IST-2000-26249
ITCOLE
Innovative Technology for Collaborative Learning and Knowledge Building

FINAL REPORT

Report Prepared by:
Professor Philip Dean and Teemu Leinonen; Media Lab, University of Art and Design Helsinki, Finland

Contact details:
teemu.leinonen@uiah.fi, philip.dean@uiah.fi

Abstract: Final report of the ITCOLE project. Details are given of the main objectives, aims and results of the project, which has concentrated on aspects of computer supported collaborative learning (CSCL). The pedagogical approach and theory is described as well as descriptions of the software tools developed in the project and the results of their testing in many school-based experiments. The teacher training model developed in the project is also presented as well as a description of the www.euro-cscl.org web portal through which the project's results are disseminated.

Keywords: School of Tomorrow, Computer Supported Collaborative Learning, European schools, Learning Environment Software, Teacher training model, CSCL Pedagogical theory.

Related documents: Innovative Technologies for Collaborative Learning, ISBN 951-558-119-2 (Media Lab UIAH, 2003)

Content:

Project Overview

Innovative Technology for Collaborative Learning and Knowledge Building (ITCOLE) is a project focused on developing innovative pedagogical models, design principles and technology for collaborative knowledge building to be used in European education. The ITCOLE-project was funded by the European Commission's Information Society Technologies programme (IST) as part of the 'School of Tomorrow' thematic action line. The project started on the 1st April 2001 and finished 30th June 2003.

The project consortium was made up of design, technical, user developer and pedagogical partners. The project consortium consisted of design and coordination partner; University of Art and Design Helsinki, Media Lab; technical developers (originally GMD, later Fraunhofer-FIT) Fraunhofer Institute for Applied Information Technology (FIT) and University of Murcia; user developer Helsinki City Education Department and pedagogical research partners from University of Helsinki, University of Amsterdam, University of Salerno, University of Rome La Sapienza, University of Athens and University of Utrecht.

The project had three key scientific and technical objectives:

- Develop pedagogical models of collaborative knowledge building for European education.
- Develop a modular knowledge-building environment to support collaborative learning.
- Evaluate, test and disseminate the environment in European schools in order to build meaningful pedagogical practices and to advance the use of collaborative learning technology.

The pedagogical models and software technology were developed, tested and disseminated throughout the European education landscape free of charge in order to help in building a coherent and unified network of participants that supports sharing of expertise, content, practices and tools. The project has developed a network spearheading the use of collaborative learning technology by utilizing pedagogical best practices.

In the next sections we will summaries the project's main results. We start by presenting our contribution to the CSCL research and development of pedagogical practices. Next we will present three different CSCL software developed in the project and main results of the field tests where the software were used in more than 80 collaborative school project. The need for new kinds of teacher training arose in the field studies and to serve this need a teacher training model was developed in the project. The conclusion section presents the dissemination and exploitation activities and future plans of the project Consortium.

1. ITCOLE in the IST

As a School of Tomorrow project, ITCOLE has created several pedagogical and technical innovations that have a lot of potential to improve the quality of learning within primary and secondary schools across the Europe. The pedagogical and teacher training models developed, and the collaborative technology that supports these activities, enables teaching and learning that meets the requirements of knowledge and skills needed in the Information Society. The pedagogical models and methods focus on developing students' skills to adopt, cultivate, create new and share knowledge with others. The inquiry process is supported with ICT. In the process the key factors are problem solving and creativity in collaboration.

Building a project consortium with pedagogical, technical, design and user partners ensured the multi-disciplinary approach. High-level pedagogical expertise as well as active practitioners of education, with tight connections to everyday life in schools, was brought to the project via the pedagogical partners. The technical partners, with earlier experience in developing computer supported collaborative software systems, and the design partner's ability to conceptualize the pedagogical ideas as a working software system ensured the high quality and usability of the tools developed in the project.

In the IST programme, the Consortium has mainly participated in the School of Tomorrow cluster of projects established by the Commission. The collaboration with other projects has consisted of both official and unofficial exchange of information and experiences. The project has also co-operated with a number of horizontal support actions launched by the Commission, including concertation meetings, the Proacte web site activities and EUN VALNET project.

Through the European SchoolNet and the EUN VALNET project the results of the ITCOLE project have also been tested, studied and disseminated in a number of countries, not represented by partners of the ITCOLE project.

