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ICT Research
The policy perspective

Educating Europe
Exploiting the benefits of ICT

European Commission
Information Society and Media

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ICT Results is an online editorial service established on behalf of the Information Society and Media Directorate-General.

The service's main aim is to:
- raise the visibility of ICT-funded research results
- support projects' access to markets and encourage uptake of innovations
- raise awareness of European ICT programmes and activities

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More reports in this series on *ICT Results*:
http://cordis.europa.eu/ictresults/index.cfm?section=news&tpl=publication

Technology, the quiet achiever in the class

In this report produced for the publication series ICT Research: The Policy Perspective, we look at how information and communication technology (ICT) is playing a key role in the education and training of European citizens. ICT offers far more than a convenient way to deliver educational content. Today, researchers are demonstrating how ICT can actually enhance the learning process for all Europeans and make lifelong learning part of everyday activity.

Emma is a typical 18 year-old. She loves to go out with her friends, she enjoys shopping and sport. She manages to update her Facebook status, send instant messages to several pals, watch TV, eat her breakfast and finish off her latest assignment – all at the same time! She is studying hard and can't wait to go to university in September.

There is just one small detail about this picture of fast-paced student life. Emma lives at home on a remote farm, several miles from the nearest road and more than an hour's drive to her school.

But Emma does not feel cut off, even when bad weather stops her getting to class. With broadband internet she has immediate access to her school's intranet system. And once she is logged on, ICT provides far more than a communication platform between her and her school. Yes, she can see her school timetable, download learning resources and assignments and submit class work. But she can also participate in discussions and access demonstrations and videos that complement what she can learn in class. She can even collaborate on joint assignments virtually with her classmates, sharing documents and resources

Thanks to the power of information and communication technology, Emma is a diligent student. ICT does more than keep her connected; it is giving her a love for learning. Her mind is open to the world of opportunity before her.

The great enabler?

> ***Education's purpose is to replace an empty mind with an open one.***
>
> **Malcolm Forbes**

When it comes to education the EU plays a supporting rather than legislative role because national governments of member states are firmly in charge of their education and training systems. Education is evidently important at the EU level, but following the 'subsidiarity principle', it is believed that individual member states are in the best position to develop the policies and legislation for national education programmes.

Nevertheless, the EU's supporting role is an important one, first enshrined in the **Maastricht Treaty** which stated that the Community shall "contribute to the development of quality education by encouraging cooperation between member states and, if necessary, by supporting and supplementing their action".

One of the main drivers for EU-level involvement in promoting and enhancing educational activities is that 'knowledge' is the fuel that drives the **Lisbon Strategy for Growth and Jobs**. In May 2009, the **European Council** acknowledged that "[e]fficient investment in human capital through education

and training systems is an essential component of Europe's strategy to deliver the high levels of sustainable, knowledge-based growth and jobs that lie at the heart of the Lisbon strategy".

But this same Council statement also made it clear that, for Europe, education is not simply a utilitarian tool for a more productive workforce. Education, the Council noted, promotes "personal fulfilment, social cohesion and active citizenship".

The European Commission and member states have worked on numerous policy initiatives in the field of education and training since 2000. The May 2009 Council Conclusions set the stage for a **strategic framework for European cooperation in education and training** (ET2020). Building on earlier work, the framework sets four strategic objectives, specifically:

- making lifelong learning and mobility a reality;
- improving the quality and efficiency of education and training;
- promoting equity, social cohesion and active citizenship;
- enhancing creativity and innovation, including entrepreneurship, at all levels of education and training.

These are ambitious aims. They will only be realised in the medium- to long term. But ICT, the key enabler of a knowledge society, will play an important part in delivering on these objectives.

Learning – the new way

Technology has changed the world – and it is now changing *what* and *how* we learn. We have access to an unimaginable abundance of content and knowledge at the press of a button. At the same time changes in society and the economy place much greater emphasis not just on knowing facts, but 'soft' or transferable skills. Teaching methods increasingly use inquiry-based, problem-solving approaches involving collaboration and interaction between students and teachers in the class or on the other side of the world.

But just as technology continues to reshape our society, it also provides the tools to help us adapt to the changes it sometimes ushers in. ICT suggests new ways to engage learners and motivate them to continue; it can foster innovation and creativity; and it is increasingly integrated into the management of knowledge in businesses and other organisations.

"In the information society, developing and maintaining know-how in organisations is crucial to becoming and staying competitive," noted Viviane Reding, Commissioner for Information Society and Media in a 2009 press statement. "Today it is no longer enough to simply acquire knowledge: we need to transform, enrich and structure it; and then to share and re-use it."

