

**Technology-enhanced learning**

The European Union is funding research that explores how leading-edge information and communication technologies can help make learning more efficient.

The technology-enhanced learning research programme is managed by the European Commission's unit 'Cultural heritage and technology enhanced learning'. The unit also supports research on technologies for digital libraries and preservation of digital resources (DigiCult programme).

'Cultural heritage and technology enhanced learning' is part of the Directorate-General 'Information Society and Media', and one of the units of the Directorate 'Digital Content & Cognitive Systems' (Luxembourg).

For more information:

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Technology-enhanced Learning

Short descriptions of 32 research projects funded under the Sixth Framework Programme for Research and Technological Development (FP6)

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INTRODUCTION

The 6th Framework Programme for RTD
The European Community's Sixth Framework Programme for Research and Technological Development (FP6) was adopted in September 2002 by the Council of Ministers and the European Parliament. It had an overall budget of € 17.5 billion until end 2006. One of the seven thematic priorities was Information Society Technologies (IST), with an indicative budget of € 3.6 billion for the five year period.

Based on the concept of the European Research Area, FP6 aimed at channelling support into actions and projects designed to build partnerships among Europe’s best researchers. The bulk of funding was concentrated on large-scale projects with the potential of having an integrating effect on Europe's research landscape, resulting in a common endeavour and leveraging a critical mass of research efforts, scientific excellence, knowledge, financial resources and infrastructure. As regards the technical content, FP6 focused on specific themes that are strategically important to Europe’s future.

EU-funded research in the field technology-enhanced learning
Technology-enhanced learning research, funded as part of the IST programme under FP6, aims at improving our knowledge of how learning can be supported by information and communication technologies.

Research priorities under FP6
• enhance our capacity to reflect the complexity of learning in complex and dynamic environments
• reinforce learning as a social process through new collaborative models
• customise learning to individual needs – at school, work, throughout life, ubiquitously
• build competence – by linking organisations’ objectives and learning goals of individuals
• support pedagogical approaches that blend new and old ways of learning

Projects resulting from the first call
The first IST call for proposals under FP6 (December 2002 - April 2003) included 'Technology-enhanced learning and access to cultural heritage' as one of its strategic objectives. Eight projects were retained for being co-funded with a total budget of € 41.2 million. The projects started work on 1 January or 1 February 2004.

Research topics covered by the call 1 projects:
• personalisation and adaptive learning, dynamic mentoring (LeActiveMath, iCLASS)
• services based on high performance distributed computing infrastructures, such as GRID for collaborative learning (ELeGI)
• experience-based learning in the classroom, merging formal and informal learning (iCLASS, CONNECT)
• bridging the gap between research and education at universities and professional training at the workplace (PROLEARN)
• promoting interoperability and standards for learning objects and systems (TELCERT, UNFOLD)
• building a European Research Area in the field technology-enhanced learning (KALEIDOSCOPE).

Projects from IST Call 4
Technology-enhanced learning was again among the strategic objectives of IST Call 4 (December 2004 - March 2005). The call was based on the Commission's IST Work Programme 2005-2006 and targeted research exploring interactions between the learning of the individual and that of the organisation; and contributing to new understandings of learning processes.
In the same call, e-learning was addressed under 'Strengthening the Integration of the ICT research effort in an Enlarged Europe'. All in all, some 150 applications for funding were submitted to these two parts of Call 4, from which 24 projects were retained for funding. They started between October 2005 and March 2006. EU funding amounts to a total of € 83.7 million.

The projects can be clustered in four groups:

- **Learning & knowledge**
  This includes research on synergies between learning systems and knowledge management systems and on new approaches to workplace-based learning and competence building, where competencies are seen as the key bridge between the needs of the learner and those of the organisation. The research teams are testing component infrastructures in various organisational settings, focusing on the interactions between learners and on capturing (tacit) knowledge in associative networks, or on the interactions with business processes and competency models.

- **Learning & cognition**
  The projects responding to this part of the call focus on supporting and understanding the learner as an individual and within the context of different and complex social situations, and involve strategies such as role play, affective engagement, and improving the attention span. This research, integrating pedagogy, cognitive science, neuroscience and computer science, will result in tested pedagogical paradigms, conceptual models and innovative technology in different subject areas such as music, mathematics and languages.

- **Collaborative learning**
  Some projects combine elements of the two above mentioned research fields and explore new forms of collaboration amongst groups of learners or workers, specifically for ambitious complex problem solving. In this context, development of simulations and games play a major role. One Integrated Project will develop innovative solutions to improve learning in communities of practice.

- **Technology-enhanced learning in the 'enlarged Europe'**
  The projects resulting from the call 'Strengthening the Integration of the ICT research effort in an Enlarged Europe' deploy a number of different technologies and delivery channels including mobile technologies, digital TV, games and integration in open-platform environments, both for universities and schools. The consortia show strong participation from the new EU Member States.

### Project types or 'instruments'

**Integrated Projects** are expected to assemble the necessary critical mass of activities, expertise and resources to achieve ambitious goals ('programme approach'). Typical for **Specific Targeted Research Projects** (STREPs) are a 'single problem approach' and more focused objectives.

**Networks of Excellence** are designed to strengthen scientific and technological excellence on a particular research topic with the aim to foster European leadership and to overcome fragmentation of existing research capacities at long term.

**Co-ordination Actions** aim at promoting and supporting the co-operation or networking of research and innovation projects or of stakeholder groups towards a specific objective and for a fixed period of time. Finally, **Specific Support Actions** contribute to the implementation of the Framework Programme, the analysis and dissemination of results, or the preparation of future activities. They may also be used to stimulate international cooperation, to encourage and facilitate the participation of SMEs, small research teams, as well as organisations from the new EU Member States.
At the centre of CONNECT is the 'Virtual Science Thematic Park', an advanced learning environment, that exploits the potential of wireless communications and virtual and augmented reality to connect informal learning strategies and formal curricular activities in science education.

The project team carried out work to explore, test, refine and demonstrate an innovative approach crossing the boundaries between schools, museums, research centres and science centres. Both students and teachers were involved in extended episodes of playful learning.

The Virtual Science Thematic Park was the main hub of resources available in the developed network and served as distributor of information and organiser of suitable educational activities, such as students' virtual and conventional visits to science museums and science centres. These visits served (through an informal but yet structured way) main educational aims of the official curriculum.

The CONNECT team has prototyped five exhibits integrating AR technology: the Airtrack, the Aerofoil, the Biotube, the Hot Air Balloon, and the Electromagnetic Spectrum. They correspond to common units of scientific learning content and were tested in four countries: Sweden, Finland, United Kingdom, and Greece.

To complement the project’s technical work, a pedagogical framework has been developed containing learning scenarios and different ways of creating educational "pathways" to connect schools and science centres, i.e. of embedding a real-time or remote visit of a school class to a science centre into the learning/teaching context in the classroom.

CONNECT mobilised a multidisciplinary group of experts from the fields of learning technologies, cognitive science, psychology, information and communication technologies and science education and could draw on the assets of research centres in several countries, a European network of science museums and a multinational group of secondary schools supported by the appropriate educational bodies.

**Project facts**

- **Strategic objective:** 'Technology-enhanced learning and access to cultural heritage'
- **Project type:** Specific targeted research project
- **Start date:** 1 February 2004
- **Duration:** 36 months
- **EU funding:** € 3,000,000
- **Partners:** 17
- **Project coordinator:** Institute of Communication and Computer Systems, Greece
- **Contact:** Dr. Sofoklis A. Sotiriou, e-mail: sotiriou@ellinogermaniki.gr
- **Project website:** http://www.connect-project.net/
New learning environments

iClass
Intelligent distributed cognitive-based open learning systems for schools

iClass combines research in the fields of pedagogy, cognitive science and computer science towards the realisation of personalised learning and empowerment for learners and teachers in the K12 sector.

The educational vision driving the iClass project is personalisation through empowerment. The research and technological development work carried out in this project aims at leading to personalised and empowered learning, based on the analysis of the needs of learners and teachers.

The iClass team is creating a suite of pedagogically coherent tools and a set of pedagogical methodologies. The tools take into account the needs specific to contemporary classroom teaching situations, and the methodologies facilitate openness and personalised and/or collaborative activities in the classroom and beyond. These tools and methodologies aim to increase the effectiveness of and accessibility to education by giving the users sufficient control and choice options to attain empowerment in tailoring their teaching and learning experiences to their specific preferences and needs.

Teachers are being empowered through tools (e.g. diagnostic) and a methodology in order to design and deliver personalised learning. Learners are being empowered by the iClass in the sense that the system supports self-regulated learning, where human actors – the learner, assisted by the teacher – are the owners of the profiling process and of the creation of a personalised learning path. The technology's role in self-regulated learning is that of a facilitator, providing the required environment, tools and data for the learner to exercise her self-regulation.