2. CSCL, Pedagogical Theories and Practice

Computer Supported Collaborative Learning (CSCL) is set to play an increasingly important role in education. In the field of learning science and research on education CSCL is seen as one of the most promising pedagogical paradigms. With the increase in research, CSCL practices are increasingly implemented in schools across Europe. The idea that meaningful learning takes place primarily in communities is widely acknowledged in the field of learning science and research of education. Also the idea that knowledge is not static but situated in teams, organisations and social networks is widely accepted. During the e-learning boom of the last five years hundreds of conference systems, learning management systems and virtual learning environments have been developed. Most of these environments have been designed to manage study materials, students, their basic cooperation and simple evaluation and grading of their work, rather than to promote engagement in active learning and knowledge building. In the majority of the e-learning platforms on the market the course material plays a central role, and communication and cooperation is supported to help students to overcome the possible challenges faced when studying the course material. As such the pedagogical vision is rather different than in the case of CSCL. Besides the pedagogical approach, most of the e-learning applications are, in general, very expensive for schools and other educational institutes.

According to the review made in the project, Deliverable 2.1 *Perspectives of CSCL in Europe*, there are huge differences in how ICT has been implemented in education in different European countries. The emphasis placed by the government and other authorities varies a lot between countries. However, even though the countries have started to build the information society at different times, that is, equipping schools with computers and networks, it seems that secondary level students have quite good accessibility to computers in all four participating countries. The difference between the situation in primary and secondary level was acknowledged in each country. Further, it seems that during the next few years there will be substantial investments in each country, at governmental and/or private level, to equip all the schools with computers and networks. What also seem to be common are the constraints: lack of trained personnel to give adequate support for teachers and lack of guidance to use ICT in a pedagogically meaningful way. Computer labs are still used by too many students and teachers, and therefore they are not providing possibilities for the use ICT in a versatile way or to create meaningful learning environments. Teachers use mostly basic applications, such as word processing applications, and students use educational programs or multimedia products designed for individual learning.

All the four countries participating in ITCOLE field tests had already employed the same basic theoretical framework (constructivism, socio-cultural/situative view) to create CSCL practices and to conduct research within this area. However, in each country the development work is concentrated in some special domains, methodologies, or theoretical approaches. In Greece, the researchers in the field of CSCL have emphasized the importance of research on conceptual change, especially in mathematics and science education. In addition to pre-post –settings, the Greek researchers have developed methods for analysing students' interaction. In Finland, special focus has been on developing the pedagogical model of progressive inquiry, in investigating cognitive and motivational dimensions of CSCL in different school levels, and in developing qualitative content analysis methods as well as analysis based on video data. The Italian researchers have been interested especially in the features of community development and different forms of collaboration. The latter focus has inspired them also to develop the discourse analysis technique further. In the Netherlands the emphasis, especially in secondary education, has been on authentic learner-centred learning contexts, and in how students 'learn to learn' within these new learning conditions, including shared regulation processes between learners as well as individual (meta)cognitive, self-regulation processes.

An important result of the ITCOLE-project was the further development and testing of the progressive inquiry model. This framework is especially developed for pedagogical purposes. It is a general model for conducting scientific inquiry in schools.

Explained briefly, progressive inquiry is a sustained process of advancing and building knowledge, characteristic of scientific inquiry. It entails that new knowledge is not simply assimilated but constructed through solving problems of understanding. Characteristic of this kind of inquiry, compared to direct assimilation, is that the student treats new information as something problematic that needs to be explained.

Within the development of progressive inquiry the ITCOLE project focussed on problem-based learning models. Problem-based learning is an approach where a curriculum is problem centred rather than discipline centred. Problem descriptions, as concrete and as authentic as possible, are used to focus self-directed study and to motivate students to find relevant information. A problem-based curriculum differs from the traditional subject-based curriculum in the following respects:

- Cumulative learning - a subject is not learned in depth at any one time, but is introduced repeatedly and in increasing levels of complexity during the course of study.
- Integrated learning - subjects are introduced as they relate to a problem rather than separately.
- Progression in learning - what and how students learn changes as students acquire skills and knowledge and as they mature.
- Consistencies in learning - the aims of problem-based learning are reflected in all aspects of teaching and learning, including the learning environment in the classroom and assessment practices.