At a European level, ICT has a role to play in facilitating the exchange of knowledge between groups, across borders and language barriers. And it can help individuals and organisations take a much broader view of education, letting them follow flexible learning pathways with more emphasis on non-formal and informal learning, and increased recognition of their wider education wherever in Europe they happen to be.

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Education – with enhancements

Welcome to the world of technology-enhanced learning. At its most basic this is where school pupils use laptops, research projects can be prepared online and where there is an interactive whiteboard in every classroom. But it is also a vision for the future, a paradigm shift where technology transforms *what* we learn and *how* we learn it.

Of course, in the early days of the web, technology-enhanced learning was synonymous with e-learning. We thought that you could simply put some resources online, people would access them and that would be enough to stimulate learning. The early e-learning experiment was perhaps overly focused on the exciting new technology – not about the ultimate objective: learning.

But today, the technology is smarter. Improvements in interactivity, artificial intelligence and greater understanding in the cognitive processes involved in learning new information and skills is helping scientists to develop entirely new ICT-based learning processes. Technology-enhanced learning is transforming education and training: to make it more effective, more attractive, more accessible and more adapted to today's contexts – personal, family, large-group, organisation, community, etc. Thanks to technology more people want to learn, it is more of an 'experience' and rewarding. And it is also more effective – what they learn 'sticks' and it makes a difference to their work and lives.

A life of learning

But we still have a long way to go. In 2008, the European Commission reported on the extent to which ICT supports innovation and lifelong learning. "In the last decade, the EU has had considerable success in introducing ICT to education and training. Yet if institutions have been ICT-equipped and teachers and trainers ICT-trained, ICT has not yet transformed teaching and learning as it has transformed processes in other key sectors such as enterprise or public services," the progress report noted.

The EU's **Lifelong Learning Programme** is working at all levels to change this situation, from engaging with Member States to pan-European exchanges and open collaboration initiatives. It has a budget of €7 billion for 2007 to 2013, and provides an umbrella for all activities in areas of education, learning and vocational training.

The central role of ICT in the EU's education agenda is recognised through one of four **transversal activities** within the Lifelong Learning Programme. "Effective integration of ICT into education must go beyond simply replacing, streamlining or accelerating current practices," states the programme's website. "ICT has become embedded in our social and economic fabric and it should be similarly embedded in education and training systems. Actions are not about developing technology itself, but about the use of ICT tools to enhance learning environments and experiences."

The uptake of ICT solutions and its deployment in educational contexts may also be promoted through the €730 million **ICT Policy Support Programme** (PSP) of the Competitiveness and Innovation Programme. Although no annual work programme has specifically covered technology-enhanced learning, there is a major focus on **eInclusion** – the use of ICT to tackle issues around accessibility, ageing and social inclusion. Several European projects explore the use of ICT for "ageing well". They cover aspects of lifelong learning, including 'serious games' to stimulate mental activity and memory enhancement in elderly citizens.

The Union's research framework programmes, meanwhile, fund projects with a more long-term vision. Since the launch of the **Seventh Framework Programme** (FP7) in 2006 the European Commission has invested €150 million in co-funded research into specific technology-enhanced learning projects.

The current priorities outlined in the **ICT Work Programme 2009-2010 of FP7** reveal how far we have come. The problems and challenges that technology-enhanced learning faces today go far beyond pure technological issues. The programme calls for researchers to look at how technology can integrate learning into wider organisational contexts, how personalisation makes lifelong learning more attractive, and how ICT, by using intelligent toys, simulations and 'serious games' can stimulate and improve our cognitive capacities, creativity and innovation.

In other words, researchers are trying to find ways not to stuff us full of facts, but make learning an enjoyable part of everyday life.

Progress in the use of ICT for education and training across Europe has been substantial in the last few years. But there is still a long way to go as we learn how ICT can support exciting new learning paradigms.

The development and use of ICT for learning, education and training will help Europe maintain its prominence on the global stage, supporting positive and tangible social change, and bringing benefits to the individual, business and whole communities.

More information:

Lisbon Strategy:
http://ec.europa.eu/growthandjobs/index_en.htm

EU education and training:
http://ec.europa.eu/education

FP7: http://cordis.europa.eu/fp7/

ICT PSP: http://ec.europa.eu/information_society/activities/ict_psp

ET2020: http://ec.europa.eu/education/lifelong-learning-policy/doc1120_en.htm

ICT for competitiveness and innovation:
http://ec.europa.eu/enterprise/sectors/ict/index_en.htm

e-Skills: http://ec.europa.eu/enterprise/sectors/ict/e-skills/index_en.htm

eInclusion:
http://ec.europa.eu/information_society/activities/einclusion

Ageing well in the information society:
http://ec.europa.eu/information_society/activities/einclusion/policy/ageing