As the pedagogical standpoint of the iClass system the project has created the 'Self Regulated Personalized Learning Model' which amalgamates pedagogical considerations of self regulated learning, personalisation, and intrinsic motivation. This model serves as a concrete blueprint for the realisation of the iClass educational vision in technology-enhanced environments. It is being validated through ongoing analysis of state of the art research and of end-user feedback. It will also serve as a reference for monitoring the alignment of the project activities with the educational vision and to foster it.

The iClass system allows for various educational approaches and thus can be used in most, if not all, learning and teaching situations. The project team will concentrate on proof of concepts with 10 years plus students, although the results of their work will be applicable to a broader range of both primary and secondary school students.

Project facts
Strategic objective: 'Technology-enhanced learning and access to cultural heritage'
Project type: Integrated Project
Start date: 1 January 2004
Duration: 54 months
EU funding: € 9 000 000
Partners: 17
Project coordinator: Siemens Business Services, SA/NV, Belgium
Contact: Mr Eric Meyvis, e-mail: eric.meyvis@siemens.com
Project website: http://www.iclass.info/iclass01.asp
New learning environments

LE ACTIVE MATH
Language-enhanced, user adaptive, interactive e-learning for mathematics

LeActiveMath has developed a third generation learning system that adapts to the learner and learning context. Features of the system are advanced personalisation, intelligent feedback and tutorial dialogues, open student modelling and interactivity to support active and exploratory learning.

LeActiveMath has delivered an intelligent web-based learning system for mathematics. Main target users are students at high school, college or university level, but the technology can also be used in informal contexts for self learning. The system adapts to the learner and learning context and comprises personalisation, tutorial dialogues, open student modelling and interactivity. It supports active and exploratory learning.

The added value of LeActiveMath to previous systems is due to
- intelligent feedback and tutorial dialogue;
- integrated interactive tools that understand the semantics of learning objects;
- pedagogically grounded elements, contexts and strategies that employ tools beneficially;
- reaction to the student's motivational and emotional state;
- advanced personalisation;
- opportunity and scaffolding of self-guidance and learner-initiative;
- inspectable student model;
- accessible exercise repository and teacher support and free non-commercial usage.

LeActiveMath features a truly open architecture with one central student model, reusability of single components and tools, integration in one configurable system and innovative semantic knowledge representation and integrated tools using it. The semantic content encoding relies on and extends existing standards (such as OpenMath, IEEE LOM, Maths QTI).

Tools and components are motivated by pedagogical and cognitive research results. In particular, the system is designed as learner-centred and to support the learning process and the learner's initiative.

Project facts
Strategic objective: 'Technology-enhanced learning and access to cultural heritage'
Project type: Specific targeted research project
Start date: 1 January 2004
Duration: 42 months
EU funding: € 3 950 000
Partners: 9
Project coordinator: Deutsches Forschungszentrum für Künstliche Intelligenz (DFKI), Competence Centre for eLearning, Germany
Contact: PD.Dr. Erica Melis, e-mail: melis@activemath.org
Project website: http://www.leactivemath.org/
Using GRID technologies for learning

**ELeGI**
European Learning GRID Infrastructure

**ELeGI aimed at supporting a shift to a paradigm where learning is conceived as knowledge construction that combines experiential, contextualised and collaborative approaches in a personalised and ubiquitous way. The work plan was to define and implement a software architecture that brings together Grid, semantic and knowledge technologies.**

The ELeGI project set out to develop software technologies for effective human learning, promoting and supporting a learning paradigm shift. The focus was to change from learning as information transfer, based on content and on the key authoritative figure of the teacher, to learning as knowledge construction using experiential and collaborative approaches in a contextualised, personalised and ubiquitous way.

In the concept of 'human centred design' of learning applications, learning is clearly a social, constructive phenomenon. It occurs as a side effect of interactions, conversations and enhanced presence in dynamic virtual communities. The project focused on experimental research based on this concept and integrated the leading edge of currently available and future ICT, including the powerful developments of services in the Semantic GRID, with innovative scenarios of human learning.

The main goals of research carried out under ELeGI were:

- To define new models of human learning enabling ubiquitous and collaborative learning, merging experiential, personalised and contextualised approaches.
- To define and implement an advanced service oriented Grid based software architecture for learning, allowing to access and to integrate the different technologies, resources and contents that are needed to support the new learning paradigm.

Development work in ELeGI was driven both by pedagogical needs and by requirements provided by various test-beds, and informed through experience gained through implementing demonstrators on virtual scientific experiments, e-assessment, and socially mediated learning.

**Project facts**

- **Strategic objective:** 'Technology-enhanced learning and access to cultural heritage'
- **Project type:** Integrated Project
- **Start date:** 1 February 2004
- **Duration:** 41 months
- **EU funding:** € 7 472 000
- **Partners:** 22
- **Project coordinator:** Atos Origin, Spain
- **Contact:** Mr Pierluigi Ritrovato, e-mail: ritrovato@crmpa.unisa.it
- **Project website:** [http://www.elegi.org/](http://www.elegi.org/)
Standards compliance and conformance testing are key elements required to accelerate market take-up of innovative technologies. TELCERT developed software tools and other resources to help authors, suppliers and standards organisations improve the interoperability of e-learning systems and materials.

In technology-enhanced learning standards compliance and testing are key elements for making learning system elements reusable in different ways so as to meet diverse learning needs, for widening the market opportunities of suppliers of novel technologies and for reducing time and cost of integration of content tools and services with differing adaptations of specifications and standards.

Standards bodies such as the IMS Global Learning Consortium have made progress in developing specifications to facilitate interoperability. Still, e-learning communities lack test backed conformance programmes to underpin interoperability and assure confidence.

One focus of the work of the TELCERT team was thus on producing state of the art reports, guides and tutorials to help understand the issues involved - the technology involved in the XML and UML environment, adopting standards and specifications, developing application profiles, testing content and services and developing conformance and certification programs providing assurance to buyers.

Further, TELCERT created a set of tools that allow learning communities to localise international specifications for e-learning content and services, and enable publishers to create interoperable products. SchemaProf, for example, is a powerful XML-based tool that allows users to create application profiles defining local cultural and pedagogical needs within an e-learning product. The Content Reengineering Tool (developed from the widely used RELOAD editor) helps publishers adapt content to a particular user profile.

Finally, the TELCERT project has designed a new test system which verifies that content conforms to the profiled specification and provides information for product certification programmes.

Project facts
Strategic objective: Technology-enhanced learning and access to cultural heritage
Project type: Specific targeted research project
Start date: 1 January 2004
Duration: 30 months
EU funding: € 1 799 972
Partners: 10
Project coordinator: X/Open Company Limited, UK
Contact: Mr David Rose, e-mail: d.rose@opengroup.org
Project website: http://www.opengroup.org/telcert
This co-ordination action aimed at accelerating the adoption and further development of standards for e-learning systems in Europe, namely the IMS Learning Design specification. The project set up communities of practice, and held seminars and conferences to raise awareness and to spur interaction between members of the education and technology communities concerned.

As regards the adoption of learning technologies standards, an important step forward was marked by the publication in January 2003 of the IMS Learning Design (LD) specification which enables flexible and sophisticated pedagogical approaches.

IMS-LD provides support for multiple as well as single learners and their coordination; for a wide range of present, as well as future, pedagogical models; for learning activities and learning services, as well as for content.

However, there is a significant gap between the release of a new specification and the full realisation of its potential benefits in the teaching and learning practice. The definition, implementation and adoption of standards in e-learning involve a hierarchy of groups with very different roles, and highly divergent discourses: specification designers, authors of learning resources, content providers, tools developers, teachers and learners.

The UNFOLD project brought together researchers, developers, content providers and teaching professionals to promote and coordinate the adoption and implementation of IMS LD as the best available solution to make educational activities - and not just content - interoperable across different applications.

The core activity of UNFOLD has been to support and facilitate Communities of Practice (CoPs) which are groupings of people who come together around common interests and expertise, creating, sharing, and applying knowledge within and across the boundaries of tasks, teams and organisations. The CoPs were launched in July 2004 with the establishment of three communities, for Systems Developers, Learning Designers and for Teachers and Learning Designers.

Parallel to the progress of UNFOLD’s work, and in many cases incited by it, the use of the IMS-LD specification has increased significantly. Providers of open source course management systems and e-learning applications, who are gaining an increasing share of the market, have started to adopt it, and teachers, many of whom complain about the lack of functionality and constraints imposed by existing e-learning environments, are increasingly coming to see IMS Learning Design as an attractive and flexible solution to interoperability problems.