Students use their existing knowledge in order to learn rather than being treated as a *tabula rasa*; the process of enquiry fosters self-directed learning; and students 'learn how to learn' so that they are better able to apply problem-solving to new situations. Students work in groups on authentic problems. They often use a process of seven steps to work on a problem:

- Clarification of terms. Students check if they understand what the problem is.
- Defining problems. Students formulate relevant questions they have to answer.
- Problem analysis. Based on existing knowledge, students formulate ideas and hypotheses.
- Structuring and elaborating existing knowledge.
- Formulating goals for learning. Students discuss about the kind of knowledge that needs to be constructed and what they will study.
- Finding relevant information. Students gather information that meets the goals for learning.
- Restructuring information and reporting. Students present the findings in their own words and discuss the outcomes.

Another area of pedagogical method development focused on in the ITCOLE project was to find methods for supporting students' conceptual change and shared and individual regulation processes.

Changes in students existing conceptual structures are difficult to achieve, because of their complexity and their counter-intuitive nature. Students are often unaware of fundamental presuppositions that constrain their understanding of scientific explanations or take these presuppositions to be fundamental truths about the physical world that cannot be questioned (such as, for example, the belief that space is organized in terms of the directions of "up" an "down" or the belief that unsupported objects fall down). An important goal of science instruction is to make students aware of their ideas and beliefs and also to make them understand that these beliefs are not unique. Understanding that your beliefs can be tested and sometimes that they can be falsified, understanding how to use evidence to evaluate a theory and how to revise a theory in light of disconfirming evidence, are fundamental to understanding science.

The development of this meta-conceptual awareness in students is very much related to the more general problem of creating intentional and purposeful learners who can take control of their own learning, know how to learn and how to correct their mistakes. Collaborative work leaves students open to strong social influences that have the potential to "shake" their convictions (by experiencing a variety of alternative opinions), question their sense of understanding (through social pressure when in the minority), and create both contexts of conflict and needs to reach agreement in order to stream operations. Through all these experiences students realize a multifaceted reality in which different opinions can be reasonably supported and challenged and where different forms of resolution have to be tried out to achieve some result that they can be proud of. The use of computers has the additional advantage of stabilizing information and opinions in a written form and structuring communication so that multiple discussions can be well organized (i.e. the tree structure of the knowledge building area in Synergeia

& Fle3). In this way, affordances for meta-cognition created in a collaborative environment can be taken full advantage of, allowing students to think deeper in their own time, and for the teacher to make appropriate comments, either to guide interaction or to provide the norms of the discipline under study.

3. CSCL Software

An important result of the ITCOLE-project was the development of a modular knowledge-building environment to support collaborative learning. In fact, three software tools for collaborative learning were developed, evaluated and tested.

3.1. Synergeia

Synergeia is an extension of BSCW. BSCW (Basic Support for Cooperative Work) enables collaboration over the Web. BSCW is a 'shared workspace' system which supports document upload, event notification, group management and much more. Built on BSCW, Synergeia adapts this system of shared workspaces to create virtual places for learners to work and collaborate in groups. The Synergeia software consists of two components:

- The asynchronous communication and collaboration software: BSCL (Basic System for Collaborative Learning).
- The synchronous communication and collaboration software: MapTool and Instant Messages.

The software can be found at http:// bscl.fit.fraunhofer.de, the Synergeia server for the ITCOLE project run by Fraunhofer FIT, Germany. BSCL is explicitly designed to support collaborative learning and knowledge building according to the progressive inquiry model. This pedagogical concept focuses on asynchronous, textual discourse, which fosters reflection, critical thinking and joint knowledge building. The threaded discussion facility of BSCW has been re-designed and enhanced with a flexible system of thinking types to make the character of the notes and their relationships more explicit for the students. A knowledge building functionality has been developed. You can find more information of the use of thinking types below, in the description of FLE3.

As an initial synchronous tool, MapTool has added a drawing facility that allows a group of students to work together in order to construct a conceptual map of the ideas they are exploring. A synchronous chat stream is maintained as an integral part of the multi-user drawing tool in order to support the coordination of work.

With BSCL, teachers have many options for structuring the virtual learning environment used by their students in various educational activities. They can also choose among several sets of thinking types in different knowledge building areas. Students can also use many features to structure their own group work. To provide a more personal appearance of the computer screen, photos of the students are prominently used to indicate whose workspaces or remarks are displayed.

In addition to the standard awareness features of BSCW – like the extensive history reports – BSCL displays lists of all members of a folder, with indications of each member’s level of activity, for example, whether they are using synchronous tools at that time.

