

Market Intelligence Report Learning

*An initial study of the market for Learning, defined as:
"The provision, delivery and administration of learning through the use of
new media and network technologies"*

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EXECUTIVE SUMMARY

This document provides market intelligence into the sector defined as Learning by the Intermediary Technology Institute (ITI) in Techmedia. The overall education and training sector is very large; however ITI Techmedia's interest is in the use of digital media and communications in Learning. For the purposes of this document, the definition of Learning is:

“The market for the provision, delivery and administration of learning through the use of new media and network technologies”

The report describes the future market opportunities, challenges, key drivers and the potential functional needs of the Learning sector.

Using this acquired knowledge as the base input, the ITI will select those functional needs that have strongest potential market 'fit', and the greatest potential to be a success when utilised within the identified target markets. The functional needs will be used to define potential technology platforms which will then be used as input to ITI Techmedia's programme selection process.

During this process, ITI Techmedia will continue to report to its Membership on progress and results. Members are encouraged to provide comment and input to this process, and to become actively involved in programmes.

Digital media and communications will comprise around 6% of education and training sector revenue...

The overall education and training sector comprises a significant proportion of global gross domestic product (GDP). The sector is forecast to grow steadily in the short to medium term, with expenditure reaching USD2.3 trillion by 2008. However, it is estimated that only a small proportion of the overall market (around 6%) will fall within digital media and communications, i.e. the area of interest for ITI Techmedia.

...which exhibits a number of key trends

The Learning sector exhibits a number of key trends and drivers, including:

- the market for Learning services is increasingly demand-driven rather than supply-led
- maturing user demands leading to the provision of engaging learning services and rich content
- integration of learning platforms with other enterprise applications such as human resources and knowledge management will enable possible cost reductions
- growing acceptance of electronic learning beyond the corporate sector
- increasing availability of a variety of delivery channels

- development of collaborative environments designed to allow learners to feel part of an extended community
- movement away from simple access to knowledge to 'learn by doing' techniques
- sector supplier consolidation
- geography independent solutions
- dearth of off-the-shelf rich learning content.

These trends and drivers will create opportunities for new technology providers. However, a number of barriers to market entry exist for new technology providers, including the emergence of Learning standards. Learning technology standards will become increasingly critical to the success of the industry enabling:

- mixing and matching of content from multiple sources
- ability to develop interchangeable content that can be reused/ assembled/ disassembled quickly and easily
- freedom to choose from multiple providers
- a reduction of investment risks.

Despite the immaturity of existing standards, opportunities remain for companies to develop key elements of technology which become critical to the industry, allowing rapid company growth followed by profitable returns for the original investors.

All market segments are poised for significant growth

Four major market segments comprising the Learning sector have been considered:

- Corporate
- Formal
- Government
- Informal.

Projections developed by ITI Techmedia indicate that all these sectors are poised for significant future growth as illustrated in Figure 1 below.

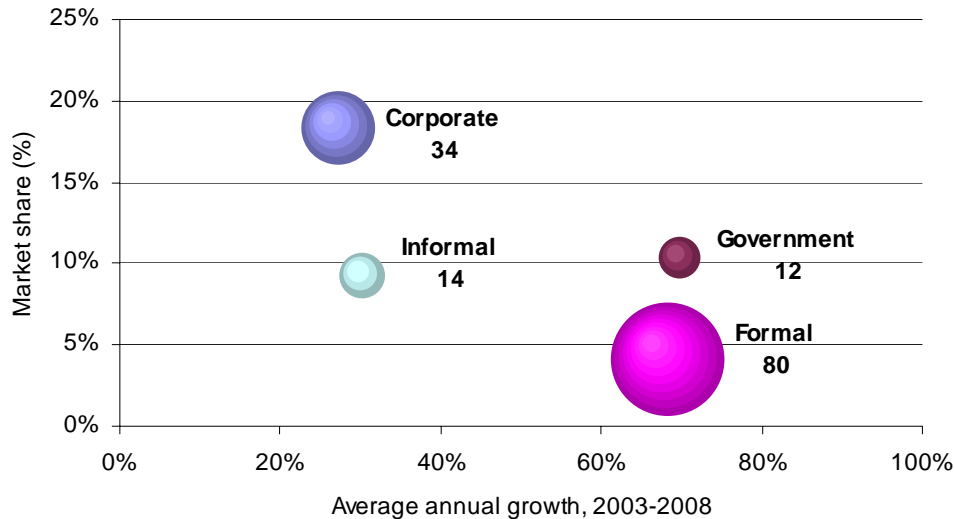


Figure 1: Annualised growth, share of total education and training market and revenue by market segment, 2008 [Source: ITI Techmedia]

The Formal sector is projected to exhibit the strongest growth rate to, and the highest revenue in, 2008. However, despite this strong growth, Formal Learning revenues will comprise less than 5% of total Formal education and training revenues – the lowest of any of the segments analysed.