**Project facts**
- Strategic objective: 'Technology-enhanced learning and access to cultural heritage'
- Project type: Co-ordination Action
- Start date: 1 January 2004
- Duration: 24 months
- EU funding: € 660 000
- Partners: 4
- Project coordinator: Department of Technology, Fundació Universitat Pompeu Fabra, Spain
- Contact: Prof. Josep Blat, e-mail: josep.blat@upf.edu
  Mr Dai Griffiths, e-mail: dai.griffiths.1@gmail.com
- Project website: http://www.unfold-project.net/
KALEIDOSCOPE
Concepts and methods for exploring the future of learning with digital technologies

Bringing together experts from many disciplines, the KALEIDOSCOPE network integrated cutting-edge research in the fields of educational, social, cognitive and computational sciences and emerging technologies.

KALEIDOSCOPE was funded as a Network of Excellence for establishing a coherent and strong European Research Area in the technology-enhanced learning domain. It adopted a multidisciplinary and cross-cultural perspective and contributed to shaping the scientific evolution of technology enhanced learning.

The network succeeded in integrating the leading research teams in the field and has created a community of more than 1,000 researchers, covering a large range of expertise from educational, social, cognitive and computational sciences. Among the project's activities were sharing of knowledge and tools, developing agreed vocabularies, a common theoretical framework and methodologies and identifying important research issues. Other issues were training of researchers, and exploring innovation and commercialisation of research.

The project was organised around a set of integrating actions such as 'Jointly Executed Integrating Research Projects', and the creation of 'European Research Teams' and 'Special Interest Groups'. The 'Shared Virtual Laboratory' helped members to share, exchange and re-use software, standards and techniques, and thus also promoted technical interoperability between learning environments and tools. One aim of the network was to link research to the commercial technology-enhanced learning market. An activity named 'Gateway' built pathways between the different stakeholders in this emerging marketplace. KALEIDOSCOPE also offered advanced training activities, through the 'Virtual Doctoral School' which gave students access to top researchers and other students all over Europe, exposing them to a wide range of knowledge.

The Users' Group was created as the network's main link with the world of educational practice. Its objective was to develop more effective ways of detecting users' needs and expectations, and to enhance dialogue and mutual understanding between research and the 'real world'. Key interests were the learners' attitudes, motivation, behaviour, values and context - all factors that deeply affect how people use technology and interact with others to learn collaboratively.

Project facts
Strategic objective: 'Technology-enhanced learning and access to cultural heritage'
Project type: Network of Excellence
Start date: 1 January 2004
Duration: 48 months
EU funding: € 9 350 000
Partners: 91
Project coordinator: FIST S.A. - France Innovation Scientifique et Transfert, France
Contact: Mr. Frédéric Legros, e-mail: kaleidoscope@fist.fr
Scientific project manager: Dr. Nicolas Balacheff, CNRS – Centre National de la Recherche Scientifique, e-mail: nicolas.balacheff@imag.fr
Project website: http://www.noe-kaleidoscope.org/
PROLEARN integrated the key areas of research most relevant to professional learning in SMEs and larger companies. It worked towards bridging the gap between academic research and education and learning at the workplace.

Research conducted under PROLEARN aimed at advancing the state of the art in the key areas of personalised adaptive learning and interactive media, with learning resources connected to real-world settings and reusable in different contexts. The project investigated issues especially relevant for professional training in SMEs and larger companies, including brokerage platforms and services, business models for specific markets, and advanced training and knowledge work management arrangements.

As a network of excellence, PROLEARN brought together the most important research groups in the aforementioned areas, namely in the Professional Learning Cluster (PRO-LC), as well as other key organisations and industrial partners. This work helped to bridge the gap between academic research and education and training and continuous education in companies.

Through PROLEARN awards, best practice examples, show cases and workshops the network enforced European professional training in technology enhanced environments. Through roadmaps and policy guides, it analysed future trends relevant for future professional training tools, environments and scenarios.

PROLEARN's two main horizontal activities were:

- The PROLEARN Academy, funded for teaching and educating researchers and employers in the area of technology-enhanced professional learning and related issues. At the same time, it fostered the integration of researchers in the network of excellence by establishing research exchange programmes and joint research activities.

- The PROLEARN Virtual Competence Centre focused on the integration of industry. It contributed to spreading excellence to company driven competence centres, chambers of commerce, employment centres and competence centres of trade and industry associations.

PROLEARN also has established the annual EC-TEL, "European Conference on Technology Enhanced Learning".

Project facts
Strategic objective: 'Technology-enhanced learning and access to cultural heritage'
Project type: Network of Excellence
Start date: 1 January 2004
Duration: 48 months
EU funding: € 6 006 500
Partners: 20
Project coordinator: Learning Lab Lower Saxony, Universität Hannover, Germany
Contact: Prof. Wolfgang Nejdl, e-mail: nejdl@l3s.de
Project website: http://www.prolearn-project.org
The goal of APOSDLE is to increase knowledge worker productivity by supporting informal learning and teaching activities in the context of knowledge workers' everyday work processes.

APOSDLE aims to enhance knowledge worker productivity by supporting informal learning and teaching activities in the context of knowledge workers’ everyday work processes and within their computational work environments.

The key distinction of the APOSDLE approach as compared to more traditional (e-)learning and teaching approaches is that APOSDLE will provide integrated ICT support for the three roles a knowledge worker fills at the professional workplace: the role of learner, the role of teacher, and the role of worker. This ICT support exploits synergies between learning and knowledge management by reusing content not originally intended for learning, and not require new content to be created. It will utilise contextualised communication for teaching, and not burden experts with additional tasks; and it will be based on knowledge sources available within an organisation – specifically business space, (e-)learning systems, and knowledge management – and not require a switch to a new system.

The outcome of APOSDLE will be a methodology and reference architecture for technology supported workplace learning enhancing the learning processes of the individual and the organisation respectively.

In order to ensure the general applicability of this outcome, the project team will use an application-driven approach covering the needs of three fundamentally different organisations: a network of SMEs, a public organisation, and a large corporation. Their needs and constraints will provide APOSDLE with the necessary guidance to develop innovative technology support for learning processes, contextualised teaching methods and effective work.

**Project facts**

- **Strategic objective**: 'Technology-enhanced Learning'
- **Project type**: Integrated project (IP)
- **Start date**: 1 March 2006
- **Duration**: 48 months
- **EU funding**: € 7 650 000
- **Number of partners**: 12
- **Project coordinator**: Joanneum Research Forschungsgesellschaft mbH, Austria
- **Contacts**: Mr. Harald Mayer (Administrative coordinator), e-mail: harald.mayer@joanneum.at
  
  Mrs. Stefanie Lindstaedt (Scientific coordinator), e-mail: slind@know-center.at
- **Project website**: [www.aposdle.org/](http://www.aposdle.org/)
Learning organisations, competence building

KP-Lab
Developing Knowledge-Practices Laboratory

KP-Lab will create a learning system aimed at facilitating innovative practices of sharing, creating and working with knowledge in education and workplaces.

KP-Lab aims at developing theories, tools, and practical models that enhance deliberate advancement and creation of knowledge as well as transformation of knowledge practices. The essential way of developing the collaborative technologies is a co-evolution process of researchers, technological developers and users.

Therefore, the design principles are the following: 1. Organising activity around collaborative advancement of knowledge artefacts, 2. 'Symmetric knowledge advancement' around authentic problems, 3. Deliberate transformation of knowledge practices, 4. Co-evolution of tools, social practices, and agents.

KP-Lab involves design experiments and longitudinal studies in educational institutions and professional organisations. The technology builds on emerging technologies, such as semantic web, real-time multimedia communication, ubiquitous access using wireless devices, and interorganisational computing. The technologies will be mostly based on open source technology. The first three years of the project will be a research and development phase, and the two last years will be a dissemination and exploitation phase.

The consortium will represent expertise in various domains. Researchers in pedagogy and psychology define and investigate the models of tools and practices; researchers of technology investigate and develop the technological solutions; enterprises offer authentic environments for investigation and participate in the development of technological tools; and institutions representing end-users participate in the co-evolutionary processes.

Project facts

- Strategic objective: 'Technology-enhanced Learning'
- Project type: Integrated project (IP)
- Start date: 1 February 2006
- Duration: 60 months
- EU funding: €11,200,000
- Number of partners: 22
- Project coordinator: Helsingin yliopisto (University of Helsinki), Finland
- Contacts: Liisa Ilomäki (Coordinator), liisa.ilomaki@helsinki.fi
  Kai Hakkarainen (Scientific coordinator), kai.hakkarainen@helsinki.fi
  Hannu Markkanen (Technical coordinator), hannu.markkanen@evtek.fi
- Project website: www.kp-lab.org/

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Learning organisations, competence building

PROLIX
Process-oriented Learning and Information eXchange

PROLIX’ objective is to align learning management with business processes in order to support organisations in improving the competencies of their employees.

