INNOVATION IN E-LEARNING: Expanding the realm of the possible

An EPS Focus Report

January 2005

Contents

Introduction......................................... 1

Case Studies:
NESTA Futurelab ................................. 6
Cambridge-Hitachi................................. 11
Caspian Learning................................. 14
Swedish Net University......................... 17

Fundamental Notions of Mathematics.................. 21
Giunti Interactive Labs ........................ 27
IBM .................................................. 31
Conclusion........................................... 36
Previous EPS Focus Reports .................... 40

"Forward-looking e-learning providers don't just look to improve on existing processes, they seek to create new ways of doing things through information technology"

Martin Owen, Director of Learning, NESTA Futurelab

NICK EVANS, RESEARCHER
nicevans@epsltd.com

REBECA CLIFFE, EDITORIAL ASSISTANT
rebeca@epsltd.com
Introduction

In this report, we look at a sample of innovative technologies and practices from the e-learning arena in both training and education. These flag up current hot topics in the sector, and indicate how learners of the future might receive and consume content.

E-learning is the term used to refer to a process of technology-supported learning, as well as the technologies and resources that support the learning process. Innovation can be defined as an idea, practice or object that is seen to be new.

New developments in the underlying technology have implications for the way in which educational and training content is delivered and used, while existing technologies can be used in new ways to deliver innovative learning experiences. Innovation in this report may be something pioneered by a particular company, a trend that can involve a whole category of e-learning technology and practice, or even a whole set of e-learning solutions taking place in a particular area or country.

What progress has e-learning made compared to traditional forms of learning?

Although e-learning adoption is growing, education and training is still dominated by traditional methods. According to the most recent EPS Education and Training Market Monitor, print is still the overwhelmingly dominant delivery medium for education and training in the US and Europe, accounting for 52% of total revenue, at $16.7 billion. Electronic delivery generated 21% of total revenue, compared with the 27% derived from in-person conferences, seminars and studies. In the training market, which includes workplace and work-related learning, in-person conferences and seminars represent 50% and electronic delivery 35% of total revenue. So while most training is still conducted in the classroom, companies’ use of technology-based learning solutions is growing. In the education market, 81% of total revenue is generated from sales of print materials and electronic delivery accounts for only 10% of total revenue. Here, traditional methods are clearly dominant.

Some countries are more advanced in their use of e-learning than others. Research from the Economist Intelligence Unit examined e-learning readiness, based on IT infrastructures, integration of the internet into everyday life by a significant percentage of the population, successful educational systems, and strong government support. The Nordic countries all rank among the top ten ‘e-learning ready’ countries, and in this report we look at some innovative e-learning practices in the country holding the number one spot - Sweden. The UK also makes it into the top ten and a number of UK-based companies are featured in this report.
What kinds of innovation are occurring in e-learning?

This report will consider a number of case studies looking at innovative technologies and practices from across the field of e-learning. We have not sought to give a comprehensive account of innovation in the sector, rather to spotlight some interesting new developments.

Supporting innovation in UK e-learning – NESTA Futurelab

NESTA Futurelab has been supporting a range of innovative projects in e-learning in the UK since 1998. Funded by UK and European government bodies as well as commercial partners, it is active in encouraging new developments in a range of areas, mostly for the under 19 age range.

In this report, we look at a number of specific projects currently supported by NESTA Futurelab and its ideas about the future of e-learning.

Interactive whiteboards for the UK schools market– Cambridge-Hitachi

Interactive whiteboards provide functionality and content that can be used to increase pupils’ engagement with lessons. They are popular with schools, and in the last twelve to eighteen months have been adopted with growing rapidity. In January
2004, the UK government announced it was setting aside £50 million in funding for the provision of interactive whiteboards in UK schools. This announcement was both recognition of a trend and a move that stimulated further activity in this area.

Cambridge-Hitachi (www.cambridge-hitachi.com) is a joint venture company formed just prior to the government’s announcement. It is becoming a key player in the production of content and software for interactive whiteboards as they become increasingly widespread amongst schools.

**Developing games for interactive learning – Caspian Learning**

Games have attracted attention from the education and training sector because they are felt to offer a highly interactive and engaging way of learning. The British Educational Communications and Technology Agency (BECTA) (www.becta.org.uk) has an ongoing project to investigate how computer games can support teaching and learning in schools. Part of its goal is to see if existing games could be used to support the curriculum. Meanwhile the potential of games environments for ways of teaching science and modern languages has been a recent area of interest for NESTA Futurelab (www.nestafuturelab.org) in the UK (see below).

Caspian Learning (www.caspianlearning.co.uk) is a young UK based company that offers a range of games to support the teaching of the national curriculum. Its products highlight how the interactivity offered by a 3D games environment can be combined with educational principles to create a stimulating learning experience.

**E-learning in Swedish higher and adult education – Swedish University Net**

Sweden has come top of the hierarchy of e-learning ready nations in a number of surveys and is a country notable for its innovative e-learning practices. Part of the reason for this is that certain features of Swedish society have made it particularly receptive to e-learning. The country has an excellent IT infrastructure and there have been a number of government initiatives to push forward progress in e-learning.

Swedish Net University (www.netuniversity.se) is an innovative solution for co-ordinating higher and adult e-learning. It is a central e-learning university, hosting e-learning content and acting as a central co-ordination point for communicating with individual universities throughout Sweden.

**Pioneering ‘P2P’ learning – ‘Fundamental Notions of Mathematics’**

Distance learning courses are a key feature of the e-learning landscape, often offered by universities and in some cases schools. However, a distance-learning course can require more determination on the part of the learner, because they often do not have the interaction with a teacher that can provide both detailed feedback and motivation. Many such courses are increasingly aware of this and provide access to a teacher, for example via email.

Fundamental Notions of Mathematics (www.theducation.se) is a distance learning course set up by Johan Thorbiörnson, Lecturer in Mathematics at Stockholm University. It has an
innovative learning structure and enjoys a significantly higher success rate than many other distance learning courses.

**Enabling context and location based learning – Giunti Interactive Labs**

Mobile learning can encompass learning or training content delivered on any number of mobile devices, from mobile phones, to Personal Digital Assistants (PDA’s), Tablet PC’s and even iPods. Duke University in North Carolina (www.duke.edu), US, last year launched an initiative where each incoming student is given an iPod pre-loaded with university content. In the UK, the Joint Information Systems Committee (JISC) (www.jisc.ac.uk) has noted that significant adoption of mobile and wireless technologies has begun in the UK education system. Part of their attraction is the low cost relative to desktop computers and the personalised access they give to the resources of the web.

There are many projects currently exploring the development of mobile learning. The UK’s Learning and Skills Development Agency (www.lsda.org.uk) has a research programme using smartphones and PDA/phone hybrids for mobile learning and learner/mentor interaction, and there are two major European Commission projects in the field, MOBIlearn (www.mobilearn.org) and m-learning (www.m-learning.org).

Giunti Interactive Labs (www.giuntilabs.com) is an Italian company that has played a leading role in a number of European Commission R&D projects and is active in developing cutting-edge mobile and wireless technologies that enable location- and context-based learning.

**Embedding learning with workflow – IBM Learning Solutions**

Corporate bodies, while usually still heavily reliant on classroom based instructor-led training, are increasingly aware of the potential cost savings and operational benefits to be gained from e-learning. Where companies implement e-learning it is usually as part of a blended solution. A recent CIPD E-Learning Survey Results Report (www.cipd.co.uk) surveyed 110 people working in companies across a range of sectors. E-learning was overwhelmingly felt to be more effective when combined with more traditional forms of learning, with 81% of interviewees either agreeing or strongly agreeing. The survey also interestingly revealed that a majority of 58% believed that the current generation of e-learning products does not demonstrate what the future will look like.

IBM (www.ibm.com) offers learning solutions to corporate and public bodies and other organisations that wish to outsource some aspect of their e-learning infrastructure. The company is implementing and developing learning practices that focus on integrating learning with workflow and on collaborative learning within institutions.
Case Study: NESTA Futurelab (www.nestafuturelab.org)

Supporting innovation in UK e-learning

based on an interview with Martin Owen, Director of Learning

Futurelab was originally a project within NESTA (the National Endowment for Science, Technology and the Arts). NESTA was setup through an Act of Parliament in 1998 to support invention and innovation in the UK. Specifically, NESTA supports and funds ground-breaking projects in areas such as science, technology, arts and learning in order to help transform them into innovative products or services. According to its own web site, NESTA is the UK’s biggest single source of early-stage seed funding. NESTA is funded by an endowment from the National Lottery.

NESTA Futurelab grew out of the view within NESTA that the response from UK mainstream media, entertainment software producers and educational software publishers to the sudden widespread availability of high-speed internet connectivity was inadequate. NESTA Futurelab was set up to take the risk of developing, promoting and funding innovative e-learning projects.

NESTA Futurelab is now a separate entity in its own right, however. NESTA Futurelab's main source of funding is from the UK Department for Education and Skills (DfES), but it also raises some funds from the UK Department for Trade and Industry and in the past has received funding from the European Union. Further funding comes through corporate relationships - the BBC Digital Curriculum is a partner and Futurelab is currently in talks with other prospective commercial partners. Revenues are also raised on occasions through Futurelab activities such as conferences to try and cover the cost of running the activity.