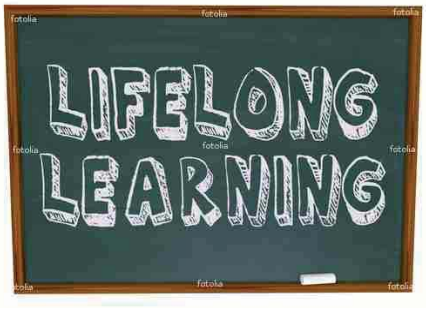
Enhanced learning with technology:
http://ec.europa.eu/information_society/tl/edutra/inno

Digital literacy:
http://ec.europa.eu/information_society/tl/edutra/skills/

Technology-enhanced learning research in FP7 falls under Challenge 4 – Digital Libraries and Content. There are four R&D objectives:

- Large-scale pilots for the design of the future classroom.
- Reinforcing the links between individual and organisation learning, and creativity.
- Developing smarter systems and technologies that:
  - are intuitive and adapt to users and their context;
  - make more use of emotions to aid learning;
  - improve feedback and guidance for teachers and students.
- Revolutionary appliances (including toys) with advance cognitive functions that can be used to train a student's 'thinking skills'.

Funding is also being made available for networking, dissemination and coordination activities.



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Meeting the challenges

The application of ICT in education and training in Europe is still in its infancy. The e-learning experiment of the early 2000s merely demonstrated that simply putting content online is not enough. Today, ICT offers much more powerful technologies that can make our 'learning journey' more engaging and effective. With relevant knowledge and skills European citizens will be prepared for the future.

Mobilising knowledge

ICT blurs the boundaries of the class room. Technology makes it possible to access 'education' wherever you are and training that is more suited to your context. But current research is taking this mobility to another plane: new technologies could help to make knowledge itself more 'mobile' – easier to manage and transfer. ICT can turn our learning into a truly exploitable asset.

Lifelong learning

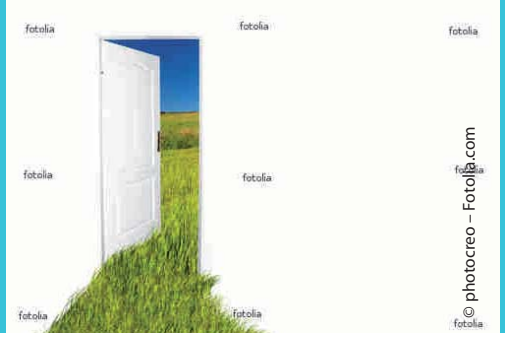
We never stop learning, but Europe is looking at how to make education and training, whether formal, informal or non-formal, more accessible to everyone, regardless of age, ability or social integration. Researcher are exploring how ICT and applications such as social networking and online collaborations can improve access to groups that are more excluded from mainstream learning opportunities – for example, the elderly, housebound and those who have rejected formal schooling.

Personalisation

The beauty of technology-enhanced learning is that it can adapt and make the learning experience an individual experience – no two people are the same. Significant research is investigating how technology can drive personalised learning. And because we all love to play, researchers are also looking into the benefits and functionality of 'serious games'.

Did you know?

- Almost 16% of young people in the EU still leave school early, often without qualifications.
- Around three-quarters of 18-24 year-olds complete upper secondary education.
- Only 10% of adults aged 25-64 take part in lifelong learning.



He who opens a school door, closes a prison.
Victor Hugo

Making the most of what we learn

Mobility is a pillar of European society. Whether we are working or living at home or elsewhere in the EU we have come to expect certain standards. But as people get more mobile, knowledge and learning must become more mobile and flexible too. Current research into technology-enhanced learning is exploring new ways to transfer and apply learning – within organisations, across borders and into new contexts.

The classroom of today is nothing like that of even 30 years ago. The walls have gone; the boundaries between school and home, education, entertainment and leisure are blurred. Learning is now a pervasive process.

Approaches to education have changed dramatically too. These days the learning process is centred around collaborative working, creativity, multidisciplinarity, adaptiveness, intercultural communication and problem solving. There is perhaps less focus on hard facts and more on the cognitive capabilities of students and their soft or transferable skills.

One of the top priorities of European education policy is to make education and learning more "mobile". This means that our acquired knowledge should be more recognised across the EU, more exploitable throughout our working life and beyond, more manageable across an organisation and more transferable between people.

Mobilising knowledge

ICT has already proven that it can deliver educational content wherever we are, but now research in going up a gear. The latest challenge is to find new ways to make knowledge itself more mobile. New technologies will help individuals and organisations to manage their learning better so that it can be transferred and applied more efficiently at work or in society.

Initiatives such as the **European Qualifications Framework**, adopted by the European Council and Parliament in April 2008, are already helping to make formal qualifications more transferable between EU member states.