The objective of PROLIX is to align learning with business processes in order to enable organisations to faster improve the competencies of their employees according to continuous changes of business requirements. PROLIX supports a complete learning process life cycle comprising 1. the analysis of complex business situations; 2. the identification of individual and organisational learning goals; 3. the analysis of competencies and their matching with individual skills; 4. the definition of appropriate learning strategies and the simulation of competency-oriented processes; 5. the execution of improved learning processes; 6. the monitoring of learners’ performance according to the goals defined.

Therefore, PROLIX will develop a process- and competency driven framework for interlinking business process intelligence tools on the one hand with knowledge management and learning environments on the other.

In order to demonstrate its concept, PROLIX sets up three test beds in different fields of application. The team will specify, design, implement and start to demonstrate its tools and services in relatively mature environments, which are a 'Government test bed' with the UK Government Care Programme (Social Care Institute for Excellence), a 'Telecom test bed' with British Telecom (BT) learning, and an 'Educational publishing test bed' with the publishing houses Klett and EDITIS.

PROLIX unites 19 partners from nine different countries made up of two leading European software vendors for learning management (imc Germany) and Learning Content Management (Giunti Interactive), the largest independent European business process management company (IDS Scheer), leading European research partners in learning technology, didactics and cognition as well as technology-enhanced learning software architecture.

PROLIX wants to open to the learning solutions industry in Europe the potential to better integrate its solutions in business process architectures.

Project facts

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<th>Strategic objective</th>
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<td>Project coordinator</td>
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<td>Contact</td>
<td>Mr. Volker Zimmermann, e-mail: <a href="mailto:volker.zimmermann@im-c.de">volker.zimmermann@im-c.de</a></td>
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<td>Project website</td>
<td><a href="http://www.prolixproject.org/">www.prolixproject.org/</a></td>
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Learning organisations, competence building

TENCompetence
Integrated Project TENCompetence – Building the European Network for Lifelong Competence Development

TENCompetence will further develop models and tools for the creation, storage and exchange of knowledge resources, learning activities, programmes and network data for lifelong competence development.

TENCompetence will develop a technical and organisational infrastructure for lifelong competence development. The infrastructure will use open-source, standards-based, sustainable and innovative technology. It will be freely available and have the potential to boost the ambitions of the knowledge society, by providing individuals, SMEs and other organisations easy access to facilities that enable the lifelong development of competencies and expertise in various applications and fields of knowledge.

The TENCompetence infrastructure will support the creation and management of networks of individuals, teams and organisations in Europe who are actively involved in the various applications and domains of knowledge. These 'learning networks' will support the lifelong competency development of the participants from the basic levels of proficiency up to the highest levels of excellence. The network consists of learners, educational institutes, libraries, publishers, domain specific vendors, employers, associations, and all others who deliver services or products in the specific field.

The learning networks include:
- competency frameworks for the different applications/fields of knowledge;
- formal as well as informal learning facilities, including the sharing of knowledge, learning activities, units of learning and learning programmes;
- the learning of individuals as well as of teams and organisations;
- all levels of learning: primary, secondary and tertiary education, adult and company training and other forms of informal learning;
- social exchange mechanisms to stimulate the exchange, sharing and support between the individuals, teams and organisations within the network.

Project facts
Strategic objective: 'Technology-enhanced Learning'
Project type: Integrated project (IP)
Start date: 1 December 2005
Duration: 48 months
EU funding: € 8 796 000
Number of partners: 13
Project coordinator: Open Universiteit Nederland
Contact: Mr. Eric Kluijfhout, e-mail: eric.kluijfhout@ou.nl
Project website www.tencompetence.org
Collaborative learning, communities of practice

COOPER
Collaborative Open Environment for Project Centered Learning

COOPER has researched how ICTs can support individual and collective competency building in remote project teams.

In recent years, project-centred collaborative learning has been increasingly employed by modern universities and corporation training teams. COOPER has created an online environment that supports project-centred collaborative learning, anytime and anywhere. The project team has conducted extensive case studies in real-world universities and companies specialised in various subjects. R&D work was driven by the following general requirements:

- Defining a set of team management processes that are most suitable for supporting project-centred learning;
- Creating knowledge sharing and recommendation services to facilitate collaborative teamwork processes;
- Proposing pedagogical tools to support competency building and competency assessment in heterogeneous virtual teams;
- Constructing an infrastructure, with a set of telecommunication tools, to support the distant cooperation in a distributed, virtual team.

The COOPER team exploited many advanced technologies for supporting these requirements, such as dynamic process modelling, web application modelling, virtual companies, recommender systems, latent semantic analysis, VoIP communication.

The results of this project can help universities and corporations improve their infrastructure and methodologies in project-centred learning, especially in two learning environments: Graduate (or post-graduate) university studies with projects involving students and lecturers located at different institutions and corporate training for multi-national participants.

The integrated COOPER platform, evaluated through tests on three case-study sites, is available for downloading from the project website.

The project partners continue to collaborate as a network of expert centres for supporting the exploitation and deployment of the COOPER technologies.

Project facts
Strategic objective: 'Technology-enhanced Learning'
Project type: Specific targeted research project (STREP)
Start date: 1 December 2005
Duration: 24 months
EU funding: € 1 950 000
Number of partners: 8
Project coordinator: L3S Research Center and Leibniz University Hanover, Germany
Contact: Mr. Xuan Zhou, e-mail: zhou@l3s.de
Project website www.cooper-project.org
LEAD investigates network learning in classroom situations, i.e. the link between real-life group activities and computer support in collaborative problem-solving processes.

'That morning the students had their lesson in the computer room. The teacher told them that they would work in small groups to discuss their solutions for the problem that was introduced during the previous lesson. Besides face-to-face, students could also discuss electronically. At first, the students reacted with surprise: "Why should we use computers if we can simply talk to each other?" When they started to discuss with the support of the computer, the shared workspace of the computer application enabled them to put forward their ideas in writing, thereby creating a dynamic representation of the knowledge they shared during their discussion.'

LEAD focuses on one specific type of 'higher-level cognitive' learning activity, i.e. collaborative problem solving. Collaborative problem solving is an essential aspect of our day-to-day performance in society. In addition, when people solve problems they learn. It is therefore not surprising that problem solving as a learning activity has a long and fruitful tradition in educational practice.

The LEAD project offers a new direction compared to the communication processes of the traditional classroom. Rather than having a group of students sit together to talk about a topic orally, LEAD proposes effective networked-computing support for face-to-face discussions. In combination with traditional, non-mediated activities, this may lead to the occurrence of particular forms of interaction, knowledge construction and representation, with the potential to trigger a wider range of learning mechanisms.

In order to develop a deeper understanding of the learning processes in these situations, LEAD takes into account social, cognitive, and developmental processes and blends empirical educational research with theory-driven design. This will result in a Discussion Support System (DSS) with associated theoretical models, as well as pedagogical scenarii that will guide teachers on how to effectively use computer supported face-to-face problem solving in the classroom.

Project facts
Strategic objective: 'Technology-enhanced Learning'
Project type: Specific targeted research project (STREP)
Start date: 1 December 2005
Duration: 36 months
EU funding: € 2 000 000
Number of partners: 7
Project coordinator: Universiteit Utrecht, Instituut Pedagogiek en Onderwijskunde (IPEDON), Netherlands
Contact: Mr. Jerry Andriessen, e-mail: j.e.b.andriessen@uu.nl
Project website: www.lead2learning.org
Effective collaboration dynamics are at the core of learning, knowledge exchange and innovation processes. Nevertheless, in today’s global environment, a large number of collaboration initiatives fail to deliver the value expected, as complexity is enhanced by the diversity and the distributed nature of the people, groups, and knowledge sources and by the knowledge integration processes involved.

Research and development work undertaken in the L2C project aimed at specifically addressing and significantly advancing the state of the art (both theory and practice) in two relevant areas:

− Technology-enhanced learning of collaboration dynamics and competencies development;
− Design of advanced simulations based on models of human behavior in different organisational contexts.

