3	2	7,7	10	47,6
1-3 times a month	1	1,4	-	-	-	-	4	19
Once a month	-	-		-	-	-	1	4,8
Not applicable	1	1,4	-	-	-	-	-	-
Total	**70**	**100**	**9**	**100**	**26**	**100**	**21**	**100**
Missing	17		3					

Table 15: Students usage of the technological solution

In table 16, the usage of the technological solution for various activities is listed.

	CNICE		Apple		Grenoble		EUN	
Chatting	32	36,78%	4	33,33%	6	23,08%	5	23,81%
Create an online quiz	4	4,60%	1	8,33%	8	30,77%	5	23,81%
Database work	15	17,24%	3	25,00%	4	15,38%	3	14,29%
Development of WebPages	28	32,18%	6	50,00%	12	46,15%	12	57,14%
Educational software	46	52,87%	7	58,33%	3	11,54%	7	33,33%
Email communication	56	64,37%	8	66,67%	15	57,69%	18	85,71%
File sharing	26	29,89%	4	33,33%	2	7,69%	11	52,38%
File upload	17	19,54%	2	16,67%	3	11,54%	10	47,62%
Forums	39	44,83%		0,00%	1	3,85%	7	33,33%
Internet searching	59	67,82%	8	66,67%	25	96,15%	19	90,48%
Photo editing	14	16,09%	7	58,33%	17	65,38%	12	57,14%
Preparation of presentations	40	45,98%	8	66,67%	12	46,15%	19	90,48%
Reference books like dictionaries, thesaurus,..	35	40,23%	2	16,67%	13	50,00%	8	38,10%
Scanning	21	24,14%	6	50,00%	4	15,38%	11	52,38%
Spreadsheets	24	27,59%	5	41,67%	3	11,54%	7	33,33%
Use of a virtual learning environment	30	34,48%	4	33,33%	5	19,23%	12	57,14%
Video editing	4	4,60%	9	75,00%	11	42,31%	5	23,81%
Word Processing	56	64,37%	9	75,00%	12	46,15%	17	80,95%
Other	3*	3,45%					4**	19,05%

Table 16: Usage of the technological solution for various purposes

*Respondents report here collaboration and cooperation through the webpage.
** Developing a cultural guide is named here, together with forming communities

In the Spanish pilot, a standard pattern of computer use can be observed, with word processing, Internet searching and e-mail on the top of the list. In the Apple pilot, the emphasis is on media related purposes, but the wireless technology can be used for all purposes. In the Grenoble pilot, Internet searching is by far the most used purpose. In the EUN pilot, it is interesting that the preparation for presentations is an important purpose for which the technology is used.

In table 17 is listed for what purpose the technological solution has been used. It is interesting to see that in all pilots, except for the Grenoble pilot, the technological solution is used for relatively new pedagogical approaches as collaborative learning and project-based learning. It seems that in the case of the Grenoble pilot the technological solutions are, in about two thirds of the cases, is used on remedial and supportive exercises.

	CNICE		Apple		Grenoble		EUN	
	N	%	N	%	N	%	N	%
Brainstorming	4	4,60%	4	33,33%	5	19,23%	13	61,90%
Collaborative learning	44	50,57%	9	75,00%	8	30,77%	20	95,24%
Computer assisted instruction	47	54,02%	4	33,33%	8	30,77%	8	38,10%
Demonstrations	20	22,99%	6	50,00%	12	46,15%	11	52,38%
Peer Tutoring	13	14,94%	2	16,67%	10	38,46%	7	33,33%
Project-based learning	32	36,78%	8	66,67%	5	19,23%	18	85,71%
Remediation, supportive exercises	26	29,89%	2	16,67%	17	65,38%	3	14,29%
Role-playing	5	5,75%	2	16,67%	2	7,69%	2	9,52%
Self directed groups	7	8,05%	5	41,67%	6	23,08%	8	38,10%
Simulations and games	23	26,44%	3	25,00%	9	34,62%	8	38,10%
Software drills	16	18,39%	1	8,33%	7	26,92%	5	23,81%
Other	2*	2,30%					2**	9,52%

Table 17: In what way was the technological solution used?

*The specific technology of Malted is named here.
** Respondents report uploading work for other schools and questions & answers on a discussion board.

4.3.3 Impact on learning

4.3.3.1 Pedagogical aspects affected by the use of the technological solution

On the average, 68% of the respondents to the global questionnaire estimated that there was “a little” change in their pedagogical approaches, whereas 20% estimated that there were “a lot” of changes in their approaches to teach. 14% estimated that there were “not at all” changes. It appears that the Apple and EUN pilot had the most “a lot” changes in pedagogical approaches, while the other pilots had clearly over half of the respondents estimating that they had “a little” changes (tables 18 and 19). Thus, it can be estimated that there was some pedagogical shift was taking place due to the OASIS pilots and the pedagogical oriented training.

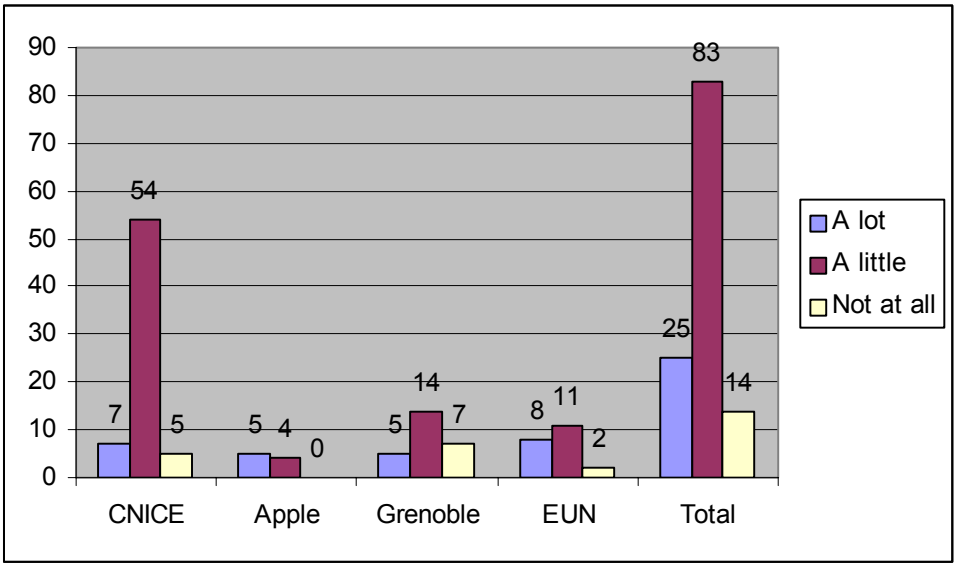


Table 18: Change in pedagogical approach of respondents (N)

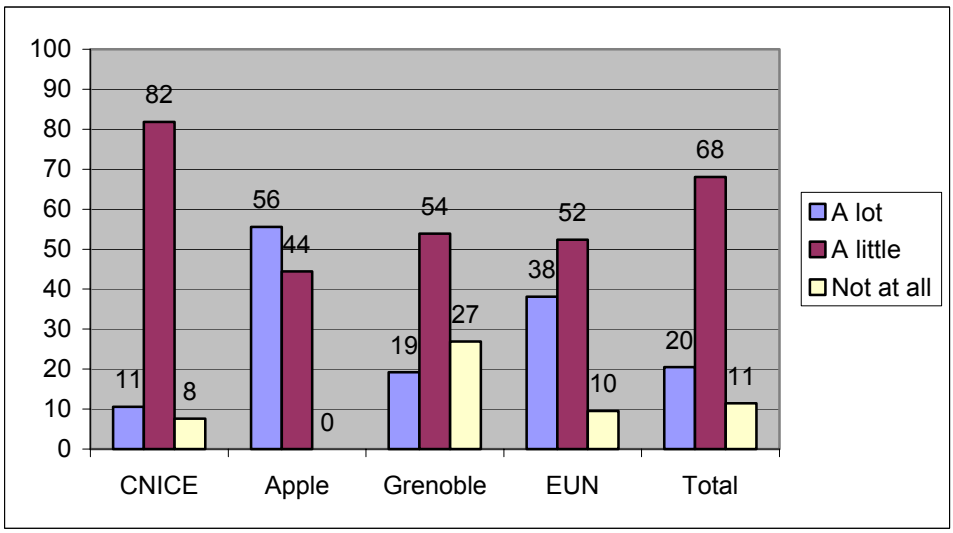


Table 19: Change in pedagogical approach of respondents (%)

Looking more closely to the pedagogical aspects that were affected by the use of the technological solution (table 20), it can be estimated that the technological solution urged some changes in the pedagogy; the collaboration among colleagues was estimated to be "more" in more than half of the replies to the global questionnaire. Furthermore, collaboration among students increased dramatically in all the pilot sites (in all cases more than 57% replied "more"), which lets us believe that more and more peer learning was taking place among students. The respondents also estimated that learning became more students centred in all pilots but Grenoble, where the respondent estimated that there was "no effect". Yet again, as there is no knowledge of the prior situation in Grenoble, thus it is nearly impossible to know whether the teaching already was students centred to start with.

The use of the given technological solution also seemed to affect the time that teachers needed to prepare their lessons. A quite a change can be observed in the increase of teachers' preparation time, most importantly in the case of the CNICE pilot, but also for the other pilots. However, in some of the local evaluations it becomes clear that the increase in preparation time was because of adapting new practices and methods, but many participants estimated that in the long term, the preparation time would decrease, as in any other practices.

Thus, from the above it can be observed that both teachers' and students' pedagogical practices were affected: both groups spent more time collaborating among themselves, it was estimated that learning became more student centred and at the same time more individualised according to each student's needs. In all pilots, students' motivation increased dramatically.

In addition, when the participants were asked to assess the way that the ICTs are used (table 17), there was a great shift towards collaborative learning methods (in 3 out of 4 pilots more than half used them for collaborative learning). Here the Apple and EUN pilots have the most similarities, in both pilots ICTs were used by more than half of the respondents to make demonstrations and project-based learning. In the Spanish pilot computer-assisted instruction was practised by most respondents, and in the Grenoble pilot remediation and supportive exercises were practised a lot. Neither of these findings

necessarily comply with the basic ideas of CSCL, but maybe some differences in educational culture and the tradition of computer use can help to interpret this data.

		CNICE	Apple	Grenoble	EUN
Preparation time	**Less**	1 *1,2%*	2 *16,7%*		1 *4,8%*
	No effect	3 *3,7%*	3 *25,0%*	13 *50,0%*	6 *28,6%*
	More	77 *95,1%*	7 *58,3%*	13 *50,0%*	14 *66,7%*
Collaboration with colleagues	**Less**	1 *1,3%*		3 *11,5%*	3 *14,3%*
	No effect	30 *38,0%*	6 *50,0%*	6 *23,1%*	7 *33,3%*
	More	48 *60,8%*	6 *50,0%*	17 *65,4%*	11 *52,4%*
Collaboration among students	**Less**	1 *1,3%*			1 *4,8%*
	No effect	12 *15,4%*	2 *16,7%*	11 *42,3%*	4 *19,0%*
	More	65 *83,3%*	10 *83,3%*	15 *57,7%*	16 *76,2%*
Learning becomes students centred	**Less**	6 *7,6%*		2 *7,7%*	1 *4,8%*
	No effect	18 *22,8%*	3 *25,0%*	16 *61,5%*	3 *14,3%*
	More	55 *69,6%*	9 *75,0%*	8 *30,8%*	17 *81,0%*
Learning becomes individualised	**Less**	7 *8,9%*	1 *8,3%*	2 *7,7%*	4 *19,0%*
	No effect	11 *13,9%*	2 *16,7%*	8 *30,8%*	9 *42,9%*
	More	61 *77,2%*	9 *75,0%*	16 *61,5%*	8 *38,1%*
Motivation of students	**Less**	2 *2,5%*		1 *3,8%*	
	No effect	3 *3,7%*		6 *23,1%*	
	More	76 *93,8%*	12 *100,0%*	19 *73,1%*	21 *100,0%*

Table 20: Pedagogical aspects affected by the use of the technological solution

In the following question the respondents were asked whether the use of the technical solution changed any of their own pedagogical practices. It is interesting to observe from the table 21 that, to some extend (average 0.30), respondents estimated that they were left with more time with students in classroom than before, even if their preparation time had increased. This is promising, as one of the claims for the ICT use in schools usually states that by employing more student centred methods combined with ICT based practices, teachers are left with more time to concentrate in teaching and students, instead of repeating some mechanical exercises with them. Figures in the same table also demonstrate that, in deed, collaboration among students has increased and learning has become more individualised allowing more personal learning experiences to take place.