Futurelab looks to partner with educational institutions for feedback and input on projects. Futurelab believes that testing a project in the learning environment where it will be used is far more effective and provides more valuable feedback than for tests done in a laboratory environment. Futurelab also looks to partner with commercial publishers, developers and media companies to take project ideas through development and to market. It believes that working in partnership on projects allows it to draw on a wider pool of skills, knowledge and experience and to develop better quality products as a result.

Futurelab projects

Most of the projects supported in NESTA Futurelab are aimed at learners of up to 19 years of age, largely because the DfES’ ICT in Schools division has been a major funder. However, Futurelab projects tend to be aimed as much at the informal
and home learning environment for this age range as at the school environment. The relationship between home and school learning is becoming increasingly important, a point emphasised in the recently published Tomlinson Report on education for 14-19 year olds. There is no doubt that children learn outside of the classroom as well as in it; the difference is that outside of the classroom children choose what they learn, so logically, if children do these things naturally, there must be something highly motivating and engaging about what and how they learn in this environment. Futurelab aims to take lessons from children’s learning habits outside of the classroom in order to better understand what motivates them to learn, and to bring these lessons back into the classroom. This is one reason why Futurelab has provided a large amount of support to e-learning computer game projects.

Savannah: collaborative mobile learning

Savannah is a game where children act together as a pride of lions on an African savannah which is actually a virtually enhanced version of their school playing field. The children wear wireless wearable PDAs linked to a Global Positioning System (GPS) which provide them with information about their surroundings and allow them to imagine the school playing fields as the African savannah. Much of the virtual enhancement of the children’s surroundings is auditory; children hear sounds as they cross the ‘savannah’ such as long grass moving, water running, elephants passing, or Maasai warriors approaching. Images are then displayed on the PDAs to match the sounds the children hear.

There are two components to Savannah. The children have a ‘lion’s den’ which they must return to periodically to reflect, discuss and do more research on what they have done out on the savannah. The second component is actually going out on to the savannah where they must act out role plays which are assigned by their wearable computer. The structure of the activity is very much a mixture of action followed by reflection on the action. This act-reflect cycle is repeated a number of times in different ways.

Children are taught a range of skills from this activity. They learn about ecology, planning, map reading and map making, collaboration and communication with peers, and they also learn to learn in a number of different ways by exploring different approaches to problems for themselves.

Futurelab partnered with a number of other organisations to make the project possible. Mobile Bristol, a part of Hewlett Packard Labs based at the University of Bristol provided the computers, while the BBC Natural History unit provided Futurelab with video footage and expertise about animals and their habitat on the African savannah.

Iya-Ola: connecting language learners with native speakers

Iya-Ola is a corruption of the greetings ‘Hiya’ in English and ‘Hola’ in Spanish. Iya-Ola is a collection of Spanish and English language learning games with an unusual twist. Students can only progress through Iya-Ola by collaborating with students in another country through online audio-visual chat rooms: English students learning Spanish must communicate with Spanish students and vice versa, giving each set of students the opportunity to practice their foreign-language skills with native speakers.
Iya-Ola language games are aimed at 9 year-olds, though the concept of collaboration could be used for students studying at a range of levels. Equally, while Iya-Ola is initially focused on English and Spanish, the concept of using the internet to enable real-time communication between language learners has the potential to be developed for use with other languages.

The games on Iya-Ola teach learners Spanish or English phrases and vocabulary before allowing them to practice the language they have learnt in conversation with each other. Each game has English and Spanish versions; students in Spain complete the English language game and vice versa. At the end of each round there is a problem to be solved by the two sets of students, but the team in the other country has the answers they need to complete it. Each set of students must ask for and find the answers to the problem they are solving by conversing with the other team through the chat-room and using the Spanish or English language skills they have learnt during the course of the game.

Iya-Ola is currently in development testing in a UK primary school in Nottingham and a Spanish primary school in Avila. The project is at the stage of establishing what can be done with the concept and the idea may still evolve further. Once completed, the course will be published and made available to primary schools by Immersive Education (who also worked with Futurelab to develop Mediastage, a virtual film studio for educational use).

Comments on e-learning

Teachers and e-learning

Teachers are very good at delivering on what is asked of them pedagogically. When the UK government introduced 'literary hour' to primary schools in the late 90s in a bid to improve literacy levels, primary teachers responded very quickly to meet the new guidelines.

Technology is a more difficult issue. Teachers have been very quick to integrate the internet into the classroom, for example, because it fits well with existing teaching methods and provides instant access to a range of information which can be included in lessons. TV, on the other hand, has been around for about 50 years and most teachers have still not, in Martin Owen’s view, learnt how to use the technology effectively in the classroom. Stronger guidance may need to come from the government and the curriculum on using e-learning in order to make sure that it is brought into the curriculum in a coherent way across the country.

Martin Owen believes the UK’s Department for Education and Skills and the Qualifications and Curriculum Authority are both well aware of the needs of UK schools in the 21st century and of the importance of e-learning technologies, and he is confident they will provide the appropriate backing.

How e-learning will evolve

Information and communication technologies are becoming increasingly pervasive and are causing profound changes in the way we do many things. Not all things will change completely, however; books, reading and writing will continue to play an important part in our lives for some time yet and will continue to play a key role in education. E-learning technologies,
however, will broaden the scope and methods through which societies can provide education.

e-Learning development phases
When information and communication technology first appeared it was used to do routine tasks: the word processor replaced the typewriter, for instance. At this stage, the use of ICT in education was about learning how it could be used, the equivalent of learning the operational skills needed to use a word processor, and most secondary school ICT teaching has been about this. This is followed by a second stage where ICT feeds into and improves on established processes – a company puts its product catalogue on the web and makes it searchable, for example. In education, this stage is beginning to evolve and technology is starting to replace functions. There is also a third phase, however, where the existence of technology opens up new possibilities and allows us to change the way we do things and replace previous processes, it is society and individuals that must change in order to make use of the new possibilities offered by new technologies. A catalogue supplier who moves online, for example, might find that the nature of its business changes - as internet users browse the catalogue online, the company has the opportunity to compile a wealth of data about the tastes and habits of its users which can be extremely useful to advertisers. This data then becomes a new source of revenue and Martin Owen is aware of at least one catalogue supplier for whom the provision of customer data has now become its main source of revenue.

This is the next phase for education, and forward-looking e-learning developers will be examining new ways of doing things through information technology, rather than simply improving on existing processes. In this age, information in itself will be of less importance as it will be easily available; more important will be what can be done with that information. For example, in geography, it was traditionally considered important for pupils to know all the world’s capital cities from memory. This practice of memorising information becomes far less important now that the internet can provide easy and almost instant access to a vast range of information.

Futurelab’s view of the future
Futurelab consciously takes a long-term view of e-learning and its projects often reflect that. It believes that mobile learning will become increasingly important as the potential of mobile devices and computers in the learning environment become better understood. In contrast, the desktop computer will come to play more of a peripheral role in schools.

Martin Owen also believes that there is an inextricable link between learning and assessment. The assessment systems we have are a throwback to the 19th century when the assessment medium available – a paper exam – defined to a large extent the way in which learners could be assessed. Information technology, however, has opened up possibilities on a whole new range of assessment methods and we will start to see exploitation of these. New assessment tools will emerge which will not just change how we assess, but what we assess. Computer games provide some very interesting ideas in this regard. Most computer games provide the player with a wealth of information during play which allows the player to know instantly and at any moment how well they are doing; games designers put a lot of effort into these reporting tools as
computer games players remain more involved in games if they know how far or close they are to completing their objectives. IT-based educational assessment systems could take a number of lessons from computer games in providing learners with assessment and reporting on their performance as they work so that learners are able to immediately react and focus on key areas for improvement.
Case Study: Cambridge-Hitachi (www.cambridge-hitachi.com)

Interactive whiteboards for the UK schools market
based on an interview with Peter Donovan, Managing Director, Cambridge-Hitachi

Cambridge-Hitachi, founded in 2003, is the result of a joint venture between Cambridge University Press and Hitachi Software Engineering. It provides curriculum-based interactive whiteboard software to the UK school sector.

Beginnings: capitalising on a new trend

In 2002 the education group within Cambridge University Press realised interactive whiteboards were starting to be a significant force in the UK education market. At this stage, the company had some informal contacts with Hitachi as a result of discussions around joint marketing opportunities that led to Hitachi’s marketing its whiteboards under the Cambridge University Press brand. At around this time it was realised that CUP needed an increase in scale to take advantage of the growing opportunities in e-learning. 2003 saw more intensive discussions with Hitachi and as a result of these it was decided that the two companies would create a formal joint venture company. The full agreement was in place by the end of 2003.

Hitachi and Cambridge University Press, organisations with very different cultures, bring different strengths to the combined offering. The hardware is particularly durable and new software has been generated specifically for the current curriculum. Meanwhile, the CUP brand is one that teachers know and trust, and offers content produced through engagement with education professionals.