However, the **ET2020** statement by the Council of Europe in May 2009 takes a much broader view. It states that more effort is needed to establish "more flexible learning pathways – including better transitions between the various education and training sectors, greater openness towards non-formal and informal learning, and increased transparency and recognition of learning outcomes."

This ability to identify learning outcomes and manage a person's 'learning journey' throughout their life is important for individuals and organisations alike. Employers want to be able to identify knowledge (and knowledge gaps), transfer skills and see the big picture of a workforce's competencies. Individuals, meanwhile, want to be able to demonstrate their skills and knowledge to prospective employers, plan out career paths and simply keep track of what they know and what they have learned for future reference.

It sounds like a formidable task, but ICT research is already demonstrating some of these principles

in practice. An ePortfolio, for example, is a kind of virtual learning record (and perhaps a strategic plan for your future education). Software for ePortfolios is already commercially available, but more research is required to make them and other learning management systems more interoperable and compatible with other knowledge and human resource management packages – a focus of several projects funded under the first calls for technology-enhanced learning projects in FP7.

The **2009-2010 ICT Work Programme** for technology-enhanced learning research is clearly focused on new tools and systems to help organisations and individuals unlock and exploit their knowledge potential. In particular, the programme states that projects will target research to "reinforce the links between individual and organisational learning, and creativity: embedding learning experiences in organisational processes and practices, through innovative systems embracing talent, knowledge, workflows, collaborative innovation and competency management."

ICT also has role to play in building up competencies at the European level too, especially in the areas of science and mathematics. Through simulations, virtual labs and the use of 'augmented reality' applications, ICT is helping to extend the knowledge of students, scientists, mathematicians and engineers in Europe and provide them opportunities for advanced training. In this way the EU will be better positioned to stay at the forefront of scientific and technological innovation.

In essence, this is the power of ICT: it can offer personalisation in parallel with strategic planning across larger groups, a region or the EU in its entirety. All too often there is an irritating conflict between business interests and personal interests. But technology-enhanced learning systems can create a win-win solution, planning and delivering learning opportunities that suit both parties.

What could be more powerful for Europe's future than well educated, skilled citizens who find personal fulfilment through their learning? This is precisely what ICT research is seeking to deliver.

Projects in focus

CALIBRATE
GRAPPLE
xDELIA
COOPER

The simple exchange of educational resources is an easy way to improve the quality of education and the adoption of best practices and innovative teaching methods. And it is easy to see how ICT can help here. As early as 2004 the **CALIBRATE** project created an EU-wide "swap shop" for digital learning resources by "federating" national repositories. It is effectively improving the transfer of good resources – making knowledge as mobile as Europeans.

The project was so successful that it was turned into a fully functional platform. The Learning Resource Exchange (LRE) is a network of 18 content repositories, including 16 from ministries of education which allows teachers to search for material. It opened in December 2008 and a full public service is expected early in 2009. It already contains more than 128,000 items, all freely accessible through the LRE website. Thanks to technical improvements in the brokerage system that underlies the LRE, a new repository can be connected in a matter of days. As a result many new associate partners are joining the LRE federation, including OER Commons in the USA and museums such as Cité des sciences et de l'industrie in Paris. "We are in active discussions with [many] organisations which have expressed interest in becoming LRE associate partners," says project coordinator Jim Ayre.

But can something created for use in one country be used successfully in another? Despite differences in languages and curricula, many resources do "travel well," he points out. "They tend to be more visual, more interactive, with a minimum of text – Flash animations rather than text-heavy lesson plans or worksheets."

A second achievement is a so-called learning toolbox. "We thought it would be useful to have some sort of authoring tool, so teachers could both adapt resources found in the LRE and create new ones," says Ayre. "So another focus in the project was the development of a collaborative learning platform called LeMill that was designed as a web community where teachers could find, author and share learning resources."

Sometimes it is difficult to keep track of what you have learned or to really map your lifelong learning journey, especially if you include informal and non-formal and life experience as part of your education. Two FP7 projects are grappling with this challenge.

GRAPPLE is creating what it calls a "lifelong learning environment" – a system that acts as a repository and record for all your education experiences. It would also provide educators with an authoring tool to produce flexible e-learning packages that GRAPPLE automatically adapts to personal preferences, prior knowledge, skills and competences, learning goals and the personal or social context in which the learning takes place. In this way the learning is more appropriate, relevant, engaging and effective.

The **xDELIA** project, meanwhile, is seeking to develop technology that makes more use of non-formal and informal learning and real-life experience as part of a training programme. Using sensors to pick physiological and psychological responses and by studying the behaviour of volunteers, the project plans to develop a platform that can be used to improve financial decision-making.