Strong growth in these sectors will create opportunities in a number of areas, including:

- enabling the creation of content in a cost-effective and timely fashion
- improvement to the efficiency, and capabilities, of the Learning management process
- development of innovative methods to support the delivery of Learning services.

ITI Techmedia will use these key trends to identify appropriate Programmes

Using the acquired knowledge in this report as input, ITI Techmedia is undertaking further analysis of the functional needs to select those with the strongest Scottish ‘fit’ and the greatest potential to be a success when utilised within the identified markets. The selected functional needs will be used as input to define potential technology platforms as part of the ITI Techmedia programme selection process.

1 INTRODUCTION

1.1 Document Purpose

The purpose of this document is to provide a 'snapshot' view of the Learning sector in order that the Membership:

- have visibility of the market analysis activities undertaken in this sector by ITI Techmedia
- can gain access to market information relevant to the sector
- are provided with an indication of the functional needs that ITI Techmedia will explore further to identify the technology platforms which will form the basis of ITI Techmedia research and development programmes.

This document should not be considered as providing a comprehensive analysis of the competitive environment within the Learning sector.

1.2 Structure and Content

This document provides market intelligence into the sector defined by the Intermediary Technology Institute (ITI) in Techmedia as Learning (see Section 2.1 for the definition of Learning). The overall education and training sector is very large; however, ITI Techmedia's interest is in the use of digital media and communications in education and training. The information captured within the document has been obtained following the principles of market intelligence gathering (otherwise known as foresighting) established by ITI Techmedia. This process is described in an abridged form in Appendix 1.

During the process of developing this market intelligence report, both primary and secondary market data were acquired and collated. Primary data were collected during Market Intelligence Workshops, attended by experienced individuals from industry and academia, supplemented by face-to-face interviews with key organisations in the sector. The primary data gathering process was augmented by desk research which was used to obtain secondary data from internationally recognised market analysts. Where possible, the source of any data used in this report has been identified.

Section 1: Introduction. This Section covers the background, aims and scope of the Intermediary Technology Institutes (ITIs). It also provides a high level description of the 'Techmedia' areas of focus. Further background information can be obtained on the website www.ititechmedia.com.

Section 2: Market Overview. This Section provides a working definition of the Learning sector, highlights the main characteristics of the sector, identifies the main trends, drivers and barriers, and describes generic value chains representing current business practice. The Section provides a framework for the subsequent presentation and analysis of data in Sections 3 and 4.

Section 3: Market Assessment. This Section provides an assessment of the market opportunities identified during the foresighting process. Each opportunity is defined and the main characteristics described in terms of drivers, inhibitors and the functional needs which will need to be met by any fulfilling technologies.

Section 4: Market Data. This Section contains the relevant market size data for each market opportunity identified in Section 3. This type of data is traditionally derived from historical figures, and therefore market projections are best viewed as providing a base reference level from which informed extrapolations can be drawn. Where possible and appropriate, the segments identified in this report are matched to existing market data; where a new market opportunity is identified, a potential market size has been projected.

1.3 Background: Intermediary Technology Institutes (ITIs)

1.3.1 Economic Context

A global driver for economic growth is the development and exploitation of technology both for present needs and future requirements. Successful economies are underpinned by a vibrant research base which extends from basic science through to pre-competitive research and development, with a clear focus driven by global market opportunities. Scotland has a reputation for world class research in many fields and already undertakes significant research activity in several areas which have the potential to be strong future market opportunities. In addition to the research base, most developed economies have institutes or organisations that promote knowledge generation and increase commercial exploitation capacity. The establishment of such organisations has had significant economic impact over the long term.

1.3.2 ITIs

The creation of the Scottish ITIs is aimed at increasing the effectiveness of Scottish businesses in the key global market sectors of Communications Technologies and Digital Media ('Techmedia'), Life Sciences and Energy, all targeted to address the particular (research) strengths and (company) weaknesses of the local economy. The ITIs will also interact with each other to identify potential overlap or "white space" market opportunities between Techmedia, Life Sciences and Energy. The creation and development of the Scottish ITIs is a long-term initiative, and will be supported for a significant period of time.

The ITIs, in essence, are a centre or "hub" for:

- identifying, commissioning and diffusing pre-competitive research that is driven by an analysis of emerging markets
- managing intellectual assets to maximise commercial and economic value.