Content for an interactive learning experience

The joint venture has drawn on the strengths of Cambridge University Press in educational publishing for Key Stages 1 to 4 of the national curriculum, as well as A-Level. Making use of the existing knowledge and expertise of the educational department of CUP, Cambridge-Hitachi produces software for:

- Literacy Key Stage 1 & 2
- Numeracy products for Key Stage 2 are to be launched shortly, followed by Key Stage 1 this year
- Science Key Stage 3 & 4
- Science for A level and foundation further education

The range of content for each key stage and subject is structured to make it suitable for use by different levels of learner. The joint venture will continue to develop and expand...
this content, and may look to expand into English Language Teaching (another strong CUP area) and perhaps materials for international markets in future.

While Cambridge-Hitachi content draws on a history of traditional publishing, it takes full advantage of technology to offer an interactive learning experience. Flash animation is used to liven up the teaching of science and maths. Video is used to teach handwriting by demonstrating not just the shapes of the letters but also hand posture and warm-up exercises. PDF resources and worksheets can be customised to suit the needs of a particular class or individual learner.

**Innovative – but easy to use**

Interactive whiteboards are effective because they do not fundamentally change teaching behaviour. They use the same interface as traditional blackboards while offering much richer functionality and content. The software does not force teachers to move through the lesson at a pre-defined speed. The teacher can vary the pace of learning to accommodate their student’s needs just as they would when writing on a blackboard. Interactive whiteboards therefore fulfil one of the key preconditions for the adoption of an innovative technology: a good fit with existing culture and working practice.

Cambridge-Hitachi has also sought to make the tool as easy to use as possible, both for learners and teachers. The company believes that the way content is presented is vital. To achieve clarity of the material presented on the interactive whiteboard, it is important that the space is not cluttered and that the type is large enough to be seen easily by all students in the classroom. Areas where pupils are able to write a direct contribution to the lesson must be in the right position for them to do this as easily as possible. Navigation must also be simple and the organisation of the material must be logical and hold no surprises when the teacher is standing at the front of a class using the tool. While some training for teachers is important when whiteboards are initially supplied, the aim is to make them as intuitive and easy to use as possible. The user should be able to learn about the tool by exploring it.

**Bringing the world to the classroom**

Interactive whiteboards offer the opportunity for learning in a different way. They allow many different elements to be drawn together and used from one device. Text, video conferencing, sound, the web, are no longer discrete elements accessible from different places within the classroom. It is a structural change key to the way a teacher can operate and interact with his or her pupils.

- ‘Interactive whiteboards provide a one-to-many medium that encompass a range of media. They bring ICT to pupils in a whole-class setting.’ – Peter Donovan, Managing Director, Cambridge-Hitachi

As well as changing the structure of learning in schools, the interactive nature of whiteboards encourages a focus and attention from learners that is not demanded of them by a passive teaching method. With whiteboards, the class can be included in lessons not just through traditional question and answer but in many different ways that will capture their attention and imagination. For example, a whiteboard can be
linked with tablet PC’s, or with voting devices for assessment purposes. They can also be used with other devices such as mobile phones – turning a school nuisance into a learning tool.

Bringing the outside world into the classroom via the web makes them a very powerful teaching channel. Hitachi can link many whiteboards together via the software to another IP address, call up another user, and add in a microphone and video to allow classes to talk to each other and see each other. This means that schools in different counties or different countries can interact, particularly useful perhaps for foreign language teaching. It also allows schools to pool resources. A sixth form that is not able to offer a particular course could enable students who wished to study it to do so by linking up to and taking part in lessons at another school via a whiteboard.

What has been the impact of interactive whiteboards?

In terms of the adoption of interactive whiteboards in UK schools, the picture is currently very mixed. Some schools have as many as one in every classroom. Others might have none, or just one or two in the whole school. In 2004 there were perhaps as many as 100,000 interactive whiteboards being used in UK schools, indicating that around 10% of the UK’s 1 million classrooms currently have use of one.

Peter Donovan comments that ‘once schools begin to use whiteboards they immediately appreciate their benefits and want to acquire more’. Teachers who have had the experience of using an interactive whiteboard are reluctant to go back to old methods. A recent BESA survey of teachers and ICT Co-ordinators found that 95% of those surveyed believed whiteboards are important or very important to them.

The obstacle to their adoption appears to be the resources that are available to pay for them, rather than any lack of desire for them on the part of schools and teachers. However, the £50 million investment by government over two years being channelled through BECTA has helped to grow the adoption of whiteboards, as has other funding via local education authorities.

- ‘Adoption of interactive whiteboards is certainly accelerating; I would expect to see rapid growth over the next five years.’ – Peter Donovan, Managing Director, Cambridge-Hitachi
Case Study: Caspian Learning (www.caspianlearning.co.uk)

Developing games for interactive learning
based on an interview with Graeme Duncan, Chief Operating Officer, Caspian Learning

Caspian Learning is a relatively new UK company, launched in 2002. Its focus is on developing games based learning applications for use mainly in schools, but also in the public sector and private industry settings.

Target market

The range of products currently offered by Caspian Learning falls into two camps – schools and corporate applications. Of these two, Caspian has turned the bulk of its attention towards the UK schools market. This focus has been driven purely by commercial factors and doesn’t reflect the applicability of the games software to the corporate environment. Academic education offers a large, scalable market that has the ability to pay, and for this reason the company expects around 70% of its business to remain in this sector. Caspian is currently selling mainly into the primary and secondary arena (ages 7 to 16), but has recently begun talks with some higher education institutions with a view to possible expansion into the HE market.

Games vs Traditional teaching

Despite the weighting of Caspian’s product range, Graeme Duncan believes that games-based e-learning applications can be used ‘wherever there is a need to impart knowledge’. He argues that when it comes to the teaching of knowledge, there is no reason why games can’t replace traditional teaching and learning methods. However, he believes games cannot replace the face-to-face interaction of individuals where the teaching of ‘soft skills’, such as interpersonal and attitudinal skills, is concerned.

Schools

The company expects games-based applications to have different possible uses within the two markets it serves. In schools, the applications could apparently be used as the sole teaching method for the national curriculum. They cover the whole of the national curriculum and are tailored to take account of different ages and abilities. However, teachers who use Caspian products usually use them in conjunction with traditional learning techniques. The applications are built with
this in mind, to allow teachers to use them flexibly in the way that suits them best.

**Corporates**

In the corporate sphere, the company has found that games generally need to be supplemented with traditional teaching. While there are variations between individuals, on a general level the generational gap between the target audience in the schools sector and corporate learners demands a different approach. There is a wider age range to accommodate, and some learners may require the comfort blanket of print materials to support their e-learning.

Games can provide significant cost savings on training for companies, and because every move is monitored the company can see a quantifiable benefit from the use of the application. As this kind of monitoring has the potential to make learners uncomfortable, it is vital to provide the right support when the technology is first installed to ensure that mistakes are seen as a positive part of the learning process, where knowledge is acquired through experience.

**The Caspian proposition**

Caspian Learning believes it offers a different proposition to other e-learning games providers because the company was set up by a group of cognitive psychologists rather than games manufacturers.

One of the founders of Caspian stumbled across the idea for the company from having seen the use of gaming technology in training within the American military, for working through post-war scenarios and developing the decision-making skills of military personnel, an original source of many current e-learning technologies and ideas. He saw the potential of applying this to education and fusing the learning aspect with 3D gaming technology as a vehicle.

Today, the cognitive psychologists within Caspian draw on the knowledge of a circle of associates in the development of games applications based on certain key principles.

**‘Active Learning’**

The first principle of the applications is active learning. Through active involvement learners engage more fully with the learning process. Users are given specific learning tasks to perform within the game, moving around the 3D environment finding questions and answers. Each Caspian application is based around 15 cognitive learning tasks. These span a spectrum of learning outcomes, from simple recall of information to, at the highest level, the application of knowledge to different situations. These 15 cognitive processes are the same for all tasks and subjects within the Caspian product range, the differentiation between applications depends on the content and the 3D environment around them. This structure allows teachers to give learners tasks to suit their level and to lead them progressively through the levels. The development of the tasks within each particular game is an iterative process. Both teachers and children are asked to test each task to allow the designers to receive qualitative feedback and monitor their engagement levels.

**Are games suited to teaching Maths and Science?**

The company is still young, having only brought its products to market for the first time 6 months ago, and has built 10
applications so far for the UK schools market. The subject focus is skewed towards the humanities, with five or six of the existing applications having been designed for history or geography. Such subjects are suited to a 3D environment as they take place in an obvious environmental setting. When designing an application to teach students about the way of life in Tudor England, the options for the learning tasks and setting are very rich. The learner can be transported to the very time and place they are seeking to understand. In a Caspian application on this topic, for example, the student can explore a Tudor castle and house, and meet a poor Tudor family to find out information about what life was like at the time.

However, Graeme Duncan does not believe such subjects are inherently more suited to 3D games applications. He argues that maths and science games can be equally well taught via this medium, and simply require a degree more lateral thinking about the 3D environment in which they are to take place. For example, for children who struggle with extrapolation maths, the problem they need to solve can be put into a 3D environment such as a bus journey. Placing the learner on the bus while they work through the question makes the concepts tangible and easier to understand. The current bias within the Caspian product range towards the humanities is due to the embryonic nature of the company, and one of its key objectives is to broaden its reach across the subject range of the national curriculum. It has some applications in maths and English; of the ten new applications currently being developed for future release, five will be for science.