There are, however, differences between the pilots, which probably are due to variations in pilots' emphasises, tools available and training provided. All the same, the motivational factor seems to be prominent in each one of the pilots; the respondents estimated that students' motivation to learn was higher than previously.

Furthermore, in the same question respondents were asked about learning taking place outside of school. As can be seen in the table 21, the most learning experiences outside of the regular school hours and venue seems to have taken place in the EUN pilot, but to some extend also in the other pilots. Here one can attempt to conclude that the emphasis put in pedagogical approaches encouraging to extend learning experiences from conventional classroom environment to outside of school boundaries have had some effect.

	CNICE			**Apple**			**Grenoble**			**EUN**			**Total**		
	Mean	N	SD	**Mean**	N	SD	**Mean**	N	SD	**Mean**	N	SD	**Mean**	N	SD
Preparation time	***0,97***	63	0,18	***0,67***	9	0,50	***0,46***	26	0,58	***0,52***	21	0,68	***0,76***	119	0,49
Time in the class-room with students	***0,32***	62	0,59	***0,44***	9	0,53	***0,31***	26	0,55	***0,14***	21	0,65	***0,30***	118	0,59
Collaboration with colleagues	***0,58***	62	0,50	***0,67***	9	0,50	***0,62***	26	0,57	***0,43***	21	0,60	***0,57***	118	0,53
Collaboration among students	***0,76***	63	0,43	***1,00***	9	0,00	***0,42***	26	0,50	***0,81***	21	0,51	***0,71***	119	0,47
Learning becomes students centred	***0,76***	63	0,47	***1,00***	9	0,00	***0,19***	26	0,57	***0,81***	21	0,51	***0,66***	119	0,54
Learning becomes individualised	***0,75***	63	0,54	***0,78***	9	0,44	***0,46***	26	0,58	***0,38***	21	0,80	***0,62***	119	0,61
Motivation of students	***0,90***	63	0,35	***1,00***	9	0,00	***0,65***	26	0,56	***1,00***	21	0,00	***0,87***	119	0,38
Learning out of the school	***0,37***	60	0,61	***0,33***	9	0,50	***0,31***	26	0,55	***0,67***	21	0,66	***0,41***	116	0,60

Table 21: Pedagogical aspects changed for the respondents themselves because of using the technological solution

The figures indicate means on a three-point scale (–1 = Less, 0 = No effect, 1 = More), number of respondents and standard deviation.

Four respondents also report other changes in their pedagogical approach. Three respondents from the CNICE pilot report increased responsibility for the teacher and for the students and greater autonomy for searching information. A respondent of EUN reports the possibility for collaboration with other schools in other countries.

4.3.4 Pedagogical satisfaction of various groups for the use of the technological solution

The last question concerning the pedagogical dimension asked the respondents to estimate the satisfaction of a number of actors in and around the school from the pedagogical point of view. In table 22, we can observe that respondents of all pilots think that students have most to gain from the use of technologies from the pedagogical point of view (average 1.7). The Apple pilot participants estimate that from the pedagogical point of view their students gained the most. Also the respondents themselves estimated that they are satisfied with their pedagogical experiences combined with the use of the given technology, again, the Apple pilot participants were most satisfied followed by the EUN participants. It seems that most spread answers to this question come from the Grenoble pilot where standard deviation to this question was 0.76 (high variation of answers), meaning the satisfaction

was most diverse. There was more diversity how the respondents saw other teachers benefiting from the pedagogical point of view, although all of them estimated that they could benefit “a little”. On the average, it was estimated that “the school” (in a broad term) could pedagogically benefit from the OASIS technologies more than individual teachers.

There is parents’ satisfaction in the Apple pilot, and a little in the EUN pilot. The local community is a little satisfied in the Apple pilot and the Grenoble pilot, in the other pilots the satisfaction of the local community is only very little. For the other groups (policy makers and adult learning groups), there is not much pedagogical satisfaction; only some satisfaction is found in the Apple pilot for policy makers. Of course it is hard to estimate how outside of school communities could pedagogically benefit from OASIS experiments, but in the section dealing with Cultural and social aspects this is more clear and evident.

	CNICE			**Apple**			**Grenoble**			**EUN**		
	Mean	**N**	**SD**	**Mean**	**N**	**SD**	**Mean**	**N**	**SD**	**Mean**	**N**	**SD**
Respondent	***1,52***	83	0,57	***1,89***	9	0,33	***1,46***	26	0,76	***1,67***	21	0,58
School	***1,18***	79	0,67	***1,89***	9	0,33	***1,73***	26	0,45	***1,38***	21	0,59
Students	***1,54***	82	0,55	***1,89***	9	0,33	***1,73***	26	0,45	***1,62***	21	0,59
Teachers	***1,06***	77	0,68	***1,78***	9	0,67	***1,46***	26	0,58	***1,10***	21	0,70
Parents	***0,53***	66	0,64	***1,25***	8	0,71	***0,65***	20	0,88	***0,95***	21	0,80
Local community	***0,09***	58	0,28	***1,13***	8	0,99	***1,16***	19	0,96	***0,43***	21	0,68
Elected representatives / policy-makers	***0,18***	57	0,50	***0,75***	8	0,89	***0,21***	19	0,54	***0,48***	21	0,68
Adult learning groups	***0,07***	55	0,26	***0,38***	8	0,74	***0,05***	19	0,23	***0,43***	21	0,81

Table 22: Pedagogical point of view: Satisfaction of various groups with the use of the technological solution.

The figures indicate means on a three-point scale (0 = not at all, 1 = a little, 2 = a lot), Number of respondents and Standard Deviation.

4.4 Organisational dimensions

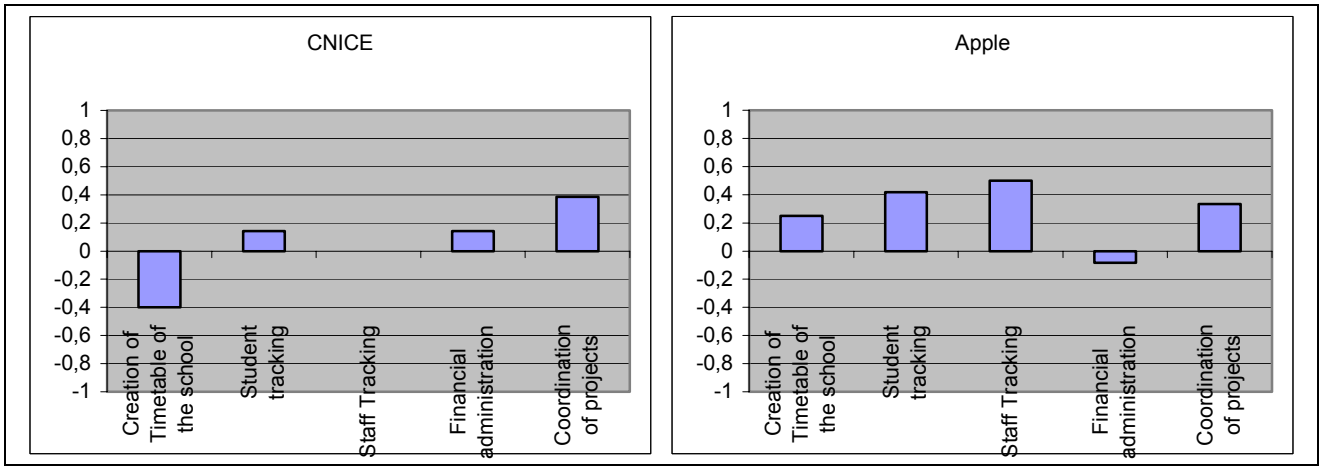
Teachers were asked for what administrative purposes ICT is used in their schools. In table 23, we can observe that in Spain, schools do not use ICT for administrative purposes very much. For all other pilots, respondents claim that in around half of the cases or more, ICT is used for all administrative purposes listed, except for food service. Administrative purposes that are used most are student information and staff information. In the category “other” teachers report that “every administrative task is computerized”, “communications”, “pupils absence management”, “Maintenance” and “Web page, departments, school magazine and sport's association.”

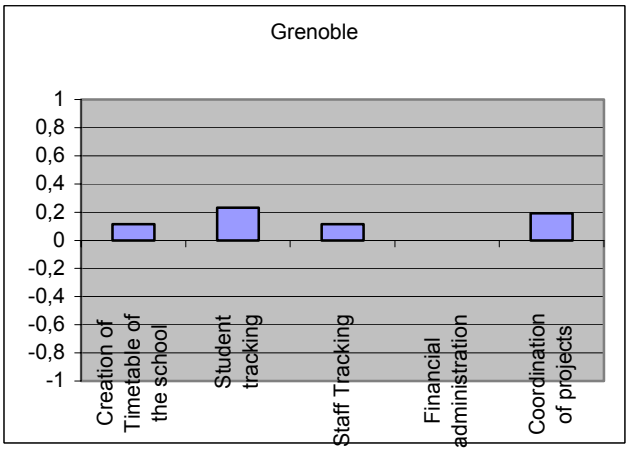
ICT is used for:	CNICE	Apple	Grenoble	EUN	Total
	%	%	%	%	%
Student information	24,14	91,67	65,38	90,48	46,58
Student grades, assessment and evaluation	29,89	50,00	53,85	47,62	38,36
Staff information	14,94	75,00	73,08	90,48	41,10
School information like schedules, class arrangements	18,39	41,67	53,85	66,67	33,56
Library information	16,09	33,33	50,00	57,14	29,45
Information about Internet and software	13,79	66,67	38,46	61,90	29,45
Information about pedagogical projects	16,09	58,33	50,00	66,67	32,88
Financial information	14,94	50,00	34,62	47,62	26,03
Food service		16,67	34,62	9,52	8,90
Other[1]	3,45	8,33		4,76	3,42

Table 23: Percentage of respondents that says that ICT is used for the listed administrative purposes at their school

[1]Other answers are listed in the text.

Respondents were asked to rate whether the technological solution had an impact on certain organisational issues. They could rate this as more difficult (-1), no effect (0) and easier (1). In figure 24 we see that on average the creation of timetables is slightly easier, except for the CNICE pilot, where the respondents think this has become much more difficult (it must however been said that this question was answered by only 12 to 15 respondents for the Spanish pilot). Student tracking and staff tracking score positive (or zero in the cases of CNICE and Grenoble). Financial administration is found to have become easier in the EUN pilot. For the other pilots, this is around zero (and even slightly negative for Apple). The coordination of projects has become easier in all pilots.





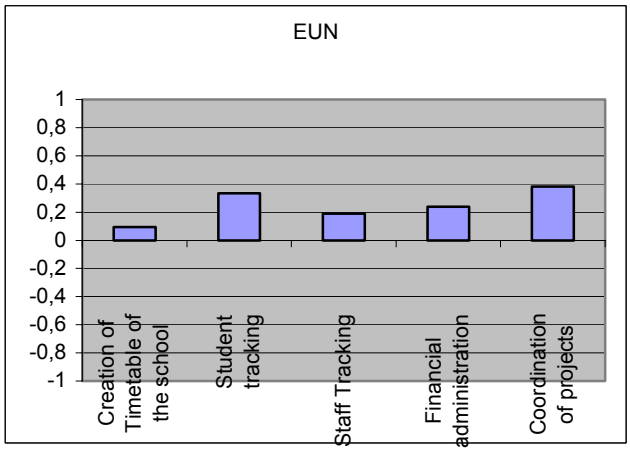


Table 24: Change in organisational issues

Table 25 lists what kind of support the respondents would need to use the technical solution in a more effective way for their work.