In terms of concrete outputs, L2C has developed:

− A dynamic online Knowledge Base for capturing the knowledge in the area of collaboration dynamics and related academic disciplines (from motivational psychology, organisational culture, holistic theories of creativity and the social network theory to distributed, technology-enhanced team dynamics, knowledge management, and innovation diffusion studies) combined with best practices and experiences from a number of industry sectors;
− A Virtual Learning Community contributing to the advancement of knowledge in collaboration dynamics and technologies (theory, practice and learning dimensions), and the development of interdisciplinary exchanges including knowledge creation and collaboration;
− An Innovative Framework addressing the effective development of collaboration competencies and targeting the design of effective technology-enhanced learning solutions based on Advanced Organisational Simulation Games (based on computer-enhanced collaborative and experiential learning models and simulation games design principles);
− A set of widely deployable, advanced, interactive and experiential Advanced Organisational Simulation Games guaranteeing the effective understanding and internalisation of (1) cognitive, motivational and attitudinal factors driving collaborations, (2) complexity of knowledge integration processes and distributed, ICT-supported teamwork, and (3) management competencies determining the success or failure of collaboration dynamics in diverse and distributed contexts;
− An Online Workshop Tool to support real-time collaboration and collect users’ insights in real-time to take advantage of participants’ immediate feedback during the simulation game workshops.

**Project facts**

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<td>Project coordinator:</td>
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<td>Contact:</td>
<td>Prof. Dr. Albert A. Angehrn, e-mail: <a href="mailto:albert.angehrn@insead.edu">albert.angehrn@insead.edu</a></td>
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<td>Project website</td>
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PALETTE
Pedagogically sustained Adaptive Learning Through the exploitation of Tacit and Explicit knowledge

PALETTE aims at improving learning in communities of practice by exploiting knowledge and competences of individual members, and by supporting social interaction and exchange of codified and tacit knowledge.

The PALETTE project aims at developing an extensible set of innovative, interoperable and standard-based services that enhance the learning process in communities of practice. Services will be validated through various pedagogical scenarios fostering the emergence of new learning practices that remove barriers for the exploitation of knowledge resources and competencies of individuals inside and outside communities.

To realise the above goals, PALETTE’s R&D process adopts a participative design approach, establishing a balance between technological and pedagogical experts. Evaluation is integrated in the process, in order to provide direct, frequent and detailed feedback.

The approach takes into consideration the underlying processes of social participation, community building and development of identity in communities of practice, where learning and knowing are deeply interconnected and articulated around the negotiation of meaning, which is at the base of any individual and collective learning.

The open source services provided by PALETTE can be classified into three categories: information services, knowledge management services and mediation services. They will provide support to community’s participants for:

- data production, exchange and reuse between autonomous and heterogeneous scenarios;
- reification of explicit and tacit knowledge about practices;
- advanced communication and collaboration between stakeholders of communities.

The consortium, composed of both technological and pedagogical experts, intends to provide innovative learning models and technical solutions that increase the overall quality of learning in communities of practice and contribute to the development of standards in the domain.

**Project facts**
- **Strategic objective** 'Technology-enhanced Learning'
- **Project type:** Integrated project (IP)
- **Start date:** 1 February 2006
- **Duration:** 36 months
- **EU funding:** € 6 000 000
- **Number of partners:** 14
- **Project coordinator:** GEIE ERCIM, France
- **Contact** Mrs Karen Marache, e-mail: karen.marache@ercim.org
- **Project website** http://palette.ercim.org
ARiSE will develop an augmented-reality-teaching platform for school classes. Existing augmented reality technology for museums is adapted to the everyday learning environment of teachers and students. The augmented-reality-teaching platform will provide 3D visual augmentation of real objects and sound and will be integrated with a multi-media database and an e-learning tool.

ARiSE promotes team work, collaborative learning and communication between students, classes and schools, even across country borders. The teaching platform will support this on the technical level by providing remote collaboration and communication functionalities.

ARiSE combines classical teaching material with audiovisual media. The use of 3D presentation and interaction techniques will lead to better understanding of complex scientific and cultural content. The interactive approach of the teaching platform raises the level of participation of students in the learning process and motivates them.

A major part of the project is dedicated to the exploration of new methods and tools for content development by users who are no augmented reality experts. In addition to content provided by professional providers, teachers as well as students will be able to create lessons for the teaching platform on their own. Collaboration between students will include the creation of content by students for students.

The research and development process is based on close cooperation with schools from the beginning of the project. All developments will be measured by real life tests in participating schools.

The consortium consists of scientists and practitioners from the fields of computer science, pedagogy and didactics from Czech Republic, Germany, Lithuania, Malta and Romania.

**Project facts**

- **Strategic objective**: 'Strengthening the Integration of the ICT research effort in an Enlarged Europe'
- **Project type**: Specific targeted research project (STREP)
- **Start date**: 1 January 2006
- **Duration**: 36 months
- **EU funding**: € 1 992 000
- **Number of partners**: 7
- **Project coordinator**: IMK, Fraunhofer Gesellschaft zur Förderung der angewandten Forschung e.V., Germany
- **Contact**: Mr. Stefan Conrad, e-mail: stefan.conrad@imk.fraunhofer.de
- **Project website**: www.arise-project.org
ARGUNAUT
An Intelligent Guide to Support Productive Online Dialogue

ARGUNAUT investigates awareness and feedback mechanisms for facilitating the interaction in e-discussion environments, and the use of graphical argumentation maps and artificial intelligence components.

The aim of ARGUNAUT is to develop tools that assist tutors in visualising e-discussions as an aid for their moderating tasks ('awareness tools'). Human facilitators will still be needed in the discussion, but the support of an advanced artificial intelligence based system will enable them to concentrate on tasks that require their unique human capabilities.

The tools developed in ARGUNAUT will have the potential of significantly increasing the educational productivity of e-learning discussions. They will be tested in four educational settings: higher, secondary, vocational and professional education.

Using previously developed tools, the ARGUNAUT partners will establish a unique moderation methodology through: studying tutor interventions using visualisations in graphically represented ('mapped') e-discussions and other computer-supported collaborative activities; defining criteria according to which these discussions can be improved; and developing an ICT system supporting the work of online course moderators, and helping them improve their practice.

The novel tools will be tailor-made for working on two existing discussion-supporting platforms – the results of past EU-sponsored projects: DUNES/Digalo and Cool Modes. A careful architecture design, however, will allow for openness and adaptability of ARGUNAUT components to a wider range of platforms and environments.

The DUNES project developed an e-learning tool that enables teachers to visualise students' arguments in discussion maps. ARGUNAUT wants to take another step towards the future and include artificial intelligence components in the tool. The vision of the project team is to provide a discussion platform with the ability to assist the moderator in the moderating process by analysing the discussion map on-line, by high-lighting trends, dynamics, and potential threats to the discussion direction.

The ARGUNAUT consortium consists of two main bodies – a technological team, and a pedagogical team. The pedagogical team will analyse discussion maps generated in classrooms in different countries during the DUNES project and will continue to enrich the discussion database with new discussions during the project period. The technological team will develop the artificial intelligence components and other tools needed.

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<td>Project coordinator</td>
<td>The Hebrew University of Jerusalem, School of Education, Israel</td>
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<tr>
<td>Contact</td>
<td>Mrs. Reuma De-Groot, e-mail: <a href="mailto:msruma@mscc.huji.ac.il">msruma@mscc.huji.ac.il</a></td>
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<td>Project website</td>
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AtGentive investigated the use of artificial agents for the management of attention as a key factor of learning performance, and has developed a conceptual model for collaborative learning rooted on cognitive science.

The objective of the AtGentive project was to investigate the use of artificial agents for supporting the management of the attention of young or adult learners in the context of individual and collaborative learning environments.

Practically, this project consisted in the design of artificial agents that are able to coach the learners in reaching a higher level of performance through managing their attention in the learning process. These agents, which appear as embedded characters, are able to profile the state of the attention (short or long term) of the learners by observing their actions; to assess, to analyse and to reason on these states of attention; and to provide some proactive coaching (assessment, guidance, stimulation, etc.).

The attentive agents were designed and delivered as part of two different learning infrastructure/contexts:

- **AtGentSchool**: an artificial characters enhanced e-learning platform for child education;
- **AtGentNet**: an advanced virtual community platform supporting knowledge exchange in knowledge communities.

AtGentive was coordinated by INSEAD’s Centre for Advanced Learning Technologies, in collaboration with academic partners such as the American University of Paris from France, Oxford Brookes University from UK, the Unit for Computer-Human Interaction from the University of Tampere, Finland. The consortium was complemented by SME partners providing design and technical know-how such as OntDekNet (NL) and Cantoche Production (FR), and organisations granting access to an extensive group of users both in a school context with the Czech E-Learning Network, and in a working context with the Swedish Trade Council.