**Future development**

The focus of the company’s activities will continue to be on the development of products for the educational arena. In the corporate field, development will take place by partnership, such as that currently in place between Caspian and its partners in the motor industry. The reason for this development model is the desire to focus on product quality rather than building a large business development infrastructure.

**Educational fun: a contradiction in terms?**

How useful are games as learning tools? Proponents of the use of gaming technology in education believe games can act as a hook to draw people in to learning by associating it with fun, and that the interactive nature of the tool brings engagement benefits to the learning process.

However some objectors claim educationalists should not try to mould games into educational tools and rather should value them for what they are – creative entertainment products that develop valuable skills. Others argue that the incorporation of education in computer games reduces the complexities of learning and that the emphasis on ‘fun’ patronises the learner. There is also the argument that children will not be fooled by the dressing up of education in different clothes and will not find e-learning games as attractive as the non-educational games they are accustomed to playing. Caspian’s Graeme Duncan disagrees. ‘The reference set is not games like Tomb Raider that children play at home, but the normal activities that take place in school. While our products won’t have the same high-level graphics as these games, they will knock the socks off other learning materials that children are accustomed to in the classroom.’
Case Study: Swedish Net University

E-learning in Swedish Higher and Adult Education

based on an interview with Mats Ericson, Director-General, Swedish Net University

The Swedish Net University was set up on 1 March 2002 as a central e-learning university based upon the e-learning courses already being provided by Swedish universities and university colleges. An initial extra imbursement of SEK600m was set aside to be distributed between ordinary universities who support e-learning, SEK500m of which was given directly to universities who donated e-learning course materials to the Swedish Net University.

At the start of the 2004/2005 academic year there were 3,500 e-learning courses available through the Swedish Net University. The Net University works closely with the universities in ensuring the quality of the course materials which are placed online.

As well as hosting the content, then, the Net University also acts as a central co-ordinating agency for communicating with individual universities. The project allows universities to share the workload in developing materials to meet the demands of the e-learning market place.

The Swedish educational system

The majority of Swedish schools, colleges and universities are publicly funded with very few private institutions at any level. University students do not pay tuition fees and there is a commitment to providing free education to Swedish citizens, whether students or adult learners. Education is also free to non-Swedes living or working in the country. Despite this, universities in Sweden are quite competitive as they often receive additional funding from the government depending on the numbers of students they take. Swedish Universities’ combined annual turnover is SEK18bn (approximately $2.54bn), of which SEK1bn (about $0.14bn) is derived from charging organisations for providing training, for example for teachers or nurses.

There has been a long tradition of distance learning in Sweden even before the widespread availability of information technology, primarily because of the relatively large size of the country when set against its low population level. With towns and cities often widely separated geographically, distance learning has played an important role in educating the Swedish population, in particular in adult education and in continuing professional development training. This has made the development of e-learning in Sweden seem like a natural progression in the provision of distance learning, and as with
traditional distance learning it will probably play its most
important role in the provision of adult education.

The rise of e-learning

Over the last decade the Swedish government has had a
number of policies in place designed to help support the growth
of e-learning, mainly based around the provision of additional
government funding to universities for each student accepted
on an e-learning course. There are 350,000-400,000 students
in the Swedish Higher Education system, of which 15% took at
least one course via the Net University. Of all university
education 'credits' (modules) obtained in Sweden, 10% are
obtained online.

Technology is transforming traditional campus education in
Sweden at pedagogic, logistic and technical levels. Mats
Ericson estimates that in 10-15 years it will theoretically be
possible for Swedish students to do everything with online
learning that they would have been able to do with traditional
on-campus learning. The only element of traditional campus-
based education which will be very hard to replicate will be the
social element of university life on campus. The 'physical'
presence of universities is not in danger from e-learning, then,
as it will remain important for university students, particularly
for those who have just left school, to be part of the social side
of campus life in order to develop as well-rounded individuals.
Most universities are trying to blend traditional campus-based
learning with aspects of e-learning. Campus-based learning
will continue to account for at least 50% of university
education in the future. Mats Ericson believes e-learning will
account for 30-40% in around 10 years, and in the longer term
may reach 50% as an upper limit.

There are also over 200 municipal learning centres in Sweden.
Learners not attending university campuses and taking e-
learning courses, particularly at adult level, will be able to go to
these centres in order to derive that social element of learning
and face-to-face support. In fact, Mats Ericson believes that e-
learning holds its greatest potential for the provision of adult
and distance education. For universities, the main benefit of e-
learning is in allowing them to capture a new market.

E-learning growth drivers

A number of factors particular to Sweden as a country and to
Swedish culture have contributed to an environment which is
well suited to the strong development and take-up of e-
learning.

Firstly, Mats Ericson believes that Swedes are naturally
interested in new technologies and have a propensity to readily
take up what is new. High-bandwidth internet connections are
widely available in Sweden with many ISPs offering multi-
megabit connection speeds ranging from 10Mb to 100Mb; this
can be contrasted with the upper limit of around 8Mb of
broadband connections in many other European countries such
as the UK. Swedish ISP Bredbandsbolaget, for example, offers
a 100Mb connection for around $79.49 a month. While Mats
Ericson believes that ADSL connections of 1Mbps are enough
for most e-learning content and applications, the wide
availability of high-speed connections in Sweden early on
helped the growth of the industry and now provides the
opportunity to deliver more data-heavy e-learning content if so desired.

Sweden has also given birth to a number of international companies, such as Ericsson, which have invested heavily in e-learning and supported its use in Sweden.

However, Sweden’s geography is probably the most influential factor in the growth of e-learning. As a large country with a relatively low population density, distance learning has always been very important in Sweden and is very much part of its educational tradition. Universities outside of the major cities, in particular, relied heavily on the provision of distance learning courses in order to attract students, and as a consequence Sweden already had very well developed distance learning pedagogies in place. Much of the pedagogical knowledge developed in distance learning could be transferred to the development of e-learning courses as there are many similarities between the two pedagogies. Many of the larger, more traditional universities are now perhaps envious of the knowledge and skills of the smaller, more isolated universities in the area of e-learning, and it is often these smaller universities which have been most progressive in the development of quality e-learning courses. Lund University, for example, is a large, traditional institution and jumped into e-learning with little prior thought or discussion on how to ensure the quality of the courses and materials they were to deliver. In Mats Ericson’s opinion, this institution relies on its name and strong reputation for traditional teaching in order to attract people to its e-learning course, but there is no guarantee that the e-learning courses it offers are of a higher quality than those from other less well-known institutions.

e-Learning across disciplines

In every subject it is down to the teachers to decide whether e-learning is possible, or whether it might offer benefits or alternatives to traditional methods of learning. IT, unsurprisingly, has lots of e-learning courses, though engineering, a subject for which you might expect e-learning to be widely used, has in fact been very reluctant to adopt e-learning.

Lack of take-up can usually be traced back to resistance from lecturers in the discipline, particularly if they do not want to break with traditional methods of teaching. Some courses are much harder to teach via e-learning: surgery, for example, requires a lot of practical work and it is not easy to deliver a complete surgery course online. It would still be possible to teach elements of surgery through e-learning, however, with students following more traditional, practical modules where necessary.

The subjects which have adopted e-learning most strongly tend to be text-based courses where it is fairly simple to transfer materials online. Economics, law and literature are classic examples of this.

Theoretically, however, almost anything is possible: there is no subject for which, in Mats Ericson’s opinion, it is impossible to use e-learning in some way. Uppsala University, for instance, was established in the 1400s and is Sweden’s oldest higher education institution; the university has, however, developed
an online e-learning course for training priests and reports take-up of the course to have been good.

The future role of e-learning in Swedish education

The concept of easy and free access to education for all and of the availability of ‘just-in-time’ education or adult education is very important in Swedish society. Access to courses is free and ideally, for adults in particular, courses should be available at any time and be very flexible in their structure. E-learning is a medium which is very well suited to supporting these concepts and consequently has received strong support.

There is a political problem emerging from the wide availability of Swedish learning materials for free online, however. With increasing numbers of foreign students signing up to follow free Swedish e-learning courses, many Swedish taxpayers are not entirely happy that education paid for and developed with their taxes is available for free outside of Sweden with nothing coming back into the country in return. The Swedish government is looking at models from other countries (in Norway, for example, students must pay part of the cost of the course), and it is likely that in the next year or two Swedish education institutions providing e-learning will be allowed to charge students from outside the European Union to follow the course; currently Swedish law does not permit educational institutions to receive money for providing education.
Case Study: Fundamental Notions of Mathematics (www.theducation.se)

Pioneering ‘P2P’ learning

based on an interview with Johan Thorbiörnson, Lecturer in
Mathematics, Stockholm University

It is increasingly important for students studying courses outside of mathematics, such as economics or engineering, to have a strong grounding in maths. However, Johan Thorbiörnson believes that students in these disciplines from around the world are now struggling with the level of maths needed on many courses. The gap between school-level maths and the level in higher education has widened and it is a problem both for students and for those in charge of higher education.

According to Johan Thorbiörnson, 25% of higher education students in maths-related courses fail their first year because of a lack of knowledge in maths. Despite this, maths is not taught as a module on many courses which require an element of mathematical understanding.