Three perspectives

In BSCL learning places are typically arranged as a series of perspectives:

- A personal perspective in which a student can develop his or her own initial thoughts and assemble ideas from others or materials from the Web;
- A group perspective that is shared in a workgroup;
- A course perspective, where ideas and materials can be discussed with all course participants.

The perspectives have special features and access rights to help them work naturally in school settings without putting a major burden on teachers to design and set up such structures.

Course and user management

In the typical working scenario of Synergeia teachers register their students or other colleagues to the system. They create courses and enrol the students to these courses. In a course the teachers could form working groups among the enrolled students. In a group a teacher may setup some initial discussion for knowledge building. If students are logged in to the system, they will see their home area with their personal perspective and the courses in which they are enrolled. In a course they will find the working groups, in which they have to perform their knowledge building tasks. By entering a group they can join or start a discussion for knowledge building. They may also start or join a MapTool session to explore their ideas synchronously in a conceptual map. If they are finished with their tasks, the students can copy their results in the course perspective to present these to or discuss these with their course members.

3.2. Fle3

Fle3 is a web-based learning environment. To be more specific Fle3 is server software for computer supported collaborative learning (CSCL). Fle3 is designed to support learner and group centred work that concentrates on creating and developing expressions of knowledge (i.e. knowledge artefacts) and design.

The software can be found at http://fle3.uiah.fi, from the Media Lab at the University of Art and Design Helsinki. Fle3 contains three learning tools and several administration tools.

WebTop

Each user of Fle3 gets a personal WebTop. WebTops can be used to store different items (documents, files, links to resources in the web, link to knowledge building notes and jam session artefacts) related to the studies or project and organize them into folders. The items in the WebTops are shared with other users in the same course or project, as users may visit each other's WebTops.

Only the owner of a WebTop may create, edit and remove items in her WebTop, but visitors may read the items. The WebTop also includes a shared "course folder" for each course or collaborative project. The shared folder is available in the Knowledge Building and Jamming, modules as well.

Knowledge Building

With the Knowledge Building tool, groups may carry out knowledge building dialogues, theory building and debates by storing their thoughts into a shared database. The knowledge building discussion is scaffolded and structured by knowledge types, which label the thinking mode of each discussion note. The Knowledge Building tool contains two default "knowledge type sets": (1) Progressive Inquiry, and (2) Design Thinking. Fle3 Users with enough user rights may also copy, edit and create new "knowledge type sets" to the system. Depending on the knowledge type set selected, users are prompted with guidelines and checklists to write their notes to the database.

The Progressive Inquiry knowledge type set contains the following knowledge types: Problem; My Explanation; Scientific Explanation; Evaluation of the Process and Summary. The knowledge types scaffold (support and lead) students to carry out research-like activities, which deepen their understanding of the area under study. The complementary knowledge type set made for collaborative design contains the following knowledge types: Design Context; Design Challenge; My Design Idea; New Information; Evaluating an Idea; Organizing the Process and Summary.

The system offers a checklist explaining to the participants what kind of things the note should include in order to advance the process, when writing their contributions to the knowledge building section. For instance when writing New Information –note in design knowledge building the Flea "agent" asks from the author:

"Does the note present some new information related to the design task? Remember to mention the source where you found the new information:

- by interviewing users
- by analyzing the design context?
- studying earlier design solutions of others."

The knowledge type sets guide students to consider adequate and important things related to the process and, in this way, helps students to write more significant notes to the database. As an aid for helping users to follow the knowledge building discussion, users may take different kind of views to the knowledge building database by sorting the notes as a discussion thread, by writer, by knowledge type or by date. With the advanced search engine users may also search the knowledge building database in many different ways.

Jamming

The Jamming tool is a shared space for collaborative construction of digital artefacts (pictures, text, audio, video). A study group may work together with some digital artefacts by simply uploading and downloading files. Versions are tracked automatically and different versions are displayed graphically. Users may also add annotations to artefacts. When setting up a jam session the tutor may choose from three types of jam sessions; (1) “mutate on previous” or (2) “explore possibilities” and (3) “diverge and converge”. This gives the users slightly different possibilities to make new versions and to make references to earlier versions. Originally the Jamming tool was designed (to be used) for visualizing ideas in a group. However, it has been noticed that Jamming could be used for many different kinds of collaborative design work that requires versioning. The artefacts under process can be text, picture, poster, music, video, animation, multimedia or a piece of software.