Project work is one of the best ways to help people put theory into practice. People also benefit from working in a team, discovering the dynamics of collaboration and teamwork. Numerous web-based packages are available that allow people to collaborate on, and manage projects among, remote teams. But these tend to be geared towards commercial project management and are not focused on project work as a learning process, per se.

The **COOPER** project has built a platform that meets the growing need for project-based e-learning. The platform combines functionality from project management, social networking methods and traditional e-learning systems. It provides a virtual environment in which geographically dispersed teams can talk together, contact tutors, set up project workflows and submit documents. It is especially for the university sector and companies with an international workforce or that have to train foreign customers.

It is extremely flexible (teams can define their own workflows) and it also integrates voice over IP (VoIP) and video-conferencing for more realistic communication between team members.

To assess the learning outcomes, the platform also incorporates a system from the Open University of the Netherlands and the Central Institute for Test Development (CITO), which includes long-term assessment schemes. Interestingly, all the output of projects is placed in a "project memory bank" – a collective memory to enhance study programmes and for institutions to provide public information about their curricula and innovative projects.

More information

CALIBRATE: http://http://calibrate.eun.org

GRAPPLE: http://www.grapple-project.org/

xDELIA: http://www.xdelia.org/

COOPER: http://www.cooper-project.org/

ICT and networked media stories on ICT Results: http://cordis.europa.eu/ictresults/ (enter search terms 'education', 'learning', 'technology-enhanced learning', 'tele-learning')

http://cordis.europa.eu/fp7/ict/telearn-digicult/telearn_en.html

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Education is not preparation for life; education is life itself.

John Dewey

Love learning, live life

Some cultures venerate the elderly for their wisdom and experience of life. And it is certainly true that nothing beats experience when it comes to one's personal education. But how can Europe ensure that citizens develop a love for learning and a passion for knowledge? Significant investment is being put into ICT research that will develop technologies to remove barriers to learning.

Lifelong learning is a European mantra and recognised as a pillar of European society. It recognises that education does not stop when we leave school, it is a continual and necessary process – as society or our own personal contexts change we need new skills, we learn new things and we must learn to adapt, applying existing knowledge to new circumstances.

At the end of 2006, the Council of **Europe adopted a European Framework for Key Competences for Lifelong Learning**. This framework identified and defined, for the first time at the European level, the key knowledge and skills (competences) that European citizens require for their personal fulfilment, social inclusion, active citizenship and employability.

These competences range from communication in a mother tongue and foreign languages to mathematical skills, digital competencies and even "learning how to learn". With this basic foundation in place, citizens will be equipped for a life of learning and Europeans will benefit greatly from being able to actively apply their knowledge.

The ET2020 strategic framework again makes it clear that lifelong learning is a priority for the EU. The framework sets ambitious benchmarks for participation in education for different ages groups. For example, by 2020 it is hoped that 15% of adults aged 25-64 will be participating in some form of lifelong learning, whether formal education or managed and exploitable non-formal learning.

The Lifelong Learning Programme (LLP) is supporting numerous initiatives to increase participation in learning and education in every age group and demographic. A lot of action involves political cooperation and coordination between member states and the work of task forces, for example in actions to agree mutual recognition and comparison of formal and national qualification levels.

But in all this work, ICT plays a crucial, albeit sometimes background, role that promotes learning and makes it more accessible and attractive for all ages.

Lifelong learning

We never stop learning. Knowledge leads to skills, creativity and innovation and is the fuel that sustains economic growth and keeps society together. Luckily, ICT is making lifelong learning, education and training more accessible for everyone, whatever their age, health or ability.

Did you know?

In 2007, the Commission issued a Communication 'e-Skills for the 21st Century: Fostering Competitiveness, Growth and Jobs', which set in motion major EU and national efforts – involving education, training, industrial and labour policies, immigration, taxation and research – to boost the e-skills needed to achieve Europe's ambitions, namely to be a powerhouse of knowledge and innovation.

The four main sub-programmes of the LLP all provide funding for projects to research, explore and pilot ICT-based content, services and ICT support for better teaching training and practice.

In addition, a specific ICT initiative focuses on the use of ICT in the wider context of lifelong learning. Here multilateral projects are supported to encourage innovation and creativity in learning and teaching, and to boost the use of new ICT tools and trends, particularly for groups at risk of exclusion such as early school leavers, ethnic minorities and the elderly.

ET2020 states that "education and training policy should enable all citizens, irrespective of their personal, social or economic circumstances, to acquire, update and develop over a lifetime both job-specific skills and the key competences needed for their employability and to foster further learning, active citizenship and intercultural dialogue."

This work dovetails with other EU initiatives, especially the **i2010 eInclusion** initiative adopted by the Commission in 2007. eInclusion promotes the use of ICT to overcome social exclusion, and improve economic performance, employment opportunities, quality of life, social participation and cohesion.