According to Johan Thorbiörnson, maths tends to be learnt by rote in many schools and so students simply memorise mathematical processes such as multiplication tables or formulae without really understanding what is going on behind the workings. Johan Thorbiörnson’s course, Fundamental Notions of Mathematics, attempts to address this gap in student’s knowledge and aims to impart an understanding of why things happen in maths. The course recaps on school-level maths and also covers the maths skills needed in the first year of university; however, it takes a very different approach to other courses. The learning process is informal and takes an innovative approach to both the learning and assessment processes. Community and discussion tools are utilised in a very unusual way to create community spaces in which students are able to conduct, in Johan Thorbiörnson’s words, “interactive experiments on maths”.

In the beginning...

Johan Thorbiörnson started the Fundamental Notions of Mathematics course five years ago. Clas Löfwall, Head of the Mathematics Department at Stockholm University also worked closely with Johan Thorbiörnson on developing the course and his ideas were central to its development.

The first step was to start a company, Theducation, which had the task of designing and developing course materials. The company was later bought by Swedish education and trade publisher Natur och Kultur. Stockholm University and
The education then collaborated in building a full academic course based on the materials designed by the company.

It was necessary to create a company to commercialise the course as Stockholm University did not have the resources to finance the development of course materials on an ongoing basis; funding was only provided to Johan Thorbiörnson for the initial research project which led to development of the course.

**About the course**

The course comprises five units which the students need to pass. These could theoretically be done in five weeks, though most students take around six months to complete the course, some longer. The aim of the course is to be as flexible as possible in order to allow students to learn and progress as they feel comfortable. The course can be applied for and started at any time of year and completed over any length of time – there is no requirement that students take the course over an ‘academic year’. Only some students take the course in this way; a number of universities, mostly technical colleges, require students to follow the Fundamental Notions of Mathematics in addition to studies at their home institution in order to address any gaps in students’ mathematical knowledge.

The range of students currently taking the course includes school and university students as well as adult learners and individuals working in maths-related professions. Over the last two years, around 5,000 students have enrolled on the course in Sweden; of these around 2,000 are currently active and using the course in Sweden. The course has also been transcribed into English to make it applicable in foreign markets.

**What makes the course different?**

In each class there are 2,000 students. This necessarily raises the question of how it is possible to educate this many people in a single class. The solution is a novel system where students work with each other in small groups within each class. After each course chapter the students can test their newly acquired knowledge through a range of individual exam-style online assessments ranging from easy to difficult. This is then followed by sets of open-ended questions which require the students to find a solution, or solutions, to the problem. Correcting answers to open-ended questions is not possible electronically (as with standardised tests where only one answer is possible) and with 2,000 students in a class would take a long time to correct by hand. Johan Thorbiörnson estimates that it would require about 25-50 teachers to correct 2,000 answers to a set of questions within a reasonable timeframe. To solve this problem, Johan Thorbiörnson implemented a system where students are automatically grouped with three other students working on the same problem when they submit their answers. The groups are normally assigned automatically by computer according to teacher-defined criteria, though groups can be set up manually also. Students then work as a group on each of the students’ answers, providing comments and feedback, in order to arrive at a common, agreed solution. The unified solution is then submitted to a teacher for marking. This approach has the immediate benefit of making marking on such a large online course more feasible in terms of teacher time, cutting the
number of responses within a class from 2,000 to 500. It also has the benefit, however, of introducing a more creative and collaborative approach to maths for students. Students are no longer working in isolation and learning by rote, but are involved in discussions, or ‘interactive experiments’, on mathematical problems which teaches them to see different ways of thinking around a problem. Feedback on work is constant, as this is an integral part of the learning process here, and feedback received from fellow students is often more detailed, and perhaps more honest, than that which would be received solely from a teacher. Feedback given as communication in a forum is also excellent for supporting later revision or ongoing work as the conversations held in the forums are saved and the process documented for later reference. This process means that the quality of the submissions are much higher than normal, both in terms of the solution itself and in terms of language and clear expression of workings. As a result, it takes, in Johan Thorbiörnson’s estimation, around a tenth of the time to mark the solutions as it would to mark solutions which are largely incorrect or poorly expressed. So, the combination of group solutions along with a higher quality of answer allows the time taken to mark solutions to be scaled down by roughly a factor of fifty: rather than employing 50 teachers to mark 2,000 submissions, it now becomes possible for one teacher to mark 500 higher quality answers.

The course’s approach is of great pedagogical interest also. Teachers have great control over the difficulty and types of task which can be set for groups of students. Smaller, easier tests can be used to start with, while the final test could cover the whole course if so desired. Teachers enjoy the flexibility they have in being able to set work aimed at the needs of particular students.

There are three examination sections to the course, and students are grouped three times also, changing groups for each examination process. Once all the assessment submission parts of the course have been completed, electronic seminars comprising groups of 20 students are held over a period of three days. A seminar teacher posts questions and provides feedback, while the task for students is to prove that they can actively contribute to mathematical debates, using the knowledge they have learnt in the course to back up their arguments. Students find this very involving, and it gives teachers the opportunity to check on students’ knowledge from across the whole course, not just on isolated areas.

Benefits of the approach

Johan Thorbiörnson believes that this approach to learning and assessment, where the course is the exam process itself, is extremely effective and that the quality of student’s knowledge when they leave this course is higher than on most distance learning courses. The teaching style is relatively informal and the course is flexible with no fixed deadlines for students to work to. Students can choose to focus most heavily on specific areas of the course they are interested in and are also allowed to retake sections of the course as often as they wish; the ability to search course materials and navigate freely through them enables this. Most courses are usually very rigid and take a more conservative approach to teaching and assessment; many maths-based courses, for example, only allow right or wrong answers to problems, whereas this course invites
students to discuss possibilities and alternative solutions to mathematical problems. The result is that students come out very confident in their understanding of what is actually happening behind mathematical workings, as well as having the opportunity to do lots of calculation practice.

The course has an almost 100% pass rate at secondary and higher education levels since students can take the exam as many times as they like. This is not the case at post-education or adult level, where most students don’t need to obtain an academic certificate and consequently are not obliged to take the exam; the pass rate here after one year is just 15%, though these students are probably gaining as much value from the course in terms of filling any gaps in their knowledge which they wish to address. Some students in technical colleges, however, are required to take the course alongside their existing ‘real world’ course in order to brush up on maths knowledge; these students are required to complete the course within a timeframe dictated by their universities, so the pass rate for these students is perhaps a better indicator of the course’s success in relation to pass rates on other types of courses. According to Johan Thorbiörnson, students at technical colleges taking the course within a set timeframe still achieve a pass rate of 80%, which compares very favourably to a normal pass rate of 30% for most distance learning courses.

Measuring success

Teachers from a range of disciplines have now approached Johan Thorbiörnson expressing an interest in implementing the group assessment process on other e-learning courses. This particular course has now for the second year been offered to all students applying for studies at Lund Institute of Technology and is also likely to be a preparatory requirement for all students signing up at the Royal Institute of Technology. These colleges have also implemented forums in which teachers answer questions and comment on student discussions. On many ‘official’ courses employing this approach, however, teachers may still want a final written exam in order to ensure that students have covered the entire course or that they are not cheating in some way. The two are not incompatible, however, and some courses have taken this system and combined it with a final written exam; students studying in this way have generally come out very well prepared for the final exam.

The maths course is currently open for free to anyone enrolled on a university course supporting Fundamental Notions of Mathematics.

Taking the concept to Sri Lanka

Johan Thorbiörnson is involved in a Swedish government project in Sri Lanka to start a national e-learning centre. There are currently between 5,000 and 10,000 students in Sri Lanka using Johan Thorbiörnson’s maths course, but there are also a range of other courses available to Sri Lankan students in areas such as IT which are based on the same assessment process. There are now more than 100 learning centres in Sri Lanka connected by internet to Colombo University. The Swedish government has very close ties with Sri Lanka and, along with Japan has been giving financial support to Sri Lankan development projects over the past twenty years.
When the assessment process first started in Sri Lanka, the pass rate was less than 50%. Within six months, the pass rate of students between the first and second semesters improved to 70%. The overall success rate at the end of the course is higher than this as students are free to retake exams as often as they like.

**Commercialising Swedish e-learning**

Swedish law states that all education must be free. Consequently educational institutions are not allowed to take money from students for their teaching activities. Therefore, foreign students are able to take Swedish e-learning courses for free simply by applying online. The Swedish government has tried to provide incentives for Swedish higher education institutions to develop e-learning courses. Stockholm University, for example, receives SEK90,000 (around $12,700) from the Swedish government for each full-year student it has signed on to an e-learning course, up to a predefined limit on the number of students it can receive money for. There is no reason, then, for Swedish universities to limit student intake to e-learning courses. In Sri Lanka, for example, while the course there is now officially linked to Colombo University, Stockholm University controls delivery and administration of the course and it would still be possible to receive money from the Swedish government for every Sri Lankan student on the course.

From political and taxpayer perspectives, however, the situation is very different. Funding for the development of e-learning courses in higher education institutions ultimately comes from the Swedish taxpayer. There is resistance from Swedish taxpayers to seeing Swedish-funded education and teaching being given away for free to foreign students.