Course and User Management

The staff and teachers taking care of the courses and course participants have tools for managing users, courses and participants of the courses. With the user management tools staff users may add new users manually or by inviting them via e-mail. With the course management tools staff users may add users to courses with a role of being ‘student’, ‘tutor’ or ‘teacher’ in that particular course.

Furthermore staff users may manage the knowledge type sets, create new ones, copy and edit existing ones and export and import them between Fle3 systems.

The staff users may also import and export courses in XML format, compatible with the Educational Modelling Language – EML defined by the Dutch Open University. In the same way the administrator of the Fle3 server may export the whole database in XML and import the package into another Fle3 server.

Fle3 is easy to localize for different languages, requiring only the translation of one text file. Currently users may choose Danish, Finnish, English, Spanish, French, Portuguese, Brazilian Portuguese, Norwegian, Dutch, Italian, Lithuanian or German as their user interface language.

Fle3 is Open Source and Free Software released under GNU the General Public Licence (GPL). The licence is protecting users’ freedom to use, modify and distribute Fle3.

3.3. MapTool & Ants

The MapTool consists of a whiteboard for collaborative drawing of concept maps. When drawing maps together students may also chat. The drawing tool facilitates both collaborative creation of conceptual maps and diagrams and synchronous textual communication among students participating in the same study project. It allows drawing lines, basic shapes, arrows and importing images from a local computer. All figures and images can be connected using lines and arrows. The tool also shows a list of connected users and telepointers showing who is collaborating in the drawing area. If a user comes late to the session, she can retrieve the previous events.

The MapTool is a one application of the synchronous system called Ants. There is a common API (Application Programming Interface) in order to easily integrate some synchronous and asynchronous tools on top of the Ants system. The API is used to facilitate the communication from the tool to the communication channel and enables the integration of different tools with different systems such as Synergeia and Fle3.

A key point of our infrastructure is the communication channel. This channel must serve a double task: propagation of state from synchronous applications and monitoring of events from external awareness applications. As a result of previous research works, we conclude that a high performance publish/subscribe notification system is the ideal option for supporting our communication channel. More concretely, we have previously worked with the DSTC Elvin notification system and we consider that this advanced middleware is a suitable solution for the Synergeia Synchronous infrastructure.

Following the basic design principles of synchronous tools, this tool supports:

- Presence awareness showing a list of connected users.
- Workspace awareness telepointer showing who is collaborating in the drawing area.
- Late coming. If a user comes late to the session, he/she can retrieve the previous session information.
- Internationalization. Different labels according to the preferred user interface language.

Several other applications can also be integrated to work with the MapTool. These tools require JDK1.2 or higher.

The Instant Messages tool enables direct communication between two or more users emulating some features from ICQ.

Maptool Log is a web tool that generates graphical representations of log events during Maptool interactions. Maptool Log queries can be made using the Tool, Course, and User parameters.

The Maptool Tutor is a tool that shows how a specific Maptool session has been constructed. When a user retrieves information from the Maptool Session (a JPEG file) or launches the Maptool applet he/she can only see the end result. However it may be interesting for a teacher or some users to know how this object has been built, who have been collaborating in the session and how they have each contributed. The Maptool tutor allows analysis of the process of collaboration by showing the progress of construction along the time scale.

4. Field Tests

The pedagogical models and the learning environments, Synergeia, MapTool and Fle3, were tested more than 80 collaborative school projects. The school projects in four countries were studied to test and evaluate the pedagogical and technical effectiveness of the software tools.

What becomes clear in the evaluations is that the environments can be used to support the emergence of an enormous variety of different school projects. Within the sample of projects, all kinds of subjects were present, within all types of school levels. In general, both teachers and students were very positive on the technological usability of the software and on the pedagogical goals of collaborative learning that can be achieved by using these environments.

Some comments were made on details of the software tools, but the learning environments, as a whole, were rated as valuable. Teachers assess the ease of use, the navigation, the screen design and the information presentation as good. The aesthetics (beauty and elegance) are also rated as good for both environments (Synergeia & Fle3), as is the attractiveness to students (reported by the teachers). For students, there were similar findings.

The evaluation results for pedagogical usability were more complex. The teachers in all four countries were of the opinion that the use of the electronic learning environments supports collaboration among students. However, they conclude that knowledge building with students is a complex process, especially when not explicitly guided by teachers. Furthermore, they concluded that in addition to virtual meetings, face-to-face meetings are necessary for the learning process.