The results of this project were validated with two pilots:

- In the AtGentSchool pilot, pupils stimulated by 'attention aware' artificial agents have shown a higher level of satisfaction and motivation.
- The AtGentNet environment, tested for collaborative learning in a workplace context, also has shown more interaction between learners and higher motivation than a legacy e-learning platform.

**Project facts**

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<td>Contact</td>
<td>Mr. Thierry Nabeth, e-mail: <a href="mailto:thierry.nabeth@insead.edu">thierry.nabeth@insead.edu</a></td>
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Learning experiences and psychological factors

eCIRCUS
Education through Characters with Emotional Intelligence and Role-playing Capabilities that Understand Social Interaction

**eCIRCUS** will investigate the efficiency of role-play, narrative engagement and empathy on cognitive and emotional learning processes in complex social situations.

eCIRCUS will develop a new approach in the use of ICT to support social and emotional learning. This will be achieved through virtual role-play with synthetic characters that establish credible and empathic relations with the learners.

To attain this, eCIRCUS investigates educational role-play using autonomous synthetic characters and involving the child through affective engagement, including the use of standard and highly innovative interaction mechanisms.

The project will introduce novel conceptual models and innovative technology to support learning through role-play and affective engagement for personal and social education involving complex social situations. It will do this by taking modern theories of narrative and role-play from psychology and by implementing them in affectively driven autonomous graphically embodied agents – actors with attitude.

This technology will be delivered through a virtual learning environment for emotional and social learning, developed through two showcases: one on anti-bullying education and one on intercultural empathy. eCIRCUS will use a classroom-based, curriculum-focused participatory design approach and a comprehensive evaluation framework, including a longitudinal study, to assess impact and effectiveness.

The dissemination of results from this project could have a significant impact on approaches to social and emotional learning; improving quality and innovation in learning technologies; determining approaches to combat bullying and support conflict resolution; and potentially improving the quality of life in European schools.

**Project facts**

- **Strategic objective**: 'Technology-enhanced Learning'
- **Project type**: Specific targeted research project (STREP)
- **Start date**: 1 March 2006
- **Duration**: 24 months
- **EU funding**: € 2 600 000
- **Number of partners**: 9
- **Project coordinator**: Heriot-Watt University, UK
- **Contact**: Prof. Ruth Aylett, e-mail: ruth@macs.hw.ac.uk
- **Project website**: www.e-circus.org/
Learning experiences and psychological factors

ELEKTRA
Enhanced Learning Experience and Knowledge Transfer

ELEKTRA merged pedagogical and cognitive science expertise with the innovations of computer game technology in storytelling, information visualisation and interactivity to design next-generation learning games.

Point of departure for this project was the observation that digital learning games suffer from various deficits that severely impair their effectiveness as a learning tool. For example, they do not make use of the motivating power of elaborate storytelling. ELEKTRA’s vision was to make learning as exciting for learners as leading-edge computer games are exciting for gamers.

The project team’s strategy to tackle this challenge was to link research in the field of pedagogy with neuroscience, cognitive science and computer science. This aimed at bridging the gap between cognitive theory and gaming practice and helped to assess the cognitive potential of learning games and to put their development on the grounds of a sound psycho-pedagogical theory.

The neuroscience part of ELEKTRA studied the effectiveness of different teaching/learning scenarios by event-related brain imaging in combination with psychological learning tests. Expertise in computer science and creativity facilitated the implementation of research and theory into the ELEKTRA learning game, an immersive 3D world for learning that uses state of the art game design techniques for visualisation, interaction and storytelling.

ELEKTRA’s 3D world visualises learning topics as highly interactive virtual landscapes, conceived as a ‘garden of knowledge’ through which the learner can perambulate freely or by following the guidance of a storyline and/or a game character. This typical concept for game-play comprises a user-centric perspective, supported by multimodal concepts for learning paths and learner models.Narration (‘the original form of teaching’) is part of the didactic design. The game-play is enhanced with interactive dramaturgy and direction in order to drive the storytelling and deepen the immersion of the learner into the learning topic.

Monitoring and assessment of the learner are integrated in a way that enables a situated and activity-driven learning experience. The virtual learning environment reacts in relation to the learner’s behaviour and cognitive state and to the learning progress represented in the learner model.

Target groups for these next generation learning games are secondary school children and university students.

Project facts
Strategic objective: Technology-enhanced Learning
Project type: Specific targeted research project (STREP)
Start date: 1 February 2006
Duration: 24 months
EU funding: € 2 420 000
Number of partners: 9
Project coordinator: Gesellschaft zur Förderung künstlerischer Informatik Laboratory for Mixed Realities, Germany
Contact: Mr. Daniel Schwarz, e-mail: schwarz@lmr.khm.de
Project website: www.elektra-project.org/
CALIBRATE
Calibrating eLearning in Schools

The work of CALIBRATE enables schools to easily locate and access a wider and more diverse collection of learning resources at a European level.

CALIBRATE brought together eight Ministries of Education (including six from new EU Member States) to carry out a multi-level project designed to support the collaborative use and exchange of learning resources in schools.

The work built on the results of previous IST projects under the 5th Framework Programme (CELEBRATE, ITCOLE and VALNET) and was designed to help strengthen the integration of the ICT research effort in an enlarged Europe.

CALIBRATE's main achievements are:

− Development and promotion of an open source technical architecture to support content exchange/collaboration between Ministries of Education and other owners of educational repositories;
− Development and promotion of an open source learning toolbox that supports the collaborative use of learning resources. It provides the users with an environment for group centred work and knowledge building activities and with course building tools of the type found in more conventional learning content management systems;
− Research and testing of new approaches that improve semantic interoperability related to the discovery and evaluation of learning resources;
− Validation of research results in up to 100 schools using an advanced validation methodology.

CALIBRATE also brought together a number of other European Schoolnet (EUN) projects and initiatives that build a wider framework and lay the foundations for the implementation of a new European Learning Resource Exchange, accessible to all interested Ministries of Education participating in the EUN and other public and private sector owners of educational content repositories.

Project facts
Strategic objective: 'Strengthening the Integration of the ICT research effort in an Enlarged Europe'
Project type: Specific targeted research project (STREP)
Start date: 1 October 2005
Duration: 30 months
EU funding: € 3 305 000
Number of partners: 17
Project coordinator: EUN Partnership AISBL, Belgium
Contact: Jim Ayre, e-mail: jim.ayre@multimediaventures.com
Project website: http://calibrate.eun.org
Learning resources, brokerage, curriculum mapping

iCAMP
Innovative, Inclusive, Interactive & Intercultural Learning Campus

iCamp will create an infrastructure for collaboration and networking across systems, countries and disciplines, pedagogically based on constructivist learning theories.

iCamp has the vision to become the educational web for higher education in the enlarged Europe of 25+. It will provide an infrastructure - the iCamp Space - for collaboration and social networking across systems, countries and disciplines. The iCamp Space will build on existing interfaces and integrate shared community features. Interoperability amongst different open source learning systems and tools is the key to sustainability of iCamp.

The content for this collaboration within social communities is provided via distributed networked repositories including content brokerage platforms, online libraries, learning object databases, etc. Here, the Simple Query Interface (SQI), a quasi-standard developed in previous projects, will serve as the basis for further development and improvements with regard to system interoperability.

The driving principle behind the technical challenges is the innovative pedagogical model of iCamp which is based on constructivist learning theories. iCamp creates an environment for a new way of social instruction that puts more emphasis on self-organised learning and social networking and the role of the educator changes. The flexible pedagogical models will be validated during the trials. iCamp aims to perform two small-scale and one large-scale trial involving students and educators from the consortium and external partners for three different topics: basic research methods, international relations and management of international projects.

The project aims at strengthening the educational landscape in Europe and at offering a sustainable infrastructure. Since iCamp is not creating an additional e-learning system, but facilitates interoperability, a main advantage is that universities can continue to use and further develop their systems, while at the same time connect to other systems and offer a wide collaboration space for their users. iCamp will provide guidelines as well as a software toolkit to ease integration into the iCamp Space.

Project facts
Strategic objective: 'Strengthening the Integration of the ICT research effort in an Enlarged Europe'
Project type: Specific targeted research project (STREP)
Start date: 1 October 2005
Duration: 39 months
EU funding: € 2 698 000
Number of partners: 11
Project coordinator: ZSI/Universität für Bodenkultur, Austria
Contact: Mrs. Barbara Kieslinger, e-mail: kieslinger@zsi.at
Project website www.icamp-project.org
LT4eL will use multilingual language tools for improving the retrieval and accessibility of learning objects through semi-automatic metadata generation for use in connection with learning management systems.

Given the huge amount of static and dynamic content created for e-learning tasks, the major challenge for extending its use is to improve the effectiveness of retrieval and accessibility by making use of learning management systems.