	CNICE	Apple	Grenoble	EUN
Teachers responsible for technical maintenance	56	5	7	1
ICT coordinator responsible for coordination of ICT related programmes and technical maintenance	52	9	21	10
Specialist network administrator	44	3	8	8
More in service training	43	4	15	12
Teacher responsible for project coordination	30	5	12	11
Teacher responsible for pedagogical support	29	2	14	7
Teachers responsible for network administration	24	2	1	2
Students responsible for technical maintenance	4	2	3	1
Student responsible for project coordination	3		1	4
Students responsible for network administration	2	1	2	
Student responsible for pedagogical support	2		1	1
Other	22	1	1	4

Table 25: Kind of support needed to use technological solution more efficient

The kinds of support that were listed under 'other' are:

The existence of ZMS
Technological training
Technical support for the ZMS
Teachers in charge of ICT should benefit from a reduction of their teaching hours.
Suitable incentives in order to make up for the necessary extra time
Suitable didactic software

Staff from the Ministry of Education or European Commission should report on the new materials and useful resources.
More technological resources, and less pupils per classroom
More information about ICT
Linux training and web and Intranet management
In my opinion the way it was applied in my School is appropriated.
ICT specialist at the school
ICT experts team to solve technical problems or in the different applications
Given the technical problems, for the subject of English the specific classroom could not be used.
From my point of view every help is interesting. I think pupils and teachers need a greater technical training.
Experienced people in maintaining hardware equipment.
Computers should not break down so often
Applications should be more adapted to the syllabus
A permanent staff technician is needed in order to maintain hardware equipment.
A greater knowledge about web pages
A combination of training in person and on line training.
A specialist who gives technical maintenance advice is needed.
More financial support
More time
Our technical network administrator wasn't interested of this kind pedagogical model. If he were more helpful to put FLE3 to our server, it would had been easier
More time to set up the EUN community and teach its use to the pupils before actually being involved in the project. At times the children were too busy learning how to use the community to actually concentrate on the project itself and the pedagogy.
More computers and faster connections
More communication from ALL of the partner schools!!

From this table it is clear that the respondents have more confidence in teachers taking up several responsibilities rather than have students do this. Most needed is an ICT-coordinator responsible for coordination of ICT related programmes and technical maintenance, or having a teacher doing this. From the table, and from the answers to the other category, it becomes clear that more training is needed.

Table 26 lists the estimation of time gain for different groups.

	CNICE			**Apple**			**Grenoble**			**EUN**		
	Mean	**N**	**SD**	**Mean**	**N**	**SD**	**Mean**	**N**	**SD**	**Mean**	**N**	**SD**
Respondent	***0,51***	85	0,67	***1,33***	9	0,87	***0,76***	25	0,83	***1,10***	21	0,89
School	***0,62***	81	0,72	***1,33***	9	0,87	***0,96***	25	0,84	***0,81***	21	0,75
Students	***0,93***	82	0,78	***1,44***	9	0,88	***1,36***	25	0,76	***1,19***	21	0,81
Teachers	***0,54***	79	0,71	***1,33***	9	0,87	***0,84***	25	0,80	***0,76***	21	0,77
Parents	***0,12***	66	0,37	***0,56***	9	0,88	***0,11***	18	0,32	***0,33***	21	0,58
Local community	***0,15***	67	0,44	***0,56***	9	0,73	***0,28***	18	0,67	***0,29***	21	0,56
Elected representatives / policy-makers	***0,08***	62	0,27	***0,38***	8	0,74	***0,12***	17	0,49	***0,24***	21	0,54
Adult learning groups	***0,05***	59	0,22	***0,50***	8	0,93	***0,06***	17	0,24	***0,24***	21	0,54

Table 26: Estimation of time gain for different groups because of the use of the technological solution

The figures indicate means on a three-point scale (0 = not at all, 1 = a little, 2 = a lot), Number of respondents and Standard Deviation.

Overall, the respondents in all pilots do not see much time gains for the various groups, except for students. For the CNICE pilot, most time gain is expected for students (but still not much). Some very slight time gains are expected for schools, teachers and the

respondents themselves. For the Apple pilot, the respondents expect quite some time gain for students, schools, teachers and the respondents themselves. A very small time gain is expected for parents and the local community and adult learning groups.
In the Grenoble, quite a lot time gain is expected for students, and also some time gain for schools, teachers and the respondents themselves. Furthermore, there is no time gain expected for other groups.
The EUN pilot sees a little time gain for students and the respondents themselves. A very little time gain for schools and teachers, and for the other groups no time gain is expected.

4.5 Economical dimensions

The questions concerning financial gains and economical aspects have not been answered by the respondents in the Spanish pilot. The other partners were asked to estimate how much certain groups gained financially from the use of the technological solutions.
Respondents could answer “not at all”, “a little” and “a lot”, recoded as 0, 1 and 2.
In table 27, the averages per pilot are displayed.

	Apple			**Grenoble**			**EUN**			**Total**		
	Mean	**N**	**SD**	**Mean**	**N**	**SD**	**Mean**	**N**	**SD**	**Mean**	**N**	**SD**
Respondent	***0,33***	9	0,71	***0,27***	26	0,67	***0,48***	21	0,81	***0,36***	56	0,72
School	***0,89***	9	1,05	***0,96***	26	0,82	***0,48***	21	0,75	***0,77***	56	0,85
Students	***0,67***	9	0,87	***0,69***	26	0,93	***0,48***	21	0,75	***0,61***	56	0,85
Teachers	***0,78***	9	0,83	***0,23***	26	0,51	***0,38***	21	0,67	***0,38***	56	0,65
Parents	***0,44***	9	0,73	***0,10***	20	0,31	***0,48***	21	0,75	***0,32***	50	0,62
Local community	***0,56***	9	0,73	***0,84***	19	0,96	***0,29***	21	0,56	***0,55***	49	0,79
Policy-makers	***0,22***	9	0,67	***0,21***	19	0,63	***0,29***	21	0,64	***0,24***	49	0,63
Adult learning groups	***0,25***	8	0,71	***0,00***	17	0	***0,33***	21	0,73	***0,20***	46	0,58

Table 27: Estimations for the financial gains of certain groups due to the implementation of the technological solution

The figures indicate means on a three-point scale (0 = not at all, 1 = a little, 2 = a lot), Number of respondents and Standard Deviation.

Furthermore, the table 27 shows that not much financial gain is expected from the technological solutions within the pilots. In the Apple pilot, some financial gains are expected for the school, the teachers and the students, and in the Grenoble pilot, there are some expectations for financial gains for the schools and for the students. The Grenoble pilot also sees some financial benefits for the local community.

The group of respondents contains many teachers, but also some other groups like school principles and ICT responsibles. In figure 28, the estimation of financial costs has been done for the respondents that answered yes to the question whether there role at school (maybe among other roles) was school principal, ICT responsible, deputy/Assistant principal and/or any kind of coordinator. The idea is that these people have a better idea of the financial implications of the implementation of certain technologies.

	Apple			Grenoble			EUN			Total		
	Mean	**N**	**SD**	**Mean**	**N**	**SD**	**Mean**	**N**	**SD**	**Mean**	**N**	**SD**
Respondent	***0,43***	7	0,79	***0,28***	25	0,68	***0,54***	13	0,88	***0,38***	45	0,75
School	***1,14***	7	1,07	***0,92***	25	0,81	***0,62***	13	0,87	***0,87***	45	0,87
Students	***0,86***	7	0,9	***0,64***	25	0,91	***0,54***	13	0,78	***0,64***	45	0,86
Teachers	***1,00***	7	0,82	***0,24***	25	0,52	***0,46***	13	0,78	***0,42***	45	0,69
Parents	***0,57***	7	0,79	***0,05***	19	0,23	***0,69***	13	0,85	***0,36***	39	0,67
Local community	***0,71***	7	0,76	***0,78***	18	0,94	***0,38***	13	0,65	***0,63***	38	0,82
policy-makers	***0,29***	7	0,76	***0,11***	18	0,47	***0,46***	13	0,78	***0,26***	38	0,64
Adult learning groups	***0,33***	6	0,82	***0,00***	16	0,00	***0,54***	13	0,88	***0,26***	35	0,66

Table 28: Estimations for the financial gains of certain groups due to the implementation of the technological solution.

Answered by School principles, ict-responsibles, deputies/assistant principals and coordinators. The figures indicate means on a three-point scale (0 = not at all, 1 = a little, 2 = a lot), Number of respondents and Standard Deviation.

In general, we can observe that this group sees more financial benefits for all groups. For the Apple technologies, the emphasis is on the benefits for the schools, students, teachers, parents and the local community. For Grenoble, the emphasis is on the school, the students and the local community. The EUN pilot sees most benefits for the parents and the school. Interesting here is that also some benefits are estimated for policymakers and adult learning groups.

4.6 Technical dimensions

4.6.1 General Usability of the technology

Three general questions were asked to assess the satisfaction of the respondents with the technological solutions in the four pilots. The satisfaction question was asked directly, and this question was checked by asking whether respondents will use the technological solution again, and whether they will recommend it to their colleagues.

Furthermore, people were asked to judge whether the technological solution enhances the quality of their work, and whether it enhances the efficiency of their work.

In table 29, it can be observed that for all pilots the vast majority of the respondents are satisfied with the technological solution of that pilot. For the EUN pilot 'only' two out of three respondents were satisfied, but in this pilot, 100% of the teachers will use the technology again, and 95% will recommend it to their colleagues.
For the other pilots, the future use and recommendation to colleagues is over 90% as well.
This indicates that for all pilots, there is a large acceptation and satisfaction with the technology, and that there is a group of teachers willing to adopt the technologies and spread it to colleagues.

		CNICE	Apple	Grenoble	EUN
Were you satisfied by this technological solution in your pilot?	**Yes**	70 *80,5%*	11 *91,7%*	22 *84,6%*	14 *66,7%*
	No	17 *19,5%*	1 *8,3%*	4 *15,4%*	7 *33,3%*
Will you use the technological solution again?	**Yes**	81 *96,4%*	11 *91,7%*	26 *100,0%*	21 *100,0%*
	No	3 *3,6%*	1 *8,3%*		
Will you recommend the technological solution to your colleagues?	**Yes**	81 *97,6%*	11 *91,7%*	24 *92,3%*	20 *95,2%*
	No	2 *2,4%*	1 *8,3%*	2 *7,7%*	1 *4,8%*
In your opinion, does the technological solution enhance the quality of your work?	**A lot**	28 *32,6%*	9 *75,0%*	8 *30,8%*	9 *42,9%*
	A little	54 *62,8%*	3 *25,0%*	9 *34,6%*	12 *57,1%*
	Not at all	4 *4,7%*		9 *34,6%*	
In your opinion, does the technological solution enhance the efficiency of your work?	**A lot**	19 *22,1%*	8 *66,7%*	8 *30,8%*	8 *38,1%*
	A little	64 *74,4%*	3 *25,0%*	9 *34,6%*	11 *52,4%*
	Not at all	3 *3,5%*	1 *8,3%*	9 *34,6%*	2 *9,5%*

Table 29: Satisfaction with technological solution; enhancement of quality and efficiency of work by technological solution

Concerning the quality and efficiency of the work of the teachers, the figures are a little different. For the Spanish pilot, most respondents claim that the quality and efficiency is improved only a little, although there is a group of respondents that claim that there is a lot of improvement, and hardly any respondents that see no change at all.