ICT R&D funding provided through FP7 is looking at next-generation applications of ICT to encourage greater involvement in lifelong learning. About €100 million in co-funded research was released between late 2007 and early 2009 for projects related to Challenge 4 of the ICT Work Programme, including 13 projects specifically related to technology-enhanced learning. Some of these projects, still in early stages, are looking at designing and developing more responsive systems that can motivate, engage and inspire people to learn, and whilst supporting the transformation of learning outcomes into permanent and valuable knowledge assets (turning learning into concrete benefits).

Ageing well – staying alert

The number of elderly people in the EU is rising rapidly, but the Commission believes that ICT could significantly improve the quality of life for older citizens. The Commission's **Ageing Well in the Information Society Action Plan** sets out a strategy for targeting ICT applications to this age group. Research under FP7 is complemented by the €600 million **Ambient Assisted Living Programme** which covers technologies designed to help older people to continue to live at home. Whilst remote sensing and eHealth systems are important, many projects look at technologies to help elderly people stay socially and cognitively active through games, mental exercises and other technology-enhanced learning approaches.

Projects in focus

AtGentive
Argunaut
ElderGames
Netcarity
COSPATIAL

It is patently clear that Generation Y does not interact, think, behave – or learn – in quite the same way as the Baby Boomers. But we all share one thing in common: education has to be relevant and engaging, or else we get bored and switch off.

So take an e-learning platform, mix in a large dose of social networking, sprinkle it liberally with intelligent software agents to stimulate users and, according to researchers on the **AtGentive** project, you will keep students' attention even during the most testing training courses or subjects.

Recent trials of two new software platforms based on this new approach show substantial promise. The platforms are designed to aid students in the classroom and to help them continue learning and collaborating long after classroom sessions have ended.

The AtGentive approach gets round the weakness of the first generation of e-learning platforms that merely put resources online. To keep students on the ball, the new platform observes the behaviour and responses of students, assesses their state of attention and intervenes to make the user experience more effective. The interventions can take many forms, from providing new information to the student, guiding them in their work or alerting them when other users connect to the platform.

"For collaborative learning to be effective, it is important for people to know how their input is being received by others and whether what they are working on is of interest to other people," says AtGentive coordinator Thierry Nabeth, who notes that in essence the project has adapted renowned psychologist Albert Bandura's concept of self-efficacy to a collaborative context. In Nabeth's view, the AtGentive approach will help end the "shallow" experience of many e-learning systems developed to date, while deepening our understanding of what it takes to hold people's attention and keep them motivated.

Collaboration and interaction is important – useful for acquiring many 'soft' skills. So the **Argunaut** project has introduced a suite of online discussion tools intended for use in school labs, initially. The system makes it possible to break a class into small groups, have them discuss topics via computers and, importantly, let the teacher track who is saying what, analyse their statements their degree of sophistication.

On one level, Argunaut sought to provide – with easily grasped graphics – quantitative data to teachers, like who is talking a lot or not at all, and who has not contributed in the last 15 minutes. This is the shallow loop. But Argunaut researchers also added artificial intelligence to provide qualitative data, like the types of statements students were making, their potential value to the discussion and the underlying learning process. This is called the deep loop.

Powerful tools help the teacher supervise discussions better, show who is off topic, who is not participating or who is dominating. The system can even tell teachers that one discussion contains only questions or comments, but no arguments.

The tools could also be used as an ideal collaborative tool for project management and planning. Executives can be sure they keep meetings on target and moving forward, ensuring that every voice is heard and every idea considered.

Another smart system is also helping to keep elderly people on the ball – mentally sharp and sociable. It also alerts caregivers when someone's cognitive skills begin to deteriorate. The **ElderGames** project has developed an inviting, interactive play table and display, and a set of computer-driven games that exercise and track important cognitive skills, stimulate social give and take, and are fun.

"This is very simple, but very important at this time of life," says Malena Fabregat, ElderGames coordinator. "Elderly people need to feel useful, to feel capable, and to feel that they have things that are interesting to do." The ElderGames play platform and suite of games meet all of those objectives. "And they provide an opportunity just to have a good time," Fabregat continues. "Play is good in itself, but the challenge was to allow the users to train what the experts told us were the most important cognitive abilities in this period of life."

Working with experts from a variety of fields, the researchers homed in on a set of important mental abilities that are most affected by ageing, including the ability to maintain and direct one's attention, executive functions such as planning, problem-solving and decision-making, fine motor skills, and memory. They analysed hundreds of games to find ones that utilised those key mental skills, that could be played interactively, and that were challenging and enjoyable enough to entice players to play again.

In addition, caregivers and doctors have been impressed by the ability of the system to warn them when an elderly person is showing even subtle cognitive changes. "The experts were able to get high-quality individual information from these group activities," says Fabregat. "This multiplied their ability to monitor and assess the people they were responsible for."