The aim of the LT4eL project is to tackle this problem by providing language technology based functionalities and by integrating semantic knowledge to enhance the management, distribution and retrieval of the learning material.

Specifically, the project will employ language technology resources and tools for the semi-automatic generation of descriptive metadata. It will thus develop new functionalities such as a key word extractor and a glossary candidate detector, tuned for the various languages addressed in the project (Bulgarian, Czech, Dutch, English, German, Polish, Portuguese, Romanian).

Semantic knowledge, in the form of ontologies, will be integrated to enhance the management, distribution and searchability of the learning material. The ontologies will allow for the multilingual retrieval of the required information.

These functionalities can be integrated in any open source learning management system. They will facilitate the construction of user specific courses, allow direct access to knowledge and support decentralisation and cooperation in content management. The project will also create a validation methodology suitable for investigating the impact of these new functionalities on the learning experience in a multilingual context.

LT4eL will contribute to the dissemination of e-learning content that reflects the linguistic diversity of the 'enlarged Europe' by creating opportunities for multilingual virtual learning communities and by delivering technologies for their support.

Project facts
Strategic objective: 'Strengthening the Integration of the ICT research effort in an Enlarged Europe'
Project type: Specific targeted research project (STREP)
Start date: 1 December 2005
Duration: 30 months
EU funding: € 1 508 000
Number of partners: 12
Project coordinator: Universiteit Utrecht, Institute of Linguistics OTS, Netherlands
Contact: Dr. Paola Monachesi, e-mail: paola.monachesi@let.uu.nl
Project website: www.let.uu.nl/lt4el
Learning & teaching music and mathematics

i-Maestro
Interactive Multimedia Environment for Technology Enhanced Music Education and Creative Collaborative Composition and Performance

i-Maestro is exploring new pedagogical paradigms and advanced technology with the objective to develop interactive multimedia environments for technology-enhanced music education. Both music theory and performance training are supported, particularly on string instruments.

Music performance is more than playing the right note at the right time. Among the many challenging aspects of music education, the i-Maestro research team is particularly interested in linking music practice and theory training, looking at interactivity, expressivity and accessibility.

Starting from an analysis of pedagogical needs and building on recent developments of computer and information technologies, the project is developing enabling technologies to support music performance and theory training, including tools based on augmented instruments, gesture analysis, audio analysis and processing, score following, symbolic music representation, cooperative support and exercise generation. Particular focus is put on string instruments.

Gesture analysis tools are being developed to provide feedback about the performance. For example, the '3D Augmented Mirror' utilises motion-capture technology to explore interactive feedbacks with visualisation and sonification to support the learning and teaching of bowing technique and body posture. The 'Gesture Follower' can compare a performed gesture with a set of pre-recorded gestures for a variety of pedagogical applications, and the 'Score Follower' listens to the player and tracks his/her location within the score in order to support automated 'page turning' and accompaniment.

Music notation is one of the fundamentals in music education. i-Maestro is promoting MPEG Symbolic Music Representation (SMR), an ISO standard for the representation of music notation with enhanced multimedia features. Cooperative work is another key area of music education. It allows different components of the i-Maestro framework to be used across a network. Other tools include the 'Exercise Generator', which supports (semi-)automated creation of exercises, while the 'School Server' offers online access to stored lesson material for sharing learning material at home and in the classroom.

The project includes demonstration and validation activities, which will be conducted by major European institutions such as Accademia Nazionale di Santa Cecilia (Rome), Fundación Albéniz (Madrid) and IRCAM (Paris). The project consortium involves leading research and education institutions, organisations and SMEs in the domains of IT and music across Europe.

The final results of i-Maestro will be incorporated in various products and services that will be made available to the public and to educational establishments.

Project facts
Strategic objective: 'Technology-enhanced Learning'  
Project type: Specific targeted research project (STREP)  
Start date: 1 October 2005  
Duration: 36 months  
EU funding: € 2 350 000  
Number of partners: 10  
Project coordinator: University of Leeds, UK  
Contact: Dr. Kia Ng, e-mail: kia@computer.org  
Project website: www.i-maestro.net or: www.i-maestro.org
VEMUS will create a music tuition environment equipped with advanced tools for automatic performance evaluation and feedback, for collaborative learning and group activities, and for distance learning.

The project team aims at building a highly interactive and networked music practising environment for popular wind instruments such as the flute, the clarinet, the saxophone and the trumpet. VEMUS seeks to put e-learning in the forefront of the music tuition agenda by smoothly blending technology with traditional face-to-face lessons and by developing the technological basis and a set of innovative, pedagogically-motivated tools to support different learning contexts:

- Self-practicing at home will be supported by automatic performance assessment and rich feedback complemented by informative and meaningful visualisations of different aspects of a musical performance that will make music practising much more effective and fun.
- For practising in groups or in the music classroom, VEMUS will develop innovative assistance tools to support collaborative learning and practising activities that enhance the students’ learning experience and link teaching in the classroom with studying at home.
- A distance learning platform will extend collaboration facilities to virtual classes through the Internet. The platform will offer a content repository, communication and progress monitoring tools, and set the ground for a virtual meeting, practising and remote coaching site.

The project will build on the knowledge and results of the IMUTUS project (FP5) that delivered an efficient self-practicing environment for the recorder, offering clear evidence of the strong potential of the concept and approach. VEMUS will largely extend the pedagogical and technological basis of IMUTUS to cover additional popular instruments, additional learning environments, and enhanced pedagogical scenarios.

The VEMUS partnership includes eight organisations from six countries, three of which are new EU Member States or Associated Candidate Countries. VEMUS adopts a strongly user-centred approach, with user groups actively involved throughout the lifetime of the project: from requirements, to field-tests, thorough evaluation activities, and more.

**Project facts**

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<td>Project coordinator</td>
<td>Institute for Language and Speech Processing/ILSP, Greece</td>
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<tr>
<td>Contact</td>
<td>Mr. George Tambouratzis, e-mail: <a href="mailto:giorg_t@ilsp.gr">giorg_t@ilsp.gr</a></td>
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<td>Project Website</td>
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The ReMath project addresses the problem of wide-ranging dissatisfaction with the state of mathematics education in Europe and the weak impact of R&D work on using ICT for its improvement. Theoretical frameworks emerging from state-of-the-art research on learning mathematics with digital media are fragmented and involve assumptions bound to the specific contexts from which they emerged. This has greatly weakened the impact of these frameworks on cognitive theory and practice. It has also weakened the impact of digital media on mathematical teaching and learning in schools.

The objective of ReMath is to integrate theories on mathematical teaching and learning with digital technologies at a European level, taking a 'learning through representing' approach and focusing on the didactical functionality of digital media. The work will be based on evidence from experience and involve a cyclical process of:

a) developing six state-of-the-art dynamic digital artefacts for representing mathematics involving the domains of algebra, geometry and applied mathematics;

b) developing scenarios for the use of these artefacts for educational added value;

c) carrying out empirical research involving cross-experimentation in realistic educational contexts.

Work will focus on primary to secondary schooling levels while giving a balanced attention to both teachers and students and incorporating a range of innovative and technologically enhanced traditional representations.

The consortium consists of internationally recognised members all of whom have integrated technological and educational research expertise.

ReMath has a potential impact on the educational system through the development of an integrated digital learning space for math education which will be available in different European languages.

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<td>Project coordinator</td>
<td>Research Academic Computer Technology Institute (CTI), Greece</td>
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<tr>
<td>Contact</td>
<td>Prof. Chronis Kynigos, e-mail: <a href="mailto:kynigos@cti.gr">kynigos@cti.gr</a></td>
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<tr>
<td>Project Website</td>
<td><a href="http://remath.cti.gr">http://remath.cti.gr</a></td>
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Focus of this project was on demonstrating how games and mobile technologies can be combined to provide new and enriching experiences for children in the school curriculum and beyond.

Project partners have developed and validated adaptable interactive tools, which enable games designed for schoolchildren to be played on a mobile platform. Through the use of alternate reality and other facilities for dynamic and creative experiences, the games bring to life subjects such as history and geography. The eMapps.com games platform runs on digital devices such as mobile phones, PDAs and Tablet PCs over GPRS and UMTS networks and includes game control mechanisms, forums, chat facilities and pre-set map-based local scenarios. Weblogs, podcasts and videocasts are key components.

The games were implemented in 15 schools in countries that became EU Member States in 2004. Teachers participated in defining the learning objectives, the type of game (e.g. competitive, collaborative, role play, simulation), assessment, feedback and levels of difficulty. Parents have been involved in contributing ‘stories’ and content relevant to their localities. The teachers received extensive support in the early stages of implementing and testing the games platform, following initial training at summer schools.