For the Apple pilot, most respondents see a lot enhancement of the quality of the work and also a lot of enhancement of the efficiency of their work.

For the Grenoble pilot, about one third of the respondents say that the quality and efficiency of their work improves a lot, one third sees it only improving a little, where another one third of the respondents see no improvement at all.

For the EUN pilot, slightly more than 50% of the respondents see a little improvement in quality and efficiency and slightly less than 50% of the respondents see even a lot of improvement. Furthermore, there is no respondent that claims that there is no change in quality, but two respondents claim that there is no change in efficiency.

Two questions were asked directly on the ease of use of the technological solution. The first was whether the respondents found the technological solution easy to use, and the second was whether the respondents thought that it was easy to use for pupils. The answers to these questions can be found in table 30.

In each pilot, at least two out of three respondents think that the technology is easy to use. For the pupils this is even 70%.

		CNICE	Apple	Grenoble	EUN
Did you find the technological solution easy to use	**Yes**	62 *72,9%*	10 *83,3%*	19 *73,1%*	14 *66,7%*
	No	23 *27,1%*	2 *16,7%*	6 *23,1%*	6 *28,6%*
	n.a.			1 *3,8%*	1 *4,8%*
Did your pupils find the technological solution easy to use	**Yes**	47 *70,1%*	12 *100,0%*	20 *76,9%*	16 *76,2%*
	No	17 *25,4%*		3 *11,5%*	4 *19,0%*
	n.a.	3 *4,5%*		3 *11,5%*	1 *4,8%*

Table 30: Easy of use of the technological solution (n.a. = not applicable)

Barriers for an effective use of the technological solution can be found in table 31. Respondents were asked to rate the barriers as 0 (not at all), 1 (a little) and 2 (a lot).

	CNICE			Apple			Grenoble			EUN			Total		
	Mean	N	SD	Mean	N	SD	Mean	N	SD	Mean	N	SD	Mean	N	SD
Lack of technical training	***1,06***	85	0,56	***0,92***	12	0,79	***1,19***	26	0,85	***0,81***	21	0,75	***1,03***	144	0,67
Lack of hardware	***0,73***	82	0,77	***1,08***	12	0,79	***0,65***	26	0,85	***0,67***	21	0,73	***0,74***	141	0,78
Lack of funding	***0,48***	80	0,69	***1,58***	12	0,67	***0,88***	26	0,91	***0,95***	21	0,80	***0,72***	139	0,82
Lack of software	***0,60***	81	0,66	***1,00***	12	0,74	***0,81***	26	0,90	***0,52***	21	0,81	***0,66***	140	0,75
Lack of pedagogical training	***0,47***	81	0,57	***0,75***	12	0,75	***1,27***	26	0,92	***0,62***	21	0,67	***0,66***	140	0,74
Computers broken	***0,60***	83	0,75	***0,33***	12	0,65	***0,69***	26	0,84	***0,62***	21	0,74	***0,60***	142	0,75
Lack of space in school	***0,55***	83	0,77	***0,25***	12	0,62	***0,23***	26	0,59	***0,86***	21	0,79	***0,51***	142	0,75
Lack of Internet access	***0,33***	81	0,59	***0,58***	12	0,79	***0,54***	26	0,81	***0,86***	21	0,85	***0,47***	140	0,71
Lack of support from colleagues	***0,28***	80	0,53	***0,33***	12	0,65	***0,38***	26	0,57	***1,05***	21	0,74	***0,42***	139	0,64
Lack of support from school administration	***0,41***	83	0,64	***0,17***	12	0,39	***0,08***	26	0,39	***0,57***	21	0,81	***0,35***	142	0,63
School policy	***0,25***	80	0,54	***0,08***	12	0,29	***0,35***	26	0,63	***0,62***	21	0,74	***0,31***	139	0,59
Lack of student motivation	***0,24***	82	0,46	***0,08***	12	0,29	***0,08***	26	0,27	***1,38***	21	0,59	***0,22***	141	0,45
Other[1]	***1,67***	9	0,71				***0,00***	1	,	***1,00***	4	1,15	***1,36***	14	0,93

Table 31: Barriers for an effective use of the technological solution (sorted by highest in the total column)

In the table means, Number of respondents and Standard Deviations are listed.
[1]Other reasons are listed in the text.

Obviously, technical issues, lack of funding and lack of training form the top of the list of barriers (although it must be said that a value of one still means “a little”). This is amplified by the reasons mentioned under “other”, were most of the reasons are specific technical problems, together with lack of time, problems with the English language for students, not enough computers and not enough space in the school, and difficulties to collaborate with other schools.

Student motivation, school policies and support of colleagues are hardly a problem.

In figure 32, the effect of the technological solution on the maintenance of computers and on the maintenance of the network and infrastructure is shown. On average, this has become easier for three pilots, but for the Grenoble pilot, it has become more difficult (on average).

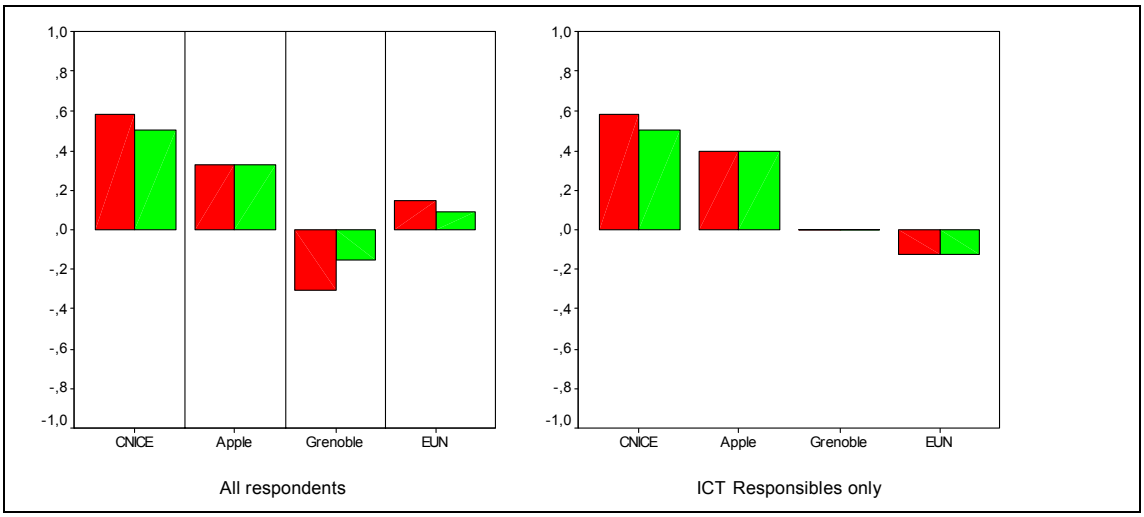


Figure 32: Effect of technological solution on maintenance of hardware

-1 = more difficult, 0 = no effect, 1 = easier. Red/Dark = maintenance of computers, Green/Light = maintenance of networks and infrastructure.

When the same question is analysed for only the respondents that were ICT-responsibles (possibly next to other roles), the pattern changes. The Grenoble pilot is improved a little towards “no effect”. From four respondents, two answer neutral, one states that it has become more difficult and one states that it has become easier.

The EUN pilot shows that the technical issues are more difficult for the ICT-responsibles than for the whole group of respondents, as the ICT-responsibles answer slightly negative, where the whole group was slightly positive. This is however due to the reason that from the eight ICT-responsibles, two answer negative and one answers positive. Thus it is necessary to interpret the results with care, due to the small number of respondents.

4.7 Cultural and Social Aspects

In table 33 is displayed that 50 projects in the Spanish pilots used teachers as resources or advisers. Only two projects used parents and two pilots used local communities. One pilot used local action groups and five pilots used elected representatives. No one used adult learning groups. Also many contacts with other schools were reported. The main reason for not using any outside groups as resources or advisors was that they didn't try (23x). Lack of time was also named often (10x).

The Apple pilot used mainly teachers as resources or advisors for their projects (9). Only three parents were used as advisors, one time the local community was uses and one case is reported for using adult learning groups. Two respondents reported lack of time for not using outside groups and two respondents report that they didn't try.

	CNICE	Apple	Grenoble	EUN
Teachers	50	9	19	16
Parents	2	3	8	7
Local communities	2	1	19	8
Local action groups	1		1	2
Policy makers	5		7	3
Adult Learning groups		1	2	1
Others	19		2	1

Table 33: Use of various groups as resources or advisors for projects

In the Grenoble pilot, the respondents report that next to the teachers and parents also nineteen times local communities are involved in the projects as recourses or advisors. Furthermore, seven elected representatives are involved, and some local action groups and adult learning groups. As other resources, companies, academies and personal resources are reported. As reasons for not involving other groups, one respondent names lack of time and one respondent reports the lack of time of the other groups.

The EUN Pilot, uses as resources and advisors mainly teachers, parents and local communities. Furthermore, three times policy makers have been used, two times action groups and one time an adult learning groups. As other resources a public Internet centre is named. The main reason for not using outside resources lay outside the schools themselves. No interest with the other parties was named twice, where no time with the other parties was named five times. Lack of time of the respondents themselves was only named once.

In figure 43 is shown that the contact with teachers and students has improved considerably for all pilots. For the Grenoble pilot, contacts with parents and with the local community have also been improved much. For the Apple pilot and the EUN pilot this is only a little, where in the Spanish pilot there is almost no improvement. The contact with local action groups, policy makers and adult learning groups has hardly been intensified in the Spanish pilot and the Grenoble pilot, where these contacts have been a little bit more (but still not much) in the Apple pilot and the EUN pilot.

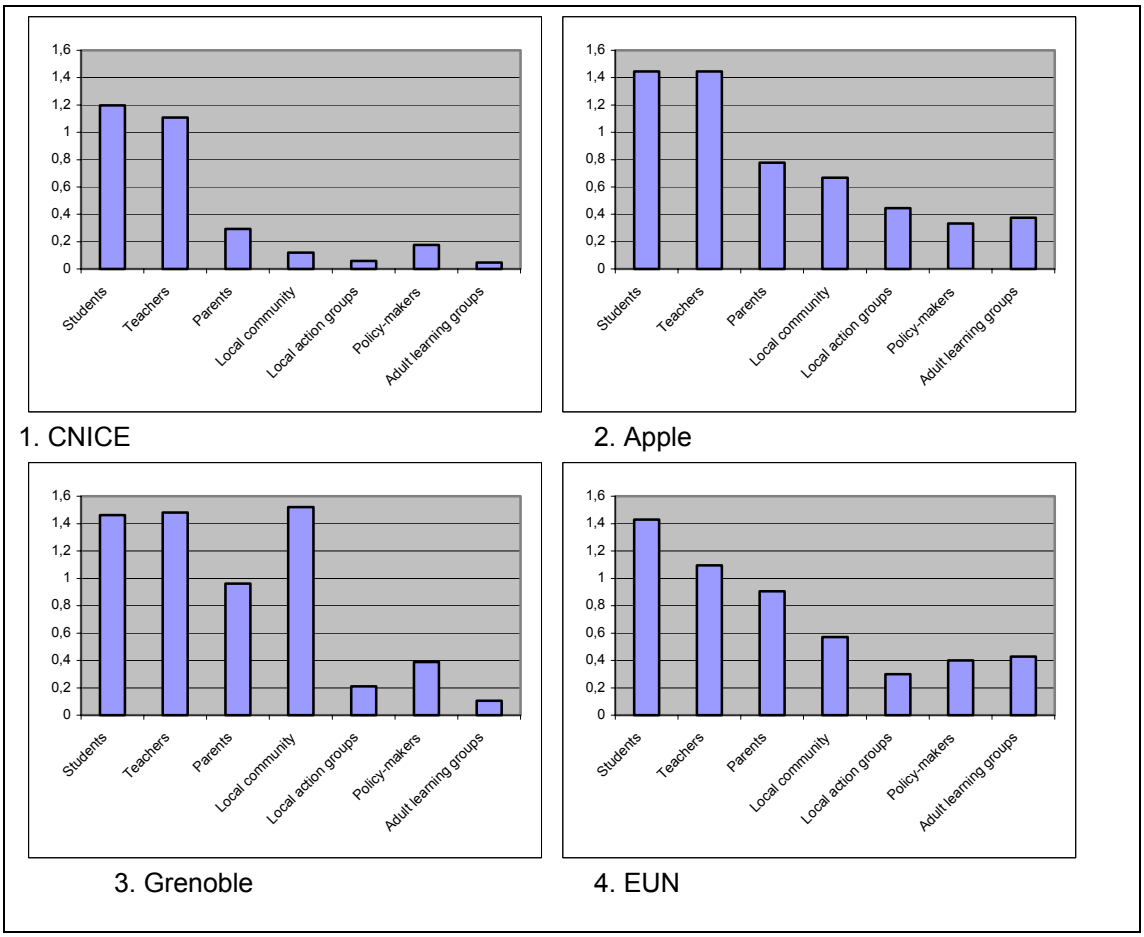


Table 34: Improvement of contacts between respondent's school and other groups outside the school

(0 = not at all, 1 = A little, 2 = a lot.)