Students reported that they have collaborated successfully within the projects. However, their teachers have the opinion that collaboration is not a ‘natural’ activity for students. This conclusion was stronger for secondary education than for primary education. With the help of Synergeia and FLE3, teachers in all countries were able to support the process of collaborative learning in an effective way. This was caused by the fact that the process was visible to everyone, and the products and ideas of others could easily be seen. However, many teachers claimed that deeper levels of collaboration and shared development of products needs extra support and guidance by the teachers. Furthermore, teachers felt that students should practice these kinds of activities more. Both teachers and students evaluate the use of thinking types as very important for the collaborative learning process.

Concerning the issue of community building, students report that they enjoyed collaborating with others. Many of them got an improved feeling of self-respect due to their contribution to shared discussions. Together with the other findings, it seems that working in the electronic learning environments stimulates community building, although this is not an automatic process. Teachers (and probably students as well) need new skills in order to foster this process of community building.

Two dimensions seem to influence the teachers' stance relative to CSCL projects. These are, previous experience with CSCL and the difference between primary school teachers and secondary school teachers (for primary teachers CSCL projects are, in general, more successful).

Successful computer supported collaborative learning projects are dependant on provision of adequate training for the teacher in both pedagogical and technical aspects, on availability of time for teachers to be able to prepare the projects and on the possibilities to do projects inside the space of the curriculum. Teachers with experience of CSCL can dedicate more time and effort to scaffold the processes within the CSCL-projects, whereas novice teachers need time to get acquainted with a new pedagogical model, a new process and with new technology. Generally, primary school teachers have more time to implement projects, which may explain that they are relatively more successful with their initial implementations of CSCL. Another factor is the fact that for students in secondary education, collaborative learning is a new paradigm, and also the students have to learn to work according to it. They might be more reluctant to embrace this new approach, whereas primary students do not have this luggage of traditional education and are more open to this new kind of education. The adoption of computer supported collaborative learning in secondary education could be improved if the curriculum of secondary education would be more problem-based.

The issue of novice versus experienced teachers also plays a role in the successful adoption of the progressive inquiry method by teachers. In the project it became clear that the sustainability and progress of the inquiry process is critically dependent on the teacher's scaffolding and contributions to the process. For experienced teachers, this was easier to establish. According to the teachers' assessment, Synergeia and Fle3 provided a flexible forum for inquiry learning that, simultaneously, offered tools for structuring the process. Many reflections and thoughts of teachers in ITCOLE after their projects, when thinking about improvements, were thoughts about improving the structure and scaffolding of the inquiry process or the collaborative learning process. This can be understood as an indication of a realisation of the importance of the progressive inquiry model.

To sum up, from the results of the testing in schools within the ITCOLE project it becomes clear that using CSCL can have an added value for European education. However, educational and pedagogical change will not occur overnight and it can be expected that this process will take many years. The success of CSCL projects is largely dependent on the degree to which teachers are familiar with the concepts of CSCL.

Taking this into account within the later stages of the project a specific dissemination resource was designed and produced. As one of the major results of the ITCOLE project the European-wide online community on computer supported collaborative learning (www.euro-cscl.org), is designed to help teachers to learn from each other, and to form a community of practitioners. The teachers that have been using Synergeia and Fle3 within the ITCOLE project have played a major role in starting up this forum. The forum is meant for teachers, researchers, school administrators and policy makers and, as such, differs from many earlier created web resources that cater only for a single interest group, for example, for only pedagogical researchers. Further development of the euro-cscl.org portal is planned as the collaborative effort of some of the ITCOLE consortium partners along with other strategic partners.

Another outcome of the project is a set of guidelines for setting up courses for professional development of teachers concerning CSCL topics.

It has become clear that teachers (and students) need quite some time and training to get used to the ideas of CSCL. Furthermore, teachers need time to be able to set up qualitatively good CSCL projects. The next step will be for national educational boards and school directors to allocate time for teachers in order to be able to achieve this, and to organise training facilities for teachers on CSCL. The euro-cscl.org portal contains examples of course ideas and best practices for teachers, submitted by members of the community there as well as relevant information for school administrators on pedagogical and technological implementation issues.

5. Teacher Training Model

To facilitate school administrators, headmasters and teachers willing to introduce CSCL activities in schools the ITCOLE project developed a teacher training and consulting model. The dual model contains both, traditional workshops and virtual learning in a CSCL environment.