The multilingual, multicultural local content created through the games is available for sharing and repurposing in the wider context of technology-enhanced learning in European schools. Teachers and children are enabled to draw on content held in other repositories while creating and playing games.

Both the eMapps platform and the eMapps learning objects repository are available from the project website.

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**Project facts**

- **Strategic objective**: 'Strengthening the Integration of the ICT research effort in an Enlarged Europe'
- **Project type**: Specific targeted research project (STREP)
- **Start date**: 1 October 2005
- **Duration**: 30 months
- **EU funding**: € 2 827 000
- **Number of partners**: 13
- **Project coordinator**: Cross Czech a.s., Czech Republic
- **Contact**: Mrs. Romana Krížová, e-mail: romana.krizova@crossczech.cz
- **Project website**: www.emapps.com/
Learning with computer games and mobile devices

mGBL
Mobile Game-Based Learning

mGBL will prototype a platform for the cost- and time-efficient development and deployment of mobile games to trigger an emotional learning process.

Within the mobile game-based learning project (mGBL) ten partner organisations from Austria, Croatia, Italy, Slovenia and the UK have joined forces to work on the development of a platform for the presentation of educational content in a playful and emotional way on mobile devices.

The largest challenge within this project is the idea of communicating content from the fields of career guidance, e-health and e-commerce in an involving and emotional way to different target audiences. Based on innovative methods from the fields of m-learning (mobile learning) and the latest research results from the field of didactics, new forms of game-based learning on mobile phones will be developed.

The development of a game based m-learning platform shall provide an easy-to-use and cost effective method for embedding different types of content into mobile games in order to convey this content at an emotional level.

Besides the modules for the development, administration and distribution of the games on different mobile devices (provisioning) the platform will contain a software-based tool for the selection of appropriate mobile games from existing game templates as well as a module for evaluation of the users’ acceptance and for measuring the individual learning success.

The results of this project will both enable new forms of learning and support traditional learning processes by involving the mobile channel for presentation and training of learning content.

Project facts
Strategic objective: ‘Strengthening the Integration of the ICT research effort in an Enlarged Europe’
Project type: Specific targeted research project (STREP)
Start date: 1 October 2005
Duration: 36 months
EU funding: € 2 326 000
Number of partners: 10
Project coordinator: evolaris Privatstiftung, Austria
Contact: Mr. Hans Jörg Peyha, e-mail: Hans-Joerg.Peyha@evolaris.net
Project website www.mg-bl.com
Learning with computer games and mobile devices

UNITE
Unified eLearning Environment for the School

Drawing from the socio-constructivist approach, UNITE is developing a ‘best-practice’ pedagogical framework which exploits the potential of new technologies to foster enquiry/discovery learning and autonomous learning.

The UNITE consortium aims at developing and establishing a technical platform enhanced with pedagogical guidance for the creation of high-quality e-learning content for secondary school children. The UNITE portal-like platform intends to support the re-use of content material, the exchange of best practices, and the improvement of pedagogic models.

The learning settings are not limited to conventional lessons. UNITE specifically supports forms of learning which are difficult to realise in the classroom and will explore innovative approaches of structuring and delivering content to the learner. Therefore, the pedagogic experts of the consortium are planning to establish a pedagogical framework focusing on mobile learning, exploratory learning and group learning situations. Their input on modes of learning will be transferred into e-learning scenarios which combine the pedagogical recommendations with appropriate technical features provided by the platform.

Constantly while developing the pedagogical and technological concepts, a validation process will be run in 14 secondary schools in 10 countries. In parallel and in close collaboration with the validation in the schools network, the project will carry out an intensive socio-economic evaluation. This will lead to a profound evaluation of the project goals, taking all important aspects into account. Moreover, it will define the basis for the sustainability of the UNITE results after the end of the project.

The interdisciplinary consortium of the UNITE project brings together researchers from the disciplines of pedagogy, technology, design and social sciences.

Project facts
Strategic objective: ‘Strengthening the Integration of the ICT research effort in an Enlarged Europe’
Project type: Specific targeted research project (STREP)
Start date: 1 February 2006
Duration: 30 months
EU funding: € 2 681 000
Number of partners: 13
Project coordinator: IGD, Fraunhofer Gesellschaft zur Förderung der angewandten Forschung e. V., Germany
Contact: Dr. Christoph Hornung, e-mail: christoph.hornung@igd.fraunhofer.de
Project website: www.unite-ist.org/
The technology and pedagogy research conducted by ELU will focus on the methodology, the design and implementation of tools required to enhance the multimedia home platform with e-learning facilities.

This project intends to develop and validate the use of interactive digital TV (iDTV) systems for learning. Despite the popularity of the PC, it is expected that TV will remain the leading device in each home and that delivery of t-learning will be part of iDTV deployment in the future. The advantages of iDTV include ease of use, low additional cost, and the small footprint.

The ELU team will research, develop and implement pedagogical scenarios for the use of iDTV at home, universities and schools. It will exploit the potential of iDTV to support a personalised, flexible and learner-centred pedagogical approach.

On the pedagogical side, ELU will examine how to bridge the gap between 'edutainment' and 'engaged learning' and how to turn a passive viewer into an active learner. ELU will also provide solutions to integrate learning support systems (human and electronic). To test the effectiveness of iDTV, several types of content will be developed.

On the technological side, ELU will provide content creation tools that combine:

- educational content authoring (thematic info, tutorial, demos...);
- entertainment content authoring (user-immersion, educational games...);
- examination content authoring (multiple-choice questions, tests...).

The content will be SCORM-compatible and will be delivered on the MHP open platform. The ELU system will include supporting facilities, such as knowledge retrieval and delivery tools. In order to validate its technology, ELU will develop tools to simulate iDTV for areas in which real deployment is not feasible at this stage.

ELU will promote the use of immersion technologies and media convergence. User immersion enables 'natural learning' while media convergence enables common-core content to be broadcasted to all viewers and personalised data to be transferred and exchanged individually.

There are two main users for the ELU facilities, teachers and learners, while the scope is both for academic and life-long professional learning.

Project facts
Strategic objective: 'Strengthening the Integration of the ICT research effort in an Enlarged Europe'
Project type: Specific targeted research project (STREP)
Start date: 1 February 2006
Duration: 33 months
EU funding: € 2 961 000
Number of partners: 14
Project coordinator: ORT France
Contact: Mr. Raphaël Attias, e-mail: raphael.attias@ort.asso.fr
Project website: www.elu-project.com/
The overall goal of the LOGOS project is to build an innovative ubiquitous e-learning environment for almost everybody. The main areas of R&D work in the project are:

- integrating a new cross-media platform for e-learning using the current technologies of Internet, mobile phone and digital video broadcasting;
- generating a new cross-media learning environment with specially developed authoring studios using existing digital archives;
- validating the new e-learning platform through extended testing of its functionality and usability for end-users.

At the centre of the LOGOS learning platform will be an authoring infrastructure that incorporates a set of tools for the creation and editing of digital objects, reusable learning objects and courseware objects. It also includes repositories for the storage, searching and retrieval of these objects. A special middleware handles the automatic creation of personalised courseware, both pedagogy-driven and exploiting information from learner profiles.

The courseware objects created by the authoring tools will be published in the framework of a learning management system. In order to support an ubiquitous, cross-media learning experience, the platform will integrate learning management services with content delivery and presentation tools specific for web, mobile and digital television infrastructures. The usage model of LOGOS is based mainly on international pedagogical approaches in cross-platform learning and is embodied in a series of scenarios, developed in collaboration with potential end users.

The LOGOS system will have the potential to promote social inclusion by assuring wide accessibility to e-learning material that is made available over existing mobile devices and TV sets (with additional set-top boxes). At the same time, the platform aims at economic impact through facilitating faster and more effective training on the job.

The LOGOS project is being realised by 15 partners from eight countries, a consortium able to cover the necessary interdisciplinarity of this research, to integrate the efforts of IT and educational researchers and professionals, to harmonise the viewpoints of e-learning providers and users, and to realise the benefits from the cooperation of academic and industrial partners.

**Project facts**

- **Strategic objective**: 'Strengthening the Integration of the ICT research effort in an Enlarged Europe'
- **Project type**: Specific targeted research project (STREP)
- **Start date**: 1 February 2006
- **Duration**: 36 months
- **EU funding**: € 2 634 000
- **Number of partners**: 15
- **Project coordinator**: Antenna Hungaria, Hungary
- **Contact**: Mr. András Kápolnai, e-mail: kapolnaia@ahrt.hu
- **Project website**: www.logosproject.com/