5 Conclusions and recommendations

In chapter 3 the results of the local evaluation sites have been discussed, and in chapter 4 the data and results of the global evaluation questionnaire have been presented. Some conclusions were made in these chapters, but chapter 5 will be concerned with the major conclusions in the five dimensions of the POETC framework. The chapter will make an attempt to draw the bigger picture, based on the findings in the local evaluation sites and the findings from the global questionnaire.

5.1 Pedagogical dimension

It becomes clear from the data received via the global questionnaire that for teachers it is difficult to start using new information and communication technologies simultaneously with new pedagogical models. It seems to be hard to concentrate at the same time in two very different new aspects, i.e. pedagogy and ICT applications, as they both require using a variety of teaching skills such as organisational, pedagogical as well as technical skills. Thus, a good training is necessary for the back-end technologies and software application used as well as the pedagogy. It could be advised that the both training would take place simultaneously, but advance step by step so that the trainees would have enough time to grasp the pedagogical concepts as well as the use of technical solutions. It is also advised that the technical training would have pedagogical starting points from the beginning on. This approach has also been proved successful in “pedagogical driving licences”, a training practice that started from Denmark and is now widely spreading in Europe.

Furthermore, the experiences retrieved from the Spanish pilot (1) and the EUN pilot (5) underline the importance of the continuous pedagogical support for teachers while implementing a new pedagogical project with new teaching practices and philosophies. In both pilots, pedagogical support was realised throughout the pilot, teachers needed help in designing their projects and, especially in the case of the EUN pilot, a lot of supportive pedagogical guidance was given in the beginning of the project implementation. At that moment many of the teachers realised that they were not necessarily confident enough in implementing new practices, especially some feedback from pupils/students and co-workers needed to be discussed with peers who were going through the same experiences, as well as with tutors who could related to the situation still seeing it from the external point of view. Both pedagogical supports implied blended learning methods, in the case of the Spanish pilot, there was an increase in the pedagogical staff to support the project participants, whereas in the case of the EUN pilot the support was in a form of web based forum that took place bimonthly. It should be recommended that if this kind of support is organised, participation to it should be made as a mandatory part of the training, this would enhance the number of participants, create better group dynamics and result as better peer learning experience.

Though not so many resources were initially allocated to pedagogical support of the schools in Spain, the pilot coordination has realised the importance of the close continuous support and follow up of the school teachers and has substantially increased the pedagogical staff for this purpose. This assistance has been crucial for the teachers, at the beginning to take benefit of the distance training (it has been indeed a blended training), later in the milestone of drafting their own projects, and all the time to feel that the project and the Education authorities did not leave them alone in the classroom. It has been very important the support of the Areas of Education Programmes of each Province, depending

on the Council of Education of The Autonomous Community, working closely with the team of the Ministry and helping with the local Education difficulties.

The experience from the use of pedagogical support in the EUN pilot also showed that although not all the participants asked actively questions, many of them estimated at the later point that reading questions from other teachers helped them significantly. After all, many of the teachers were in the same situation, but thought that they were the only ones going through the particular experience. This resulted in an idea of collecting pedagogical Frequently Asked Questions (FAQ) especially dedicated to go through experiences that teachers are exposed to while implementing computer based collaborative learning (CSCL) methods. This is subject to a further area of study in the future.

On the average the respondents to the global questionnaire estimated that the lack of technological training is “a little” barrier to use the OASIS technologies effectively. This could be seen to be in accordance with the satisfaction to the technical training received during the pilot: more than 60% of the respondents estimated that they received sufficiently technical training. The remaining amount of about 40% who estimated that more technical training would be needed is fairly large and invites us to believe that the initial level of the participants probably was somewhat varied. Thus, it could be beneficial to supply technical training that would also fit to the technical level of each participants, in that way the training would be more focused and probably also more efficient.

When it comes to the lack of pedagogical training as a barrier to use the technological solution efficiently, less than half of the respondents estimated it as “a little” barrier. More than two thirds (2/3) of the respondents said that the pedagogical training received was sufficient.

It became, however, clear from the local evaluations that many of the teachers estimated that the short preparation time and time to implement their projects caused some problems both on the technical and organisational front. New developments that include both change in technology and pedagogy need more time for planning and preparation.

Having concluded that on the training and preparation side there are room for improvements, many interesting projects have been conducted, including new pedagogies and pedagogical change for both teachers and students. On the average, 68% of the respondents to the global questionnaire estimated that there was “a little” change in their pedagogical approaches, whereas 20% estimated that there were “a lot” of changes in their approaches to teach. 14% estimated that there was “not at all” changes. It appears that the Apple and EUN pilot had the most “a lot” changes in pedagogical approaches, while the other pilots had clearly over half of the respondents estimating that they had “a little” changes. Thus, it can be estimated that there was some pedagogical shift taking place due to the OASIS pilots and their training.

Looking more closely to the pedagogical changes, it can be suggested that the changes in the pedagogy were towards the desired outcomes, the collaboration among colleagues was estimated to be “more” in more than half of the replies to the global questionnaire. Furthermore, collaboration among students increased dramatically in all the pilot sites (in all cases more than 57% replied “more”). It was also estimated by the respondents that learning became more student-centred in all pilots but Grenoble, where the respondent estimated that there was “no effect”. Moreover, when the participants were asked to assess the way that the ICTs are used, there was a great shift towards collaborative learning methods (in 3 out of 4 pilots more than half used them for collaborative learning). Here the Apple and EUN pilots have the most similarities, in both ICTs were used by more than half

of the respondents to make demonstrations and project-based learning. In the Spanish pilot computer-assisted instruction was practiced with most respondents, and in the Grenoble pilot remediation and supportive exercises were practiced a lot. Neither of these findings necessarily complies with the basic ideas of CSCL, but maybe some differences in educational culture and the tradition of computer use can help to interpret this data.

From the global questionnaire, we can observe that all the technologies piloted in the OASIS project were used for all learning subjects, although technical subjects and language are the most prevalent in the projects carried out.

The most remarkable change in all the pilot sites seemed to be the fact that students' motivation increased dramatically. This, among other positive effects, resulted in the fact that some of the motivationally or mentally challenged pupils in the pilots have improved their performance due to the fact that they were more enthusiastic, collaborative and able to approach learning in new ways. In the Spanish pilot, teaching in the computer lab proved to be particularly efficient for pupils in special need groups. In the EUN pilot, for example, the jig saw method empowered pupils who had difficulties in performing within normal lessons.

These two aspects, the fact that computed based and/or assisted learning can help challenged students and also the fact that the new teaching methods involve and empower the variety of learners approved an eye-opening experience to many of the participants and also well marks the point that ICT applications combined with collaborative teaching styles allow more individualised learning experiences for students. From the global questionnaire one can gather that, in general, learning became more individualised in all pilots but EUN where the majority estimated that there was "no effect" on this. In comparison to the above qualitative data this quantitative data might seem to be in discrepancy, but it would be good to note that the perception of the terminology might be misleading for some of the teachers who responded to the questionnaire not in their native language.

When asking the respondents of the global questionnaire what groups did they estimate that would be satisfied with the new pedagogues and technologies, all pilots report that the students, the respondent themselves and the school are the groups that are most satisfied. For (other) teachers and parents this is less the case, and for the local community, elected representatives/policy makers and adult learning groups, benefits from the pilots were virtually non-existent. However, it is important to note that in the local evaluations some important linking with outside of school communities occurred. In the Grenoble pilot, it was estimated that the local community was satisfied, and the Apple pilot, where both the local community and the policy makers were estimated to be satisfied. Furthermore, relating to the pedagogical ideas of reaching outside of school boundaries for learning experiences, fairly mixed results were found. It could be observed that there were some difficulties in achieving this, which is further elaborated under the Cultural/Social dimension of the POETC framework.

When relating these results to the research questions on the success of the pedagogical models that are proposed, we can conclude that in all pilots, projects have started in which teachers introduced approaches similar to computer supported collaborative learning (CSCL). It can also be said that teachers were enthusiastic about these new pedagogical approach and in many cases estimated that it was a good learning experience for them and a beginning for some new practices that they will apply in their teaching in the future.

However, training is needed to take full advantage of this new pedagogical approach**.** Teachers who were not properly trained encountered more difficulties. Not only the new

models need to be the focus of training, but also the technical issues need to be mastered, in order to let projects run fluently.

Good examples of problem-based learning can be found in the pilot of EUN, where teachers adopted the PIM model, and the jigsaw model. These models combine CSCL with problem-based learning. One of the remarks coming from this pilot was the fact that more tools would be needed to facilitate the combination of pedagogical approaches into the use of ICTs. The Future Learning Environment 3 (FLE3), was found useful in implementing Progressive Inquiry Model into teaching, but more similar tools would be needed to implement other approaches such as Jig Saw. These tools need to be readily available for teaches without too much of installing and server setting-up procedures, which are too complicated for the average teacher to perform. Thus, more Application Service Providing is needed for schools from the centralised sources such as ministries, national agencies and European networks.

5.2 Organisational dimension

The organisational dimension is concerned with the impact of the technology on the organisation aspects of the school. From the global questionnaire we are able to learn that prior to the OASIS project, much of administrative tasks were already computerised. The technological solutions, as used within the OASIS project, made many tasks easier, and some tasks more difficult. In the Spanish pilot, the respondents claim that the creation of timetables became much more difficult. This probably has to do with the scheduling of the computer lab, but also with the fact that finding space for the OASIS pilot in the normal timetable proved to be difficult. This, on the other hand, reflects indirectly the fact that the school organisation probably wasn't prepared enough for the experiments that were required in the OASIS pilot such as flexibility to work with computers and arrange teamwork around the needs of each pedagogical projects.

For the Apple pilot, staff tracking and student tracking, and the co-ordination of projects became particularly easier. Within the EUN pilot, the co-ordination of projects was named as the task that has became much easier, together with student tracking. In the Grenoble pilot, no tasks were named that became much easier or much more difficult.

What respondents in many cases claimed to need most to use the technological solutions more efficiently was an ICT-co-ordinator. This co-ordinator would be responsible for the co-ordination of ICT related programmes and technical maintenance. Also, a person dedicated to pedagogical co-ordination and support was needed in some occasions,

In all pilots, respondents report an increase in preparation time. On the other hand, small time gains are reported for various groups due to the use of the technological solutions, also for the respondents themselves. This indicates that the time loss, due to more preparation time, is balanced with some time gain elsewhere. Maybe the fact that new pedagogical models require more preparation is balanced with good technological support to assist the teacher in incorporating the new pedagogical models. The increased preparation time was also explained in some of the local evaluations as a beginning of the learning curve. These teachers estimated that doing this kind of a pedagogical project implementing ICTs is labour-intensive in the beginning, but would take less time when applied for the second time, as many of the processes and organisational matters would be more familiar and already planned. Most time gain is expected for students. Also time gain is reported for teachers and the school. It could be speculated that because across the board both the technology and pedagogy were new to most teachers, then naturally this

would initially increase their time investment. However to get a more balance picture one would have to revisit these practitioners after a period of familiarisation to ascertain if the time investment remained at a high level.