Johan Thorbiörnson believes that in the next year or two the government will change the system in response to voter attitudes and that Swedish universities will be permitted to derive revenues for providing courses resulting in Swedish academic qualifications to non-EU students. There is great potential here for Sweden to transform education into one of its major exports, just as Australia has already done (education is now Australia’s biggest export).

Sweden is very well placed to do this. Technologically, the country is very advanced and according to Johan Thorbiörnson is one of the world leaders in e-learning. This is borne out by an e-learning readiness report from the Economist Intelligence Unit and IBM. Other countries such as South Korea may be more developed in terms of IT and communications technologies alone, but, when these elements are combined with educational and distance learning expertise, Sweden is ahead. The next step in developing Swedish e-learning into an industry is to find commercial partners outside of Sweden with knowledge of foreign educational markets who can sell Swedish education abroad.

**The education’s commercial role**

The education has increased its turnover by 90% and 80% during 2003 and 2004 respectively. The education delivers a range of pedagogical tools and e-learning course material to schools, adult education and universities and has now about 25,000 users in Sweden. Usually a fee per user is paid by the educational organization, and the student may also need to pay
a subscription fee for the electronic literature. The company makes it possible for traditional educational organizations to deliver courses to a lot of students in a flexible way, something that otherwise may have been difficult, expensive and risky. The company also has a group of experienced teachers in different subjects who can take total or partial responsibility for the students.

Private fees for courses and course materials from Theducation range from about £15 ($28) up to about £200 ($373) for the Swedish market, thought the company would be interested in distributing materials to other markets such as the UK also. If the course from Theducation is made available to students through a university, the agreement regarding price is made between the company and the university and the university decides what format and possible fees will be used when offering the course to the students. Sales to individuals learners are for course literature only as it is illegal in Sweden to take fees from individuals for providing a course.
Case Study: Giunti Interactive Labs
(www.giuntilabs.com)

Enabling context and location based learning

based on an interview with Fabrizio Cardinali, CEO, Giunti Interactive Labs & eLIG Vice-Chair

Giunti Interactive Labs is one of the leading European players in the development of advanced content management and mobile and wireless devices in e-learning. It is the professional publishing, courseware design and development facility of the Giunti Publishing Group and has EMEA headquarters in Florence and US headquarters in San Francisco.

With involvement to-date in more than 30 EU R&D projects focused on the development of e-learning for mobile and ambient learning set-ups, Giunti Labs’ recent moves in the field of mobile and wireless learning are interesting as a pointer to the future of mobile learning.

The company recently announced the availability of eXact Mobile as an add-on layer to its Learning Content Management System, Learn eXact. This is now the first commercial LCMS platform to support the delivery of content on mobile devices, according to location and context.

Learn eXact
Learn eXact is an integrated software suite that enables the creation, management, delivery and tracking of third-generation e-learning content based on XML, Learning Objects and new generation standards. It enables the production of content and the delivery and tracking of different versions of content on different platforms and devices. According to Giunti Labs CEO Fabrizio Cardinali, the strength of this system is its purity. Rather than having added content management to a pre-existing architecture, Learn eXact is a natively XML learning standards-oriented platform.

eXact Mobile
eXact Mobile was developed in a set of EU R&D projects headed by Giunti Labs, including Mobilearn, Natacha, Sculpteur and JUST.

An add-on to the Learn eXact LCMS platform, it allows the user to create mobile learning objects in XML that can then be delivered in a location-based and context aware manner to mobile devices. When creating mobile learning objects within the Learn eXact authoring environment, the user can add context awareness rules and location detection. These stipulations will then guide the choice of content that is delivered to devices (such as HP’s Iraq Qteck and Blackberry devices and Xybernaut wearable computers).
Matching content to the surroundings

Content can be adapted for delivery to a user’s environment by eXact Mobile in two ways:

- **Context.** Information gathered by the mobile device and ambient technology is used to tailor the content delivered. For example, if it is dark or the person using the device has sight impairment, content can be delivered in larger text.

- **Location.** The user’s location can be detected using positioning technologies. Wi-fi and RFID (Radio Frequency Identification) are two such technologies that have been incorporated into Learn eXact to this end. It is possible to identify where a person is in a wi-fi network by analysing the strength of the wi-fi signal. Alternatively, a location can be tagged with an RFID tag that can be read by a mobile device to inform the content repository of the user’s location.

When information on user context or location is routed back to the content repository, it can be used to determine the nature of the content that is delivered to the user’s mobile device. These devices can include mobile phones, pocket PCs, wearable computers and emailers.

Tastes of the future for mobile learning

For Fabrizio Cardinali, the future of mobile learning lies not in the delivery of full-blown tutorials but in contextual chunks of content sent just at the right time. The context and generalisation of knowledge these ancillary items of content bring to bear is a key advantage of mobile over traditional learning.

Competency testing

A good example is the application of eXact Mobile for testing and assessment of mobile workers and sales forces. Giunti has developed a corporate-based blended set-up that integrates eXact Mobile with the Learn eXact LCMS, LMS and Skills Gap Analysis and Competency Management Modules. The company has made this application available on BlackBerry devices to pharmaceutical, banking and retail organisations. Companies can send employees in the field a set of quick trials and assessments that they can complete on a train or between meetings and ship back across the mobile device.

Decision support

Delivery of customised pieces of content also makes mobile learning particularly well-suited to providing decision support. eXact Mobile has been used to provide field maintenance support to spare parts and equipment maintainers at Comau, a European automotive plants manufacturer from Fiat Group. With an application called iTutor, relevant video and web contents are sent onto a voice operated and eye gaze controlled wearable computer. The wearable tool provides a hands-free environment for on the spot training and support.

iTutor won Giunti Labs the Brandon Hall Excellence in e-Learning Award at the Online Learning 2004 conference in November 2004. It is an application that has clear potential for use in other workplace scenarios, as well as more formal learning environments. For example, it could be used to define
learning pathways and define learning objectives for students in specific locations such as schools and colleges where customised profiles are available in locally-held versions of Learn eXact, and where the student is recognised by both the device and the content management service.

Museum education
Giunti Labs has already made significant progress in developing context-aware systems that understand where someone is and what their competencies are in order to send relevant content. In a consumer application of mobile technology, Giunti Labs has tested a museum education application with the Uffizi Gallery. In this application, the visitor standing in front of a painting can receive content about the artefact that has been repackaged according to the location of the piece, and the background and personal portfolio of the visitor. In this way, a tourist, student or professor of art can each be shipped information about a particular work of art that is appropriate to their level of prior knowledge.

From ‘learning’ to ‘ambient’ content management...
So far, eXact Mobile has only been applied in these few specific scenarios. However, the flexibility of the technology means that it could just as easily be applied to a variety of other situations.

The limiting factor is that this innovative technology costs – and the budgets are often not there to support its introduction. Part of the problem, according to Fabrizio Cardinali, is that the technology is labelled as ‘learning’ in the traditional sense and as such becomes directed towards the training department within a company. He believes this represents a misunderstanding of its potential, arguing that mobile learning developments such as those developed by Giunti Labs are blurring the lines of traditional ‘learning’. Context aware and location based mobile learning is applicable to many different contexts outside traditional ‘learning’ environments. It begins to be better defined as a decision support and assessment tool that takes account of context. As such, he advocates the removal of the word ‘learning’ from the acronym LCMS, hoping that referring instead to ‘Ambient Content Management’ will flag up the distinction and bring the possible applications of mobile technology to the attention of departments other than training.

The creative process
Giunti Labs is involved in over 30 European R&D projects. Fabrizio Cardinali explains that ‘the starting point for the development of these projects is the visualisation of a scenario. The process then involves working back from this end vision to find a way of implementing the concept via the technology’. This visionary approach has produced some fascinating technologies.

iTutor emerged from the iEye project designed to develop an innovative machine for man/machine interaction. Other European e-learning projects to which Giunti Labs contributes include:

- MOBIlearn. Explores new ways to use mobile environments in learning. Looks at using ambient intelligence, location-dependence, personalisation, multimedia, instant messaging, and distributed
databases in the creation, delivery and tracking of learning content.
• **E-Tracking.** Aims to develop an application suitable for the evaluation of e-learning systems based on the tracking of eye movements.
• **Uploaded IT.** Seeks to develop a user-based personalisation of learning objectives in distance education by means of a suitable platform and digital interactive TV.
• **Celebrate.** Aims to develop a new pedagogy for collaborative learning involving the creation and use of interoperable learning objects in a new generation of integrated managed learning environments.

**Do we need mobile learning?**

There are sceptics that question the need for ‘learning on the road’. In response to this, Cardinali compares mobile learning to the advent of (now very popular) SMS technology, when people questioned why anyone would want to send a text when they could just call.

Receptivity to mobile learning differs between markets, because learning technology for mobile is more advanced in Europe than in the US and Japan, and has a competitive advantage of perhaps a couple of years. Nonetheless, each of these areas has areas of best practice within mobile learning. For example, Europe has a strong heritage in learning and culture; the US is technologically strong, while Japan can be admired for its business models, notably the DoCoMo model.