The objective of ITCOLE teacher training and consulting model is to promote pedagogical models and good pedagogical practices for collaborative, problem-centered learning, such as progressive inquiry, and to disseminate the learning environment software, which supports them. The teacher training and consulting model also empowers change of the teaching and learning culture in European schools.

The training and consulting model is divided into four stages each closely linked to each other. The stages are

1) Orientation,
2) Action,
3) Assessment and reflection and
4) Dissemination.

Training is emphasized in the first stage of the model and consulting in the second. The idea of the model is to introduce new pedagogical models and software tools for teachers and simultaneously implement them in use in classrooms by relying on the teachers' own teaching and project ideas.

Full description of the model is available at:
http://www.euro-cscl.org

6. Conclusions

The ITCOLE consortium was successful in meeting all of the project's pre-defined objectives. The major project deliverables are listed below in this section. This section also offers a brief account of some aspects of problems that arose early in the project, dealing with the intention to produce *open source* software.

On open source

The major difficulties in the project were encountered within the problematic related to the objective to produce software according to *open source* licensing schemes. At the start of the project the *exact* licensing requirement of 'open source', in relation to the software deliverables of the project, were undefined within the project's contract. The contract's work annex, however, described a software development scheme for the project which was directly reliant on extended development of the BSCW system as developed by the German partner GMD (later to be taken over by Fraunhofer-FIT). According to the coordinator's understanding of the project proposal, the comments of the commission's evaluators at the proposal stage, and the commission's expressed opinions of the time on software licensing issues, the development of open source tools was important and an imperative within the project. However, utilisation of the open source General Public License (GPL) scheme as the license for the project's software deliverables (which was confirmed by the commission to be the expected open source licensing scheme within ITCOLE) implied that existing rights and licences governing the BSCW system (that being pre-existing knowledge of GMD/Fraunohfer FIT) would be infringed/nullified. Additionally the stated intention of Fraunhofer-FIT to ensure that their software results would be made available 'free to non-commercial educational institutions' was judged to be correct in terms of the project's original aims but legally insecure in the long-term, as this intention would be subject to future decisions of the governors/owners of Fraunhofer FIT. It was judged that any unforeseen, future decision, to impose any sort of licensing fees or restrictions would clearly be in violation of the consortium's original intentions and the project's contract with the commission.

The problems, as documented above, resulted in a situation where it was impossible for the project's consortium to agree and sign a *consortium agreement*. The agreement should have included details of pre-existing knowledge, access to this, and its relationship to the actual *knowledge* or *deliverables* within the project. The agreement would also have logically contained mention of the open source licensing scheme to be applied to the project's own software deliverables. The requirements of GMD, later Fraunhofer-FIT, in relation to their own pre-existing knowledge, and taking into account the open source requirements within the project, resulted in a clear conflict with the contents of the project's work annex within the main contract with the commission. Therefore, at some point, it was decided that no consortium agreement would be signed and the project's management and the definition of rights and access to pre-existing knowledge and knowledge/deliverables were subject to the general provisions within the main contract with the commission. The result of this was to increase the responsibility of the commission and the coordinator in relation to conflict management within the project consortium.

After long negotiation between the consortium members and the commission, aided by legal experts, the coordinator decided to propose that two learning environments be produced by the project in place of the one originally planned. The proposal was made in order to ensure that the project would, according to its contract with the commission, produce one complete learning environment available under true *open source* terms. The decision was made having taken into account the risks involved, taking into account that the project had limited resources and a short development period within which the software had to be developed and finalised. The existence of a suitable open source software platform entitled, Zope, and recruitment of additional software developers to the coordinator's team were considered sufficient factors in order to counter the risks earlier identified.
Therefore, the project has produced two related (in terms of support for specific pedagogical processes etc.) but technically different learning environments. The BSCL environment *Synergeia* has been developed by GMD/Fraunhofer-FIT and is based on extensions to the BSCW system. It is currently available free of charge for non-commercial educational institutions via Fraunhofer-FIT and it is possible for developers to request the source code, which is made available subject to certain agreements and restrictions. The FLE3 system has been developed within the ITCOLE project by the project's coordinator, Media Lab at University of Art and Design Helsinki UIAH. The software is available freely from UIAH and is subject to an open source, GPL licence. Source code is freely available to developers without restriction.