When it comes to the teachers' satisfaction to the organisational aspects of the technologies applied, the results in many of the pilots were positive. In the Apple pilot, teachers were very happy with the flexibility of the wireless solution with laptops. In some schools, the success of the technological solution almost created problems: as many teachers heard about it, they wanted to use it, which caused some scheduling problems.

Within the Spanish pilot and the SUN pilot, School Servers and Zonal Management Servers were installed. Teachers were afraid that this would cost them much more time for maintenance, but the opposite proved to be true. The reduction of maintenance time for these servers is discussed in the next paragraph on the economical dimension.

What comes to the experiments with SLIS/SLIM the local evaluators are very positive about the ease of use and security aspects that they provided. Also, the fact that this type of technology allows the partial centralisation of some of the services was perceived as a success factor on the local evaluation level. Also, the integration of the project-tracking tool in the Grenoble pilot approved to be successful among the global questionnaire respondents. About half of them estimated that it made the coordination of projects easier.

5.3 Economical dimension

When concentrating on the respondents that were either school principles, ICT responsibles, deputy or assistant principals or co-ordinators, we see that for the Apple pilot, these respondents think that there is some financial gain for the school, for the students and for the teachers, and to a lesser degree for the local community. In the Grenoble pilot, however, some financial gain was estimated by the respondents for the school and the local community. Within the EUN pilot the respondents didn't see much financial gain for any group, most gain (but still little) is found for parents, surprisingly enough. These differences reflect somewhat the variety of focuses of each pilot.

An important economical factor that is repeatedly underestimated in the world of schools is the aspect of time. It is important to stress the fact that increased preparation time for teachers is an economical factor that needs to be accounted with. On the other hand, the respondents report that there is on average a time gain for themselves and for all other groups, so apparently the increase in preparation time is balanced with some time gain elsewhere.

Another issue related to costs and how to reduce them is maintenance of computers and networks. Next to the purchase of hardware and software, the maintenance of computers and networks costs much as well. Within the OASIS project, SUN has tested thin client technology. This means that there is only one server computer that need to be managed and maintained. All other computers in the school are 'clients' that do not need maintenance. This implies an enormous reduction of the management time. Furthermore, there can be reduction of software costs, as this needs to be installed on only one machine.

In the SUN pilots as well as in pilots in Spain and France the servers used were UNIX or Linux based, also fewer problems with viruses are reported, which means cost reduction as well. All these advantages are recognised by participants in the pilot, although some problems with the technology are reported as well. Furthermore, the networks provide

protection against e-mail viruses, intrusive attacks etc. During the OASIS project, no intrusions have been reported. Combined with the fact that these technologies are based on open standards and at some cases also open source, one can conclude that these systems are stable, reliable and extremely powerful, a combination that can also result as an decrease of costs.

Running and maintenance of ICT infrastructures also present major costs. In the pilot sites different solutions were employed to ensure the communication services offered for schools. The participants in the Spanish Ministry of Education pilot and three of the schools of SUN pilot test the technological architecture and services developed and offered by using the School Server (Server) and a Zonal Management Server (ZMS). In Grenoble, the SLIS/SLIM services were used in the large scale. In the case of the SUN pilot schools, the school server services are implemented in a SUN Cobalt Qube, in the schools of the Ministry, in a similar Linux version installed on PC and in the case of Grenoble, the solutions were also based on Linux installations. The centralisation of the services seemed to prove somewhat cost efficient, although in the case of the Spanish pilot (1 and 3), the complexity of this school network setting produced a delay to start and some extra costs in providing the support.

The Apple pilot shows another possible reduction of costs: The wireless classroom. The solution with the laptops inside a cart, that can be used inside any classroom, and that have a wireless connection to the school network in any place in the school, save the schools from having to build and redecorate entire classrooms to make computer labs out of them. Furthermore, much less cables and infrastructure is needed within the building. The fact that schools found money in their own budgets to purchase more laptops proves that schools indeed see the added value of this wireless solution.

Another important factor that has some economical implications for schools is the impact of Open Source Software and especially the use of open technical standards that allow easy integration of technologies. In the case of SUN thin client usage, open source and open standards servers in the case of Spanish ministry and Grenoble pilots, this is recognised as a factor that can result as a cut in the costs of the purchase of software. Also, the EUN pilot offered some free educational platforms for the pilot participants to use, the EUN Community and the FLE3 application, both of which ran freely on the EUN servers for schools to use. Additionally, the Spanish schools were offered free educational resources through the Open Software Library. Thus, the OASIS pilot has contributed to the effort of bringing Open Source software closer to the educational community, which can play of a major importance to make sure that the use of open source systems will grow in the near future.

5.4 Technical dimension

For all pilots, the majority of the respondents were very satisfied with the technological solution. They plan to use it again, and recommend it to colleagues. Most respondents also claim that the technological solutions are easy to use for themselves, but also for their pupils.
When asked whether the technological solution has increased the quality and efficiency of their work, the respondents are also quite positive (on average).

These positive figures are supported by the experiences from the local pilot evaluations. However, there have been some local difficulties. Pilot 1 and 3 have faced a complexity in the school network that has produced a delay in the availability of the technological

services for a part of the teachers. The result was a delay in the beginning of the experimentation in the classroom. Though this is detailed in the report of pilot 1, we have observed this difficulty in previous research, development and experimentation projects. Too frequently projects are not realistic enough when assessing the problems of putting into practice the developments done within the project. The debugging of the developments begins as of the installation in the pilots of the tools designed. A further difficulty appears when the complexity of the pilot sites requires a different detailed study of each of the pilots' configurations.

The main technological proposal of the project, developed in WP 4.1 (ZMS) and 4.2(School Server), needed a close technical support for the installation in the school networks in a reasonable time. The technical teams of DIT and SIRE in Spain had to pay many visits to the Spanish schools to complete the installation of the school servers, before the distance service provided by the ZMS could reach the school networks. The localisation of the schools to experiment this technology in a larger European territory would have produced a cost difficult to balance with the rest of the project.

It is recognised that training for the technology is necessary. But after receiving training, all technologies that were tasted could be used.

Oasis project has contributed to the effort of bringing Open Source software closer to educational community, which is a key to make sure that the use of Open Source systems and standard-based technologies will grow in the near future.

5.5 Cultural and social dimension

One of the aims of the OASIS project was to connect the school and the learning that takes place within the schools with actors outside the school, preferably groups and organisations that are located in the neighbourhood of the school. The idea was to strengthen the ties between the school and the neighbourhood and thus make the school a part of the local community, instead of a building where pupils enter in the morning and exit in the afternoon. ICTs provide a tool that can make contact and collaboration with actors in the local community possible and somewhat easier.

The results derived from the global questionnaire are encouraging concerning this cultural and social dimension. In all pilots, learning outside the school has increased. For the projects conducted within the OASIS project, the main resources outside the school that were contacted were other teachers. But especially in the Grenoble pilot and the pilot of EUN also parents and the local communities were contacted. In the Grenoble pilot and in the Spanish pilot, there was some contact with policy makers.
Furthermore, the figures show that contact with other teachers and with parents has increased considerably in all pilots. In the pilot of Grenoble, the respondents of the global questionnaire report that contact with the local community has also improved much.

Despite these positive figures as a response to the training and pedagogical focus given to the pilots, the conclusions should not be too straightforward. Many respondents report that they did not have a chance to contact actors outside the school, and in many cases this was due to the lack of time and other time constraints in their work. For some respondents, the reason was lack of interest from the outside actors such as parents or experts. Especially for the EUN pilot, the main reasons for not contacting others were reasons outside the control of the school. This illustrates well that the current educational cultures in many European countries and schools don't even expect schools to reach out of their own

boundaries, let alone encourage them to interact with the local communities. Interestingly, interaction on the European and global level seem to be more of the mainstream than being active in the local community.

When looking at the local evaluations, inspiring examples can be found. From the Apple pilot, it becomes clear that creating iMovies is a great way and a powerful tool to communicate with others. These movies were not very difficult to make for the children, but the result was impressing for other people. Furthermore, bringing equipment (laptops, video camera's) outside the school to gather raw footage and material, but also to use it as devices to support communication, is found to be powerful. And the power of media-rich environments can also be expected for communicational forms like live video conferencing. The other positive examples such as Cartable Electronique "linking together school, parents and society" and examples of interesting citizenship activities in the EUN pilot should lead the way together with initiatives from national and local educational authorities supporting and creating incentives and means for schools to reach out to the communities outside.

From the EUN pilot, it becomes very clear that a community of teachers is very important to make projects like the OASIS project successful. Within the EUN pilot, teachers were encouraged to use innovative pedagogical ideas and approaches, and by forming a community, teachers were able to benefit from the peer learning and support one another to achieve their pedagogical goals. For this group dynamic to take place, it was crucial that there was at least one face-to-face training session, whereas the rest of the communication was conducted in a virtual environment that was used as "reflective chatting" environment. It is important that teachers, who are faced with implementing collaborative teaching and learning methods also get a chance to use them too for their own learning experience. Also some computer supported collaborative learning projects between classes of different teachers have sprung out of this community.

Moreover, the question of ongoing and final assessment of activities done in applying not so conventional teaching methods is crucial. There is an urgent need to find new ways of assessing the developments and achievements of students under the CSCL and project-based approach to pedagogy. Some countries already have integrated this kind of evaluation guidelines into their national strategic plans.

A last, but important, conclusion that comes from the EUN pilot is that the school and educational culture is very important for the success or failure of the adaptation of new pedagogical approaches. Even when teachers are very enthusiastic about implementing new ideas like CSCL into their teaching, a system that does not enable or even hinder these initiatives can prove fatal. Hindrance can come from many sources: rigid timetables, lack of support from management or fellow teachers, attitude of students and parents, assessment methodology. It can be said that not the technology is the problem for implementing these new pedagogical approaches, but the local cultures.

5.6 The OASIS pedagogical models revisited

An IST-project like OASIS, situated within the theme 'Schools of Tomorrow', involves, in addition to technology development and pedagogical desk research, major interventions within existing schools: these are the places where the actual implementations takes place, and where indications are to be found on technological and pedagogical improvements and innovations that were achieved.

In OASIS the existing schools are diverse in many respects, and no uniform approach is possible. The learning patrimonies and legacies have to be taken into account[15], the range of specific historical, socio-cultural, economic, political factors that have shaped educational systems and institutions. With regards to pedagogical innovations the above-mentioned patrimonies and legacies set limits to the degree in which pedagogical models can be introduced and implemented. For example in a country with a fixed national curriculum, innovations can only be introduced if they are part of an accepted framework for educational change. In a country with broad guidelines for what is allowed and expected from education (like attainment targets and competencies, without prescriptions at curricular level) pedagogical models that differ from traditional teaching and learning are easier to introduce. There is more 'freedom'.

In all cases the matter of 'ownership' is important. If teachers design or introduce new aspects in their education themselves there is more of a feeling of the ownership, as the approach appears to be more bottom-up. Often however, if innovations are top-down introduced the 'not-invented-here' syndrome emerges, with resistance and limited sustainability. The involvement of schools in a project like OASIS has both the top-down and bottom-up elements. Although user requirements were mapped and projected, the details of pedagogical innovation can often not been overseen by the future actors involved. It is not simply demand-driven, as the demand is not articulated yet, a factor observed in many instances of ICT-innovation in many fields. 'Who could have thought that the Web (or other technologies) would have such an impact on the quality of …x..?', is a question often heard.