**A new paradigm for learning**

Mobile technology offers a different paradigm for learning. It allows it to be a continual process rather than a one-off event, a process whereby the learner is drip-fed content on an ad-hoc basis as and when questions arise in work or leisure. However, this means it is likely to act as an add-on to other learning methods, its nature making it suited to a supportive role.

The mobile technology offered by Giunti Labs allows a new set of variables – context and location – to be applied to the intermediation of content and users. In this sense it can be viewed as one cutting edge of the current trend towards personalisation in e-learning. And according to Fabrizio Cardinali, ‘fostering a rapid adoption of new mobile, wireless and broadband technologies for learning and cultural heritage, empowering students and trainees with ubiquitous and personalised access is the key turning point for increasing competitiveness of Europe's publishing industry’.
Case Study: IBM (www.ibm.com)

Embedding learning with workflow

based on an interview with Richard Straub, Director of Learning Solutions, IBM EMEA

IBM is the world’s largest information technology company. Its business activities include the provision of computer hardware and software, comprehensive business and IT services, and the research, development and sale of innovative technologies. Revenue is just over $96.5 billion and the company employs 319,273 people worldwide.

The e-learning offering

In the learning and training sphere, IBM helps corporations, governments and educational institutions implement learning solutions in four key ways:

Learning Strategy

Looks at the methodologies and tools needed to implement a learning solution effectively. Includes building a roadmap for implementing learning to support business objectives.

Learning Architecture and Infrastructure

Involves setting up the underlying IT infrastructure that is a basis for the learning solution, as well as providing the required learning applications and tools.

Learning Delivery

Implementation of a blended learning approach, mixing elements of both traditional and online learning. Over time, an increasing amount of e-learning has crept into this mix, but face to face contact is still regarded as an important feature of the learning process.

Learning Content Customisation and Management

‘Knowledge Factories’ around the world produce, customise and manage content to be deployed within IBM learning solutions. IBM customers can also select content from other sources through IBM’s relationships with Thomson/NETg and 78 other suppliers.

Outsourcing – a key learning trend

The complexity and effort required to address today’s learning challenges can often mean it is more efficient for an organisation to outsource certain elements, such as technology or content. Over the past year IBM has noticed an increase in
the number of companies who are interested in embarking on some form of outsourcing.

Reaching out to new markets

It would be fair to say that the bulk of IBM’s work is with companies, though it has also been involved with a number of universities. IBM has hitherto had little involvement in the school market in Europe because of the impracticability of designing solutions for individual schools. However, Richard Straub believes this market is changing dramatically in certain areas, becoming less fragmented and more addressable for IBM, with a changing decision-making structure and education authorities that are asking new questions concerning interoperability across districts.

From vision to implementation...

Moving from a vision to the implementation of a new corporate e-learning strategy is not always straightforward. It is a process that can hit obstacles if care is not taken to avoid potential sticking points.

- Companies need organisational alignment with the implementation of e-learning objectives, ensuring that resources are targeted at exactly what they want to achieve. Throughout the life of a learning solution, good government and management guided by the key priorities for the company are crucial to its success.

- Technology can be a significant obstacle to the implementation of a learning solution. According to IBM, most companies do not have the right infrastructure and even something as trivial as not having the right PC for what they are trying to achieve can cause a big problem. Also, companies need to consider not only if they have the right infrastructure, but whether it will allow them to expand the e-learning solution to a greater number of employees in future.

- Company culture must be borne in mind when designing the technology that employees will use to learn. If the organisation does not have a strong tradition of using technology, the learning solution must take account of this. E-learning must be easy to use or learners will give up on it very easily, and it is important to capitalise on initial interest and motivation.

However, the culture of a company can also be turned into an advantage, because a good understanding of the company culture allows the design of an application that is compatible with it. Among the key general principles that guide IBM in encouraging the diffusion of an innovation is that it should fit well into the current environment, should not be complex, and must allow users to feel a sense of pride in what they achieve.

The changing face of e-learning in the corporate sphere

‘Learning is key to innovation and agility within a company’
- Richard Straub, Director of Learning Solutions, IBM EMEA
Over the past five to six years, companies have moved from a fragmented approach to e-learning, where different components were developed separately and offered in a number of different places, to a more integrated application where all these elements are delivered together. IBM has identified integration as a key trend that is laying the basis for the future development of e-learning within organisations.

More and more, companies are seeing the need for e-learning portals to serve the learning needs of their employees. Such portals are important supports to blended learning and access to online resources by employees. IBM itself claims to have been at the forefront of this trend, with the development of its Management Development portal. This offers training appropriate to managers, such as advice on how to conduct a difficult conversation, as well as short web lectures such as ‘Quick views’ and ‘Quick cases’. Keeping items of content short is important to attracting learners who operate in a time-pressured environment. Within IBM, such role-based portals have been designed for a number of different job descriptions. The company also has a generic version that is available to all employees that can be customised by the user to enable them to receive information and support that is suitable peculiarly to them.

The IBM On-Demand Workplace offering allows its customers to integrate key e-learning elements. The portal provides the framework for collaboration, resources, recommendations for personal development and other features that previously could not be found together in one portal. Integration has a number if advantages. For example, it means it is possible to convert a message between instant messaging and a mailing system without even opening the mailing system. It also makes e-learning more convenient for the user and provides a more holistic environment in which learning can take place.

**Collaboration – a new framework for informal learning**

IBM has a long tradition in collaborative tools for e-learning, reaching back to when it acquired Lotus ten years ago and gained software for email and learning. The company now sees collaborative learning as a core element of its vision for the future. Whereas the old method of learning was based on a static repository of knowledge, collaborative technologies bring new dimensions to bear on learning, allowing it to become a more fluid and dynamic process that fosters innovative thinking.

Collaborative learning environments used by IBM and its customers include:

- Instant messaging
- Web conferencing
- Expertise locators
- Social computing
- Blogs

With collaborative tools such as instant messaging, IBM and its employees can create communities on an ad-hoc basis. For example, if an employee at IBM wants to build an online community they visit what is called ‘Collaboration Central’. Here, the user can set up a defined new community, stipulating what kind of members it should have and the topics it will
discuss. Once the community has been set up, a message can be sent to all subscribers to give them the option of opting in.

‘Knowledge borders are a key obstacle for company innovation and growth’
- Richard Straub, Director of Learning Solutions, IBM EMEA

Expertise locators are innovative tools based on social networks comprising profiles of the expertise of particular individuals within the company can be used to allow employees to quickly find colleagues who might be able to answer a particular question. People are defined as ‘nodes’ on the network so that when an employee tries to find a particular piece of information it is easy to see who might be able to help. There is also a ‘skills tap’ that helps to find experts for specific questions via the instant messaging community tool, with the advantage that profiles do not need to be kept up to date.

Collaborative tools mean that knowledge can be shared across organisational boundaries within the company and employees are encouraged to develop a culture of learning from each other. Since most learning takes place outside formal learning environments, collaborative learning can play an important role in augmenting this crucial and hitherto unacknowledged sphere of learning.

**Learning On Demand**

IBM is working towards an advanced learning solution where people get the right information from the system at the right time, based on their roles and responsibilities. Relevancy and timing is key, because the company believes people will only consistently use online resources when they can really see the benefit to be derived from them. The IBM solution involves building customisation and personalisation around role-based web places. Like a Global Positioning System in a car, it is a performance-improving tool that by informing the user of short cuts helps improve performance while helping them learn at the same time.

‘The future of learning lies in making it a part of each individual’s daily work’ - Richard Straub, Director of Learning Solutions, IBM EMEA

In the IBM On-Demand Workplace, when the individual signs on they are presented with IBM information on the home page and access to the applications they need to do their job. The application will present the user with content such as news and announcements relevant to them, personalised learning activity recommendations, personal development and progress tracking and personalised career and life planning resources. Context-specific external information is also pushed to the user based on what they are working on at a particular time, with no need to waste time searching for it. In addition to this, the On-Demand Workplace gives real time access to other people within the company that the user could collaborate with. In this way, learning is contextualised and experienced in close proximity to work.

From this basis, IBM is working towards a vision of work-embedded learning where it is entrenched within a learner’s
work and is placed in a high level of context. All this is in stark contrast to a formal learning environment, which takes place away from work and out of context.

IBM believes companies are becoming increasingly interested in workflow-based learning, and that having experienced a phase of early experimentation and exploration over the last five or six years they now have a much better understanding of what e-learning can achieve. IBM itself has experienced a similar evolutionary process. Seven or eight years ago perhaps 10% of the company’s training and learning took place online; today that has risen to around 50%, and it also tries to practice what it preaches by operating innovative e-learning practices within the company itself.
Conclusion

The case studies in this report offer insights into some of the most innovative work on e-learning which is currently taking place. The projects are aimed at a range of education levels, from primary through to adult education and lifelong learning, take a number of different approaches to e-learning, and come from a variety of establishments including educational institutions, government-funded bodies and commercial developers. Yet, a number of common themes emerge from these experiences.

Community

The opportunity to be part of a community of learners, be it in the class or lecture room, on an adult education course, or with other learners in a company, is invaluable in terms of helping to provide students with the support they need to succeed. Fellow learners may often provide as much feedback on assignments as the teacher, for example. There is also a social element attached to being part of a learning community or group, which affords students the opportunity to make friends and build relationships with fellow learners and is extremely important in helping to motivate students. Mats Ericson of the Swedish Net University noted that campus education is still vital at university level for helping students to develop socially and feel fulfilled in their studies.