The ElderGames prototype is one of three games interfaces being piloted in **Netcarity**, a project funded through the Ambient Assisted Living Programme.

An interactive tabletop is also being developed by the recently launched **COSPATIAL** project. Here, researchers are focusing on another potentially excluded group: children with autistic spectrum disorders. The project is looking at how tabletop systems and virtual environments could be used to deliver cognitive-behavioural therapy for these children.

More information

AtGentive http://www.atgentive.com/

Argunaut http://www.argunaut.org/

ElderGames http://www.eldergames.org/

Netcarity http://www.netcarity.org/

COSPATIAL http://cospatial.fbk.eu/

ICT and networked media stories on ICT Results: http://cordis.europa.eu/ictresults/ (enter search terms 'education', 'learning', 'assisted living', 'elderly')

http://cordis.europa.eu/fp7/ict/telearn-digicult/telearn_en.html

I'll do it, but my way

Some people are good at remembering what they hear, others find it easier to recall what they read. And some people learn best with their hands. We all learn in different ways, but technology now makes it possible to tailor learning programmes to individuals. By making content more relevant and offering cutting-edge multimedia interactivity, ICT makes learning in the 21st century an attractive proposition.

There's a lot of theory out there about how we learn, yet the tried-and-tested method – face-to-face interactions between a teacher and students – is still firmly embedded, at least in formal educational institutions across Europe.

Of course, 15 years ago when the web really took off, we all wondered whether schools and colleges would soon be dead. E-learning was the new panacea for education: knowledge could be acquired from the comfort of your home. If you needed a teacher, then it would be via online video link.

Of course the e-learning experiment of the early web was just that: an experiment. We now talk about technology-enhanced learning. There are still so many ways to learn, but technology helps to make the learning process more engaging, efficient and aligned to our personal motivations.

An important objective of the ET2020 framework is to improve the quality and efficiency of education and training. "The major challenge is to ensure the acquisition of key competences by everyone," the Council of European concluded, "while developing the excellence and attractiveness at all levels of education and training that will allow Europe to retain a strong global role."

There was a time when the dominant thinking on education followed a 'one-size-fits-all' model. Today, an increasing number of educators recognise the individuality of learners, the teacher's role is becoming increasingly that of a key facilitator.

But whoever you are and however you learn, it must be a worthwhile process. And this is where ICT really comes in. Indeed, the personalisation of learning through ICT – both making education relevant and accessible to an individual – could become the biggest driver of citizens really embracing lifelong learning.

Using artificial intelligence, social networking and powerful visual interfaces, technology can deliver engaging and highly participative education. And by helping individuals and organisations to manage

Personalisation

No-one would dare dispute the premise that education is a good thing, but effective learning requires motivated students. And motivation stems from seeing the benefits that our knowledge brings. Europe is supporting research to exploit the power of technology to make learning more engaging and personalised – and a beneficial activity.

the learning process and outputs more effectively, individuals will have a better picture of how their learning fits into the bigger picture of their lives. They will see that greater knowledge and continual learning brings benefits of all kinds.

The ICT Work Programme for 2009-2010 calls for more research into "affective and emotional approaches" – in other words, looking at how technology can make learning really come alive for people and "press all the right buttons".

Of course, the old-fashioned world of the classroom should not be ignored, and cutting-edge research is also showing how technology can make this experience more personal and efficient for each student too. Pilot projects are planned to come up with designs for the future classroom, where technology and teaching practices are melded into new forms of delivery that support individualisation, collaboration, creativity and expressiveness in more active, reflective and independent learning activities.

The logic is, if you make learning enjoyable, meaningful and fun and it will promote independent, innovative and creative thinking. So let's play!

The 21st century classroom

With more focus on the learning needs and styles of individuals, the classroom of the future will look quite different from what we are used to today – and ICT will be the backbone of this transformation. ICT will allow schools and colleges to make education more flexible, challenging, creative and foster skills such as collaboration, critical thinking, communication and digital literacy. These trends will have profound effects on the way schools will operate in the 21st century.

In 2009, the European Commission published a comprehensive report that looked at the use of ICT in Europe's 209,000 primary schools. The report shows how national, regional and local ICT strategies are transforming the everyday school experience for young children, who today have more access to ICT and have a much broader education thanks to the use of technology. The report also found that ICT led to higher levels of teacher and learner motivation, leading to competence development and an engagement with lifelong learning.

The use of ICT is stimulating changes to curricula, facilitating new forms of assessment, building closer and more interactive relationships between teachers, pupils and parents, and supporting learning processes for all.

The **eCIRCUS** project, for example, has created virtual worlds with characters that children can interact and empathise with powerfully enough to change their own attitudes and behaviour. Two programs help children to empathise with victims of bullying and newcomers into a class.