The coordinators of the EUN-pilot articulate that in hindsight the greatest barrier to the fullest implementation of the different pilots was the short time frame afforded to schools to implement their projects, as well as fully explore and absorb the pedagogical models. The results of the pilots therefore have to be interpreted as pointers to conclusions rather than absolute conclusions. For absolute conclusions one would have to carry out the classroom activities over a much longer period of time. However, the impact of trying out these new practices seemed to have a profound effect on the teachers involved, challenging them to think about their own pedagogic practice in a way not seen before and to become more self-reflecting professionals in their jobs. Whether they were positive or negative about the experience, they were forced to examine and think about the way they teach and the impact that has on their students learning. Technology became a vehicle for their own learning and pedagogy as well as the focus of the teaching of and learning of their pupils.

So there are many factors that prohibit a prescription of one 'model' that applies to all contexts. It is not a matter of a broad un-focussed approach of implementing and testing of pedagogical "models", as reviewers have noted after the review. It is a matter of describing rich ideas and scenario's for improving education with ICT, to be situated, localised, translated by local actors. The role of the pilot coordinators is big: they are the intermediaries for the localisation, and through in-service education and training on both technological and pedagogical dimensions the main instruments for the actual formation of ownership at the side of the ones who will decide whether the innovation will have chances to become sustainable.

This sustainability, as argued, is connected to ownership at individual (teacher), organisational (school educational culture) and systemic (national or regional) level. Collecting and disseminating examples of good practice is an important motor for sustainability and further developments and innovations. What is good for one teacher or

[15] see http://www.pjb.co.uk/npl/bp7.htm

student in one context can be bad for the other actor in another context. So it means that practices are to be exchanged to foster continuous improvement of ideas and practices. This is why communities of practitioners (and learners) in which learning from and with each other deploys are of evident importance. Other tools can be of help such as the Idea Bank in IST-project ITCOLE, and the Lesson Bank in IST-project Celebrate. The lesson plan accompanying educational applications has also become somewhat a more common practice by some Ministries of Education and other educational agencies.

The first deliverable 1.2 with the title 'Preliminary Collaborative Learning Model' has been (re)source for teacher training and for on-line support, both static and dynamic as part of input for discussions within these learning communities, as it not only contains a series of pedagogical models, but also their building blocks, different scenarios and concrete projects to be used or adapted. In the peer review of the deliverable it was stated that all the dimensions of the teaching/learning process have been analysed in a consistent scenario which includes also good practical suggestions on how to implement projects that can succeed in connecting schools to the outside. The consideration of the involvement of the society and experts is well included in the overall scenario provided by the deliverable. Furthermore it is stated that "the analysis of pedagogical models is wide and theoretically grounded in a strong way. It is highly consistent with the most recent advances in educational psychology (learning in and out of schools, the apprenticeship model for successful learning, the learning by doing, etc.). Moreover, the analysis of best practices shows good examples of collaborative learning experiences and discusses the main elements that play a role in facilitating the success of the educational experience". "The deliverable has a strong potential for inspiring the educational implementation of technological solutions even in different situations, like in OASIS test sites. It shows very clear indications on how the OASIS sites can start successful implementations in different test sites. It could be used also as a starting point in teachers training activities for newbies or as part of online material for those sites, as the Spanish one, where online teachers communities are foreseen."

This validation report has sections on successful implementation of many pedagogical aspects. It is demonstrated that many elements of pedagogical improvement have been observed and are reported by the actors involved. The preliminary pedagogical models as sketched two years ago has proven to offer a fertile soil on the basis of which in different contexts innovative learning and teaching activities and practices can grow. One aspect that could be more reinforced in the pedagogical model, though, is the importance of the peer-support and peer-learning possibilities for teachers as practitioners of Computer Based Collaborative Learning.

6 Recommendations

Many lessons can be drawn from a complex and ambitious project like OASIS and it is important to express them clearly in an actionable way so that others may benefit. Therefore, the OASIS evaluation team makes the following recommendations.

6.1 General

- The POETC analytical framework should be used as a basis for evaluating the penetration of ICT practices in schools and also for identifying areas in which more effort is needed to be able to claim that ICT deployment has been successful. It includes a pedagogical vision including organisational aspects, economic implications, technical implementation as well as the cultural and social aspects of the ICT experiment The POETC framework should be used in the planning and implementation phase of any ICT project in order to focus on the total and sustainable implementation of ICTs and practices to use them in schools.
- The framework should also be a vision that decision makers, school management and teachers share.. The POETC vision should also include common understanding of concepts such as what is knowledge, what is learning, what educational goals and aims are set and for whom.

6.2 Pedagogical

- Teachers' professional development is the key to the success of any ICT related implementation. ICT skills, and notably knowledge of how to use ICT for pedagogical goals is vital. In both pre-service and in-service training teachers should be made aware of different roles that they have as a teacher, and educated accordingly. The different roles include being:
    - a reflective practitioner, using tools like reflective notes
    - a researcher, on the search for improving the learning environment
    - an educational (or instructional) designer, experimenting with new arrangements
    - a coach for pupils and other teachers

- Blended pedagogical scenarios are recommended for teaching with ICT. A mixture of classical face-to-face, problem-based, individual or group work as well as collaborative working methods seem successful. In the same way, mixing physical teaching situations with virtual ones is recommended.

- Learning resources (web-based, cd-roms), educational web-applications and other tools such as learning environments, mind-mapping tools, etc. should be readily available for teachers to use. The guidance to use those resources should be available and shared freely. This could be in format of demonstrations of projects in schools or among an educational district, or in a form of lesson plans related to a specific piece of resource.

- A creation of pedagogical FAQs would be beneficial for the transferability of good practices. Teachers encounter very similar problems, but are sometimes reluctant to ask the question or do not find the right place to ask the question. Thus, the Frequent Asked Questions-model could be applied to pedagogical questions.

- Adjusting evaluation and assessment methods to fit the learning and teaching purpose is recommended. Formative evaluation such as use of portfolios seems to be suitable for ICT integrated learning, as well as self-assessment and evaluation done by peers where collaborative learning methods have been used.

6.3 Organisational

- The curriculum and school atmosphere needs to be flexible and offer incentives for teachers to start implementing new ways of teaching and learning. Policy and decision makers should consider that in their planning.

- Organising training, both initial and in-service, for acquiring pedagogical skills to use ICT for learning purposes should be part of the national policy. This should ideally not be left to individual teachers to choose as optional studies, because, in future education, learning *with* ICT, not learning *about* ICT will be part of the whole educational arrangement.

- School managers should seek to find total solutions for the technology implementation in schools. It is labour-intensive to have several separate applications to serve all the different needs from storing student data, to organising timetables, tracking the diverse projects that students and teachers are involved and coordinating library and food services. Managed information systems and broader frameworks for educational technology in schools with easy to use tools should be put at the disposal of teachers and school administrators. In this context SIF (School Interoperability Framework) and its European implementation becomes relevant and beneficial. Furthermore, the project tracking tool designed by the Académie of Grenoble would be interesting also on a European level.

- In-service training should include project management skills and focus more on setting up trans-national school projects and an emphasis on the acquisition of project planning skills with realistic educational goals. Tools and guidance are needed for teachers better to understand differences in school educational cultures across Europe and beyond. Also, time management skills for the overall project should be developed. Time is needed for teachers to prepare their projects, to involve others, to get familiar with using ICT and to start collaborating effectively with their peers inside and outside school boundaries.

- Pedagogical coordinators and tutors are as much needed as technical assistants.

- Teachers shouldn't be overloaded and overworked i.e. punished for implementing new ways of learning and teaching.

6.4 Technical and Economical considerations

- Sometimes easy, low-maintenance and not-so-leading-edge solutions can be found interesting for schools. For example, the use of ZMS (Zonal Management System) and/or SLIS/SLIM was found to be a very useful, low-cost solution that helped to ease the organisation of the work of a lot of system administrators.

- Educational applications that help and support teaching and learning should be made readily available for teachers. The resources made available for teachers through the Spanish Ministry's portal and web-based learning platforms made available by EUN (EUN Community and FLE3) and Grenoble (Cartable Electronique) were much appreciated by teachers. Thus, it is recommended that centralised (local, national, European) services should be offered to schools with minimum costs as a supplement to solutions that are made available for commercial providers.

- Computers should be made widely available to teachers and preferably teachers would own their own computer which has proven to enhance its use for learning purposes too.

- Computers should be used as a means to enhance learning, they should not be locked away in a computer room, but be made available in classrooms and libraries where learning naturally takes place.

    - The provision of equipment and training should be kept open in schools. School communities should reflect how to, for example, create a funding process that allows for 1:1 wireless laptop and peripheral tools' availability for all schools throughout Europe.

    - For example in the Apple pilot it was clear that bringing the technology to the students/teachers is a more flexible option than bringing students/teachers to a computer lab.

- Technical development of tools for educational use should start from pedagogical needs: when developing technologies for school settings it is extremely important to have proper user requirements analysis and not to just take "a commercial" solution without further reflection on its usability in the long-term in schools and pedagogical situations. Development teams should consist of pedagogues and technicians who should agree on the development plans right from the start.

- OASIS technology should be seen as a tap that gives the water, the outlet that gives electricity; it is the medium, it should be maintenance-free, it should be interoperable, scalable, and cheap. What to do with the 'water' and the 'electricity' is the domain of users and professionals.

6.5 Social and cultural

- School organisation in general plays an important role in creating a positive learning environment. Education is about interaction within class, teachers, parents, outside experts. It is therefore recommended that involving actors from outside the conventional school community can bring richness to learning. Actors to be involved could be parents, locals, experts, grandparents, commercials, local interest groups, NGOs, etc. The contact can be kept alive both by physical means and virtual ones, and should be based on solid pedagogical arguments.

- Teachers should communicate their interest and skills in ICT with pupils and students. Too often the “technophobe” teacher gives an image to students that it is OK not to use ICT or be interested in it. This can have an influence on the fact that girls are less interested in technology than boys, who often get positive role models from male ICT teachers.

- Learning communities, both physical as well virtual, should be a priority. These communities need tutors or mentors who take the lead and can give guidance, support and scaffolding for teachers in both ICT and pedagogy related questions. Teacher training, both initial and in-service, should make it a vital part of education.

- Every school should have an online community where teachers can share and discuss issues related to the practices in implementing ICT as well as pedagogical practices. This would enormously enhance the exchange of good practices and also make many of the practices more transparent. This open atmosphere of sharing and peer-learning could also help to create a better working environment in schools. In some cases the main obstacle to implementing the pedagogical project in schools was other colleagues.

- In a similar way, virtual communities can be beneficial for teachers to discuss specific interest points related to ICT and their pedagogical implementation. These virtual groups, although maybe less official in their nature, should also have a tutor or a mentor to respond question, to support, give guidelines and also to steer discussion and bring new aspects in. In the EUN pilot such a community proved indispensable for the success of the pilot. In the case of this pilot, the support group applied the blended method; participants had two face-to-face workshops and prescribed times for virtual meetings. It is recommended that such practices be applied, as they seem to have been proven more powerful for group dynamics than only 100% virtual groups.

6.6 Steps forward

As the OASIS technical annex states, some “guidelines for the following steps to be taken after the end of the project” are expected. European Schoolnet, as a “well-networked” partner of the project, has included aspects of OASIS in its initiative called LIFE, eLearning Interoperability Framework for Europe. The purpose of LIFE is to establish a framework among the Ministries of Education in Europe and other interested partners for common action, work and approaches towards standards and interoperability for a European eLearning area, thus a very relevant forum to further advance the technical aspects of OASIS. The LIFE launch conference took place in March 2004 where OASIS-project was also presented for about 80 European participants. Six months later, in the first LIFE Expert group meeting, where about 10 ministries and about 10 eLearning Interoperability experts were present, issues related to the interoperability, infrastructure, architecture and metadata were on focus with the aim of achieving a common action plan for the future.