Information technology can provide a route to achieving this in e-learning through the use of tools such as discussion forums or by creating e-learning courses which require students to work in groups. While not all e-learning technologies or courses necessitate a community element, depending on what they are trying to achieve, recreating a sense of community virtually is becoming an increasingly important part of e-learning development, as evidenced by some of the projects in this report.

Both projects in the Futurelab case study depend on students working as part of a team to complete the tasks set for them, for example. Savannah requires the students to work in groups in an outdoor setting to complete tasks set by the mobile devices they are wearing; Iya-Ola uses an audio-visual discussion room to provide a space in which Spanish language learners in the UK can converse with Spanish students learning English to find answers to the tasks set for them. The Fundamental Notions of Mathematics course brings community into the assessment process enabling the kind of feedback which students might receive from each other on an everyday basis in a classroom setting. However, it goes a stage further and also provides structure and record to student feedback, making it a key part of the learning and assessment process in the same way that teacher feedback currently is in traditional learning.

In the corporate setting, community is a key part of IBM’s e-learning strategy. Community and discussion tools available to the learner enable them to find answers to specific problems on courses or during work by putting them directly in touch with fellow learners, workers and subject-specific experts within IBM.
Games

An eternal problem for educators is how to keep their students involved and motivated in their studies. This is particularly true for younger learners who may not yet have the self-discipline to work unsupervised. When we think of games-based learning in the context of e-learning we think of computer games designed to provide some kind of educational instruction. Learning games, however, have existed outside of e-learning – classroom games in primary school are often used to teach children some types of skills and to break up the monotony of routine study.

While computer games add a new dimension to games-based learning and offer more complex pedagogic tools than standard classroom games, both Caspian Learning and Futurelab point first to the potential the medium offers for capturing the attention of students and motivating them to complete the tasks they have been set. This is one of the reasons that educational computer games feature so highly on the list of Futurelab projects: its theory is that if students voluntarily spend most of their free time playing computer games at home, there must be something extremely compelling about computer games which needs to be captured in an educational context.

There are many doubters about the potential of computer games in education. One of the most common objections is that computer games are compelling because they are authentic games whose primary purpose is not to ‘try’ to educate children. Education dressed up as a computer game, the doubters argue, will be like dad trying to be ‘cool’; kids will see through it and steer clear. Graeme Duncan of Caspian Learning admits that given a choice of playing, for example, Tomb Raider or an educational game, children would more likely go for the former. However, the benchmark, he believes, is not other computer games, but other activities that pupils would otherwise be doing in the classroom. Given this choice, he feels certain they would choose the computer learning game.

We are not just talking about children playing computer games, however, or of using computer games simply as an entertaining medium to get a message across. At adult level games may have directly practical uses for providing simulations of situations and teaching key skills to deal with them. The first large-scale use of computer games in learning was by the US military, which developed simulators, based on computer game software engines, to recreate battle scenarios and provide skills and experience training to personnel such as fighter pilots.

Apart from this, computer games open new possibilities on teaching and assessment methods. Futurelab’s Martin Owen makes the point, for example, that a computer learning game could provide the learner with instant information on their progress, allowing them to assess their skills at any point and to work on improving those specific areas. The possibilities for computer games as a teaching tool may be wider than many people would give them credit for.

Assessment

Assessment is taking on new importance in the age of ICT. While assessment has always been necessary in order to
measure the progress of pupils, how and what abilities we can measure are changing dramatically as information technologies offer us new and more varied assessment tools. The information about pupils and their abilities that comes out of assessment is now more detailed and more readily available to teachers than in the past, and with analytical software readily available, can now be used to better shape the future learning path of classes, groups of pupils within a class, or of individual pupils. For the individual learner, assessment tools can provide instant feedback on work, better allowing the learner to know in what direction they should be pushing themselves hardest.

Progress reporting tools in computer games is one area picked out by Futurelab as worthy of more attention – the concept of immediate feedback from the computer game on the player’s progress and achievement of key objectives could be carried over to educational products to give learners the tools to better understand their progress as they are working and to work on specific areas on their own initiative.

The P2P assessment system developed by Johan Thorbiörnson is also innovative in this regard, making feedback from fellow students as much a part of the assessment process as feedback from the teacher, but also by making assessment an integral, immediate, and continually evolving component of the course itself. To a large extent, students take the course by working through the assessment process.

**Mobile**

Mobile is held up as the next step for delivering content in a number of areas – it is talked about as a medium for delivering content in areas as diverse as consumer video and music content, news information, or business information, yet except in a few very niche areas such as healthcare, mobile has not yet delivered on its promise for content for a variety of reasons.

Education is no exception to this. While not widely used currently, two of the e-learning developers interviewed in this report see it as the key medium for delivering e-learning in the future. Futurelab’s Martin Owen sees schools starting to move away from reliance on desktop PCs as the central component of ICT teaching, with mobile and embedded devices set to take on greater importance due to the flexibility these devices offer in the learning environment. E-learning activities based around mobile devices can be more easily incorporated or made part of real-world activities and traditional learning. A pupil working at a desktop PC is potentially shut off from others pupils and the teacher, while a mobile device can be carried and the pupil more easily made part of a group of students. Futurelab’s Savannah project shows how mobile e-learning activities can form the central co-ordinating component of a wider range of real-world challenges and group activities.

Giunti Interactive Labs’ primary focus meanwhile is on mobile learning. The importance of mobile learning is placed on delivering what Giunti calls ‘ambient learning’, or the placing of learning tools directly into a real-world context. Mobile devices can be carried with the learner and information delivered to meet the requirements of the learner at that particular moment. In a professional learning context, for example, relevant, targeted information can be delivered at the point of
need to solve a problem encountered at work. Alternatively, if a company has established workflow processes for different employees, mobile devices can be used to deliver continuing support to users at specific points in their workflows. The ability to deliver educational content in distinct chunks (as learning objects), which can be brought together in a tailored fashion to meet the specific requirements of individual users, takes on renewed importance in this context.

**Learning Objects**

Creating educational content as individual learning objects is necessary if e-learning providers are to deliver e-learning solutions which can meet the specific needs of individual users. A learning object will provide instruction on a solving a particular problem or learning a specific skill set or piece of knowledge. When a great many of these individual learning objects are available, and tagged in an appropriate manner, tailored courses can be delivered on the fly in response to the needs of individual learners at any moment or in any situation. Both Giunti Interactive Labs and IBM see the development of learning solutions which can be tailored to meet the needs of individual users as a central requirement. IBM's vision is to go beyond this and to develop systems which can understand at any moment what an employee or student is working on and to actively suggest to the user information or learning activities which can support them in these tasks. The system should be proactive and anticipate the user's needs, rather than waiting for the user to make a request for information.

**Lifelong learning**

Governments in many countries are keen to establish learning as an option available to people throughout their lives, enabling societies to become more skilled and to respond more fluidly to demands for skills and knowledge in new areas. The availability of e-learning technologies has the potential to transform learning from the one-off or fixed-term event that it is currently, to an ongoing process available to people throughout their lives.

The ability to access information at any time to support decisions or understanding, or to learn at one's convenience from almost any location with access to a computer, is made possible with e-learning. Mobile learning and the development of e-learning objects in particular have the potential to effect a major transformation in this area.

**Innovation in e-learning – expanding the realm of the possible**

Innovation is about exploring and pushing the boundaries of the possible. ICT in education allows us to improve on existing methods of teaching. More importantly, however, and this is something that all our case studies have demonstrated in some way, is that ICT when used innovatively opens possibilities on new methods of teaching which may either replace or complement traditional methods. If the doors to these methods are locked at the moment, ICT can provide us with the keys to open them; it is the innovators, though, who will show us the key to match the keyhole.
Previous EPS Focus Reports

2004

November/December: ELT content: What does the future hold for this market?
October: Humanities and social sciences publishing: attitudes, challenges and innovations
September: Business models for online content: balancing the bucks
July/August: The Transformation of Healthcare in the US
June: Digital Rights Management: gaining real value from implementation
April/May: STM Book Publishing: A Sector in Crisis?
March: The road ahead for digital and online newspapers
February: Classifieds Online: Where Now? Where Next?
January: DOI in 2004: Where are the tipping points?

2003

November/December: Publishing and the Investment Community
October: Future-gazing: projects and technologies for the content industry to watch
September: E-Textbooks: their place in the undergraduate content mix
July/August: Healthcare Publishing: a model for other markets
June: Aggregating Content for the Corporate User
May: Integrating Content With Workflow: Learning from the pioneers
April: E-learning 2003: lessons from the marketplace
March: Profitable Publishing Architectures
February: Digital publishing in the UK schools market
January: Open Archives Initiative: Market revolution or hot air?

All EPS Focus Reports are available in HTML and PDF to EPS Market Intelligence and Advisory Service clients at www.epsltd.com. We are happy to e-mail PDF versions to clients on request.

Executive summaries of EPS Focus Reports are free of charge to guests, and are available at www.epsltd.com.