The MapTool was developed by University of Murcia and is available freely for use and subject to GPL. During the project the MapTool was developed to be compatible with both BSCL Synergeia and FLE3 environments.
Needless to say, the efforts needed to develop two separate environments within the project increased the development effort requirements for, especially UIAH and also somewhat for University Murcia. It was also necessary for the coordinator to increase their overall financial investment in the project significantly in order to complete the tasks as agreed between the consortium and with the commission during the project, and subject to the recommendations of the project's review committee.

Note on budgets

According to the final claims on project costs by project partners the cost of the joint efforts by the consortium has exceeded the agreed budget considerably. However, the final budget situation varies greatly between partners and the reasons for those partners having increased their own efforts in the project's work are not necessarily similar. According to common practice all partners having exceeded their budgets within the project are responsible to cover those costs from their own internal funds.

Budget line transfers and inter-partner transfers of funds were proposed prior to delivery of the final cost statements to the commission in order to redistribute funds somewhat, according to the commission's own guidelines and standard practices.

The inter-partner transfers enable relatively small budget surplus from a few pedagogical partners to be transferred to reduce the more considerable budget deficit of one of the principal pedagogical partners. A relatively small transfer of funds (2.77%) occurs between coordination costs and the research and development efforts of the coordinator.

Taking into account the size of the project consortium, the number of persons involved in the work and the number and quality of deliverables within the ITCOLE project we can conclude that the project has performed extremely well within both a very limited project timescale (27 months) and a relatively small budget (1.2M€).

Finally, it is extremely important to state that the ITCOLE project would never have achieved any of its objectives without the unselfish efforts of hundreds of individuals, teachers and educational administrators within Finland, Greece, Italy and the Netherlands, whose efforts ensured the successful implementation and testing of the pedagogical models and software tools within our project. The majority of these individuals did not receive additional wages or funding for this work, which demanded a lot of time, effort and patience on their behalf in addition to the requirements of their normal duties. As coordinators, on behalf of the ITCOLE project consortium, we would like to extend our special thanks to all those who contributed to our project and hope that the results of our joint efforts will have a measurable effect in future, in the development of computer supported collaborative learning within Europe.

List of ITCOLE Deliverables

Management Deliverables

D1.1 Project Management Handbook

D1.2 Peer Review Plan

D1.3 Final report

D1.4 Advisory board meetings

D1.5 Quarterly Management Reports (1-8)

D1.6 Dissemination and Use Plan (revised)

D1.8 Technology Implementation Plan
- eTIP

D1.9 Project Presentation (brochure + videos)

D1.10 Cost Statements

D1.11 Progress reports (1-4)

Research and Development Deliverables

D2.1 A review of the state-of-the-art of pedagogical models of CSCL

D2.2 Specification of design principles for ITCOLE CSCL

D2.3 Workshops for software developers, researchers, and teachers
- Workshops for teachers in Amsterdam, Athens, Rome and Helsinki
- Developer meetings
- International teacher workshop in Athens

D2.4 Research reports and research articles in high-impact journals
- More than 50 peer-reviewed journal and conference articles.

D3.1 Study of functionality and interfaces of existing CSCL/CSCW systems

D3.2 Specification of interface/interaction types for the first ITCOLE CSCL system (2 revised specification documents + Fle3 UI prototype)
- The Fle3 UI prototype defined the features of the software and how they should look and feel for the user.

D4.1 and D4.3 System specification for the ITCOLE CSCL

D4.2, D6.1 and D6.2 ITCOLE CSCL (software)

- Synergeia available in http://bscl.fit.fraunhofer.de
- Fle3 available in http://fle3.uiah.fi
- Map Tool / Ants available in http://ants.dif.um.es/cscl/

D4.4 ITCOLE CSCL User Manual

D6.1 Tutorware tools
- Maptool log prototype
- Maptool tutor software

D7.1 Assessment instruments for carrying out the field tests and implementation and evaluation plan of case studies and scaling-up experiments

D7.2 Intermediate field test report

D7.3 Idea bank of best practices
- http://www.euro-cscl.org/

D7.4 Virtual Network (Website) of participating teachers, researchers and software developers
- http://www.euro-cscl.org

D8.1 Guidelines for teacher training and technical and pedagogical support
- ITCOLE teacher training and consulting model

D8.2 An integrated technical and pedagogical User Manual
- For Synergeia and Fle3

ACCESS TO ALL PUBLIC DELIVERABLES OF THE ITCOLE PROJECT WILL BE AVAILABLE FREELY VIA THE WWW.EURO-CSCL.ORG PORTAL