Furthermore, the training model used in the EUN pilot for 25 European teachers will be incorporated in the training of National Support Services for the use of the new eTwinning platform.

Steps forward also include looking for new opportunities to continue to work with the OASIS consortium members in the development of new educational solutions, to work on the awareness raining of new pedagogical approaches and Computer Supported Collaborative Learning as well as to pursuit the work on standardisation efforts in the field of education in the future.

6.7 Appendix 1: Global on-line questionnaire

Dear Respondent,

You have been participating in one of the pilots of the OASIS project. Below is a list of all pilots, including the technology they have been using.
In this questionnaire, we ask questions about the technology you have been using and how it has affected your work in various ways, and in particular your pedagogical approach.

The pilots, and the new technologies tested, are:

	Name of the pilot	**7 Technology used**	**8 Pilot contact person**
1	CNICE	Oasis Architecture	Agustin Muñoz: amun0033@sauce.cnice.mecd.es
2	Apple Wireless Ubiquity	Apple Wireless Classroom, media rich learning material	Josiane Morel: morel.j@euro.apple.com
3	Academy Grenoble	SLIS, SLIM	Pierre Rostaing: Pierre.Rostaing@ac-grenoble.fr
4	EUN	Open Source CSCL software VARIOUS TYPES	Riina Vuorikari: riina.vuorikari@eun.org Anne Gilleran: anne.gilleran@eun.org

Please make sure that you know in which pilot you are participating, before you start the questionnaire!

The questionnaire is entirely online, and does not contain many open questions. It will take you approximately 25 minutes to fill in all questions. Your answers are very important to the overall picture of the OASIS project and we ask you to take time to answer carefully.

With circles, only one answer is allowed. Please choose the answer that describes best your situation.

With square boxes, you can tick more than one answer.

In this questionnaire, some questions might resemble questions that you have previously answered in other questionnaires during your pilot. It was not possible to totally avoid this situation, as this questionnaire is meant for participants in many different pilots and countries, and we want to reach uniformity. The questions are most of the time a little different from previously asked questions. We apologize for this duplication of questions. For technical and methodological purposes, we kindly ask you to fill these questions again.

If you have questions, or need help with the questionnaire, you can e-mail to your own pilot contact person, or with:

Bruno Emans
E-mail: B.S.Emans@uva.nl
Telephone: +31 20 525 1329

Thank you very much for filling in this questionnaire.

8.1.1 START THE QUESTIONNAIRE

in a new window

6 - What is your school type? Please tick the option that best describes your situation:

- ○ Pre-school Education
- ○ Primary Education
- ○ Secondary Education
- ○ Special Education
- ○ Further Education
- ○ Higher Education
- ○ Adult Education
- ○ Vocational Training
- ○ Initial Teacher Education
- ○ In-service Training

7 - Where is your school located? Please tick the option that best describes your situation:

- ○ Inner-Urban
- ○ Sub-urban
- ○ Small town
- ○ Rural

8 - What is your role at school?

- ☐ Teacher
- ☐ School Principal
- ☐ ICT Responsible
- ☐ Deputy /Assistant Principal
- ☐ Librarian
- ☐ Coordinator of extra curricular/international activities
- ☐ Other, Please Specify

6-8/38

9 - How many students are there in your school?

○ <100 ○ 100-299 ○ 300-599 ○ 600-899 ○ 900-1.199 ○ 1.200-1.499 ○ 1.500>

10 - How many years have you been working in education?

- ○ Less than 5
- ○ 5-10
- ○ 11-15
- ○ 16-20
- ○ More than 20

11 - How many years have you been using ICT in education?

- ○ Less than 1
- ○ 2
- ○ 4
- ○ 6
- ○ More than 6

12 - Did you receive sufficient training for the technology used in this project?

- ○ Yes
- ○ No
- ○ No training attended

13 - Did you receive sufficient training for the pedagogical models used in this pilot project?

- ○ Yes
- ○ No
- ○ No training attended

9-13/38

14 - Is ICT in your school used for following administrational purposes? To collect:

- ☐ Student information
- ☐ Student grades, assessment and evaluation
- ☐ Staff information
- ☐ School information like schedules, class arrangements
- ☐ Library information
- ☐ Information about Internet and software
- ☐ Information about pedagogical projects
- ☐ Financial information
- ☐ Food service
- ☐ Other, Please Specify

15 - Did you use any of the following groups as resources or advisers for your projects?

- ☐ Teachers
- ☐ Parents
- ☐ Local communities
- ☐ Local action groups
- ☐ Elected representatives and policy-makers
- ☐ Adult learning groups
- ☐ Other, Please Specify

16 - If not why?

- ☐ No one was interested
- ☐ No one had time to get involved
- ☐ I didn't have time
- ☐ I didn't try
- ☐ Technical problems at the partner side
- ☐ Technical problems at our side

14-16/38

B. QUESTIONS ON NEW TECHNOLOGICAL SOLUTIONS AND THEIR EFFECTS ON PEDAGOGY AND MANAGEMENT

17 - Were you satisfied by this technological solution in your pilot?

- ○ Yes
- ○ No

18 - Will you use the technological solution again?

- ○ Yes
- ○ No

19 - Will you recommend the technological solution to your colleagues?

- ○ Yes
- ○ No

20 - In your opinion, does the technological solution enhance the quality of your work?

- ○ A lot
- ○ A little
- ○ Not at all

21 - In your opinion, does the technological solution enhance the efficiency of your work?

- ○ A lot
- ○ A little
- ○ Not at all

17-21/38

22 - Did the technological solution affect any of the following?

Pedagogical

	More	No affect	Less
Preparation time	○	○	○
Time in the classroom with my students	○	○	○
Collaboration with colleagues	○	○	○
Collaboration among students	○	○	○
Learning becomes students centred	○	○	○
Learning becomes individualized	○	○	○
Motivation of students	○	○	○

Organisational

	Easier	No affect	More difficult
Creation of Timetable of the school	○	○	○
Student tracking	○	○	○
Staff Tracking	○	○	○
Financial administration	○	○	○
Coordination of projects	○	○	○

Technical

	Easier	No affect	More difficult
Maintenance of computers	○	○	○
Maintenance of network and infrastructure	○	○	○

22/38

23 - Did you find the technological solution easy to use?

- ○ Yes
- ○ No
- ○ Not applicable

24 - Did your pupils find the technological solution easy to use?

- ○ Yes
- ○ No
- ○ Not applicable

25 - What kind of Internet connection is used in your school?

- ○ Dial up modem
- ○ ADSL
- ○ Cable, E1
- ○ E2, E3
- ○ Satellite
- ○ None
- ○ Don't know

26 - Did the type of Internet connection help the use of technology?

- ○ Yes
- ○ No, connection too slow
- ○ No, connection not reliable

23-26/38

27 - What kind of support would you need to use the technical solution in a more efficient way for your work?

- ☐ ICT coordinator responsible for coordination of ICT related programmes and technical maintenance
- ☐ Specialist network administrator
- ☐ Teacher responsible for project coordination
- ☐ Teachers responsible for technical maintenance
- ☐ Teachers responsible for network administration
- ☐ Students responsible for technical maintenance
- ☐ Students responsible for network administration
- ☐ Teacher responsible for pedagogical support
- ☐ More in service training
- ☐ Student responsible for project coordination
- ☐ Student responsible for pedagogical support
- ☐ Other, Please Specify

27/38

28 - Were any of the following a barrier to your effective use of technological solution for your work?

	Not at all	A little	A lot
Lack of funding	○	○	○
Lack of hardware	○	○	○
Lack of software	○	○	○
Lack of Internet access	○	○	○
Computers broken	○	○	○
School policy	○	○	○
Lack of pedagogical training	○	○	○
Lack of technical training	○	○	○
Lack of support from colleagues	○	○	○
Lack of support from school administration	○	○	○
Lack of student motivation	○	○	○
Lack of space in school	○	○	○
Other, Please Specify	○	○	○

28/38

29 - In what subject groups do you use the technical solution(s)?

- ☐ Art
- ☐ Biology
- ☐ Chemistry
- ☐ Citizenship
- ☐ Culture
- ☐ Economics
- ☐ Environmental education
- ☐ Ethics
- ☐ Foreign languages
- ☐ Geography
- ☐ History
- ☐ Home Economics
- ☐ Informatics/ICT
- ☐ Language and literature
- ☐ Mathematics
- ☐ Media education
- ☐ Music
- ☐ Natural sciences
- ☐ Philosophy
- ☐ Physical education
- ☐ Physics
- ☐ Politics
- ☐ Psychology
- ☐ Religion
- ☐ Social sciences
- ☐ Social studies
- ☐ Special education

Cross-curricular education, please name subjects:

29/38

30 - What are the technological solution(s) used for?

- ☐ Word Processing
- ☐ Spreadsheets
- ☐ Preparation of presentations
- ☐ Development of WebPages
- ☐ Database work
- ☐ Scanning
- ☐ Photo editing
- ☐ Video editing
- ☐ Email communication
- ☐ Chatting
- ☐ Forums
- ☐ Educational software
- ☐ Internet searching
- ☐ Reference books like dictionaries, thesaurus,..
- ☐ Use of a virtual learning environment
- ☐ File sharing
- ☐ File upload
- ☐ Create an online quiz
- ☐ Other, Please Specify

30/38

31 - In what way was the technological solution used?

- ☐ Brainstorming
- ☐ Computer assisted instruction
- ☐ Collaborative learning
- ☐ Demonstrations
- ☐ Peer Tutoring
- ☐ Project-based learning
- ☐ Remediation, supportive exercises
- ☐ Role-playing
- ☐ Self directed groups
- ☐ Software drills
- ☐ Simulations and games
- ☐ Other, Please Specify

31/38

32 - Please estimate how often, during the project, pupils used these technological solutions within school directly for pedagogical purposes.

- ○ 2-4 times a day
- ○ At least once a day
- ○ 2-4 times a week
- ○ Once a week
- ○ 1-3 times a month
- ○ Once a month
- ○ Never
- ○ Not applicable

33 - Has the use of this technological solution changed the pedagogical approach that you use?

- ○ A lot
- ○ A little
- ○ Not at all

32-33/38

34 - In what way has the use of this technological solution changed the pedagogical approach that you use?

	More	No effect	Less
Preparation time	○	○	○
Time in the classroom with my students	○	○	○
Collaboration with colleagues	○	○	○
Collaboration among students	○	○	○
Learning becomes students centred	○	○	○
Learning becomes individualized	○	○	○
Motivation of students	○	○	○
Learning out of the school	○	○	○

○ No change
○ Other, Please Specify

34/38

35 - Estimate how much you think that each of the following groups gained financially from the use the technological solutions:

	A lot	A little	Not at all
You	○	○	○
School	○	○	○
Students	○	○	○
Teachers	○	○	○
Parents	○	○	○
Local community	○	○	○
Elected representatives / policy-makers	○	○	○
Adult learning groups	○	○	○

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36 - Estimate how much time you think that each of the following groups gained from the use of the technological solutions:

	A lot	A little	Not at all
You	○	○	○
School	○	○	○
Students	○	○	○
Teachers	○	○	○
Parents	○	○	○
Local community	○	○	○
Elected representatives / policy-makers	○	○	○
Adult learning groups	○	○	○

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37 - Estimate how much you think each of the following groups is satisfied with use of the technological solutions in the pilot from a pedagogical viewpoint:

	A lot	A little	Not at all
You	○	○	○
School	○	○	○
Students	○	○	○
Teachers	○	○	○
Parents	○	○	○
Local community	○	○	○
Elected representatives / policy-makers	○	○	○
Adult learning groups	○	○	○

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38 - How much has the use of ICT improved the contacts between your school and:

	A lot	A little	Not at all
Students	○	○	○
Teachers	○	○	○
Parents	○	○	○
Local community	○	○	○
Local action groups	○	○	○
Elected representatives / policy-makers	○	○	○
Adult learning groups	○	○	○

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