LEAD, meanwhile, has built an open source collaborative face-to-face educational environment called CoFFEE. It is used within a classroom as students work together on a problem-solving exercise. It includes a discussion manager and an interface to help students visualise the problem together. The software also lets a teacher monitor, analyse and control what is going on.

ICT is even transforming how children learn to play a musical instrument. The **VEMUS** project has developed software that can listen to a student as they play and offer advice and comments. The software can be used by a student when they practice at home or as a remote learning tool where a pupil can submit a 'performance' to their teacher. It can also be used in a group setting.

Projects in focus

iClass
ChangeMasters
TARGET
80Days

The highly successful project **iClass** has created a learner-centred ICT platform and caught the attention of educationalists across Europe. "iClass really is the largest Europe-wide R&D project of its kind focusing on primary and secondary education," emphasises Ali Türker, the project's technical coordinator.

"When the project idea was conceived, research on learning styles offered great prospects for personalisation using ICT, since it would bestow the computer systems with a clear taxonomy to work with," he recalls.

But it soon became clear to the researchers – and comprehensive studies confirmed this – that learners tend to mix approaches in a given task, or use different styles in different assignments. And this, suggests Türker, is where technology can really help. "ICT platforms are uniquely positioned to bridge this gap and bring personalisation to formal education, as well as structural value to informal learning," he notes.

Web-based platforms like iClass can seamlessly mix the formal and informal learning environment and styles, preparing learners for independent inquiry later in life.

One of the project partners, the Centre for Futurism in Education at Ben-Gurion University, Israel, elaborated on 'self-regulated learning' studies to create a new pedagogical approach that iClass called Self-Regulated Personalised Learning (SRPL).

The three strands of SRPL are self-regulation, personalisation and intrinsic motivation. It boosts a pupil's motivation to learn by personalising the learning process. It trusts the individual student, with support from his/her teacher, to make mindful and meaningful choices and act on them. Pupils can customise assignments to suit individual learning needs by adding or updating learning goals and by managing task activities. The teacher who prepared the elementary plan can fix certain parameters, insert hints, as well as monitor and comment on students' progress.

The eTEN project **ChangeMasters**, meanwhile, focused more on training company executives. It involved a large pilot of an online 'edutainment' service in seven EU countries.

The ChangeMasters interactive online 'game' equips executives with real-life skills and realistic project management experience using a serious game. Basically, you have to successfully run a business, but ChangeMasters contains hundreds of parameters to define the corporation, its people and the project. "It defines the corporation's character and culture, formal and informal networks, all the elements that compose the dynamics of an organisation," reveals Albert Angehrn, the porject's coordinator. "It can even represent Western, Latin American or Asian cultural attitudes accurately. "

Typically, teams of managers work together to play a game for 90 minutes. The game is very difficult. "Nobody wins, nobody manages a painless project. I think this is the way it should be, it should be challenging and it should reflect real life. It tests the limits of managers' confidence. The idea is for people to learn lessons and acquire new skills before carrying out a task in a realistic scenario," Angehrn explains.

The game uses graphs, text and buttons to offer an overview of the game status, track emerging developments and offer players a choice of actions. The software has been used to train staff in multinational corporations and universities. The vision is that the platform will offer a channel for other high-quality business education software to, one day perhaps, become the Amazon of executive education.

FP7 is supporting several projects that continue to push the boundaries of personalisation and immersive learning. The **TARGET** project is developing a responsive learning system with serious games at its core. It presents the learner with complex situations and results in experiences that are gradually honed into knowledge.

The **80Days** project also wants to use games for educational purposes. Furthermore, such games aim at facilitating learning by providing inspiring learning experiences in an appealing and meaningful learning context. 80Days aims to significantly improve the scientific and technological state of the art of digital games for educational purposes, and pave the way for compelling and commercially successful educational games. In particular, the project is looking at tools that can help to reduce the development costs for these games.

More information

iClass http://www.iclass.info/

ChangeMasters http://www.change-masters.eu

TARGET http://www.reachyourtarget.org/moodle/

80Days http://www.eightydays.eu/

ICT and networked media stories on ICT Results: http://cordis.europa.eu/ictresults/ (enter search terms 'education', 'learning', 'technology-enhanced learning', 'games', 'class collaboration')

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What's inside?

Content for this publication was provided by the *ICT Results* editorial service, working to showcase breakthrough ICT research in Europe. It is part of a series of domain surveys drawn together from articles featuring EU-funded ICT research.

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Further information:

FP7 ICT Work Programme
http://cordis.europa.eu/fp7/ict/

Information Society Policy Link initiative:
http://ec.europa.eu/information_society/activities/policy_link

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