An active membership is core to the proposed Institutes. The ITIs are open for membership to all companies and research institutions, and all members will be encouraged to actively participate in its activities. ITI strategy and operation will be

actively guided and supported by its members. It is essential to attract members with a broad global perspective on markets and new technology directions, as well as a local focus, to ensure that propositions will be transferred effectively into the Scottish economy.

1.4 Definition of the Techmedia Sector

ITI Techmedia is centred on the development and creation of commercial opportunities encompassing the communications technologies and digital media sectors. The activities of the ITI will bring Scotland's economy to the cutting edge of emerging markets by allowing local companies to access and build upon pre-competitive technology platforms developed by the ITI.

The term 'Techmedia' arose out of the need to reflect the market evolution of communications technologies and digital media. The overall trend in the marketplace is one governed by a value chain ranging from content/application generation through delivery to consumption. Content is no longer considered in isolation from service provision, service provision in isolation from delivery channels, or delivery channels in isolation from enabling and managing technologies.

The following elements are examples of the areas which fall within the Techmedia remit. These elements are best viewed as illustrations and represent some of the over-arching philosophies. Nevertheless, these are global drivers which help to place the output of the ITI in context:

- broadcast content: ultimately the product for which the customer is paying, either directly or indirectly
- service provision: the mechanisms for providing customer-driven content and applications
- delivery: technologies and infrastructure required to transport the digital content service to the end-user, as well as providing the feedback channels for interactivity
- enabling software and systems integration: technologies and infrastructure required to condition, control and manage the delivery of content/service to the end-customer.

One globally accepted trend is the delivery of content and services over multiple channels e.g. the provision of same (or modified) content to be received over mobile devices, through TVs or via PCs. Content consumption is the key revenue generating stream in many of the markets, and is thus central to many of the drivers that affect future market evolution in the Techmedia sector.

The Techmedia sector is potentially very broad and hence a phased approach to market foresighting has been adopted. The first phase foresighting has concentrated on five major market areas, defined as:

- **Health:** the delivery of health services including clinical, education and administrative services through the processing, management or communication of information, including video, audio, graphics and signal data.

-
- **Commerce and Finance:** the conducting of business transactions and the provision of financial services using electronic means, generally involving digital computers, electronic communications and the application of information technology. It includes the buying and selling of goods and services, the transfer of funds and related internal company functions.
 - **Learning and Education:** the provision, delivery and administration of learning through the use of new media and network technologies
 - **Communication Services:** the provision, management and delivery of voice, video, data and IT services over wired and wireless communication networks. These include consumer and business services, vertical sector industrial applications and broadcast content
 - **Entertainment and Leisure:** the delivery of on-line digital entertainment and leisure services to end consumers. Specifically, this embraces the market for online music, games and movie services over fixed and wireless networks.

This report provides a first stage analysis of the Learning sector.

1.5 Next Steps

This report describes the results of the market analysis activities undertaken by ITI Techmedia in the Learning sector. As such, the report describes the future market opportunities, challenges, key drivers and functional needs in the Learning sector.

Using this acquired knowledge as its base input, the ITI will select those functional needs with the strongest potential market 'fit', and the greatest potential to be a success when utilised within the identified target markets. The selected functional needs will be used as input to define potential technology platforms, and these platforms will then be used as input to the ITI Techmedia programme selection process.

During this process, ITI Techmedia will continue to report to its Membership on results and progress. Members are encouraged to provide comment and input to this process, and to become actively involved in programmes.

2 MARKET OVERVIEW

2.1 Market Definition

There is no generally accepted definition for the term eLearning; two of the more commonly used descriptions are:

"eLearning is the use of network technology to design, deliver, select, administer and extend learning" (www.masie.com)

and

"eLearning is the use of new multimedia technologies and the internet to improve the quality of learning" (<http://www.elearningeuropa.info>)

For the purposes of this document, the definition of Learning combines elements of both:

"The market for the provision, delivery and administration of learning through the use of new media and network technologies"

In this market, the learner consumes teaching services and educational content that is delivered using information infrastructures such the Internet. The marketplace includes:

- tools to generate rich learning content
- management and control of content delivery
- provision of platforms and applications for assessment, support, administration and monitoring
- IT and network infrastructure

This report considers the Learning market only; these findings are complemented by sister documents on Communications Services, Entertainment and Leisure, Health and Commerce and Finance.

2.2 Market Segmentation

For the purposes of analysis and subsequent identification of market opportunities, the Learning market sector is segmented into four distinct vertical markets as shown in Figure 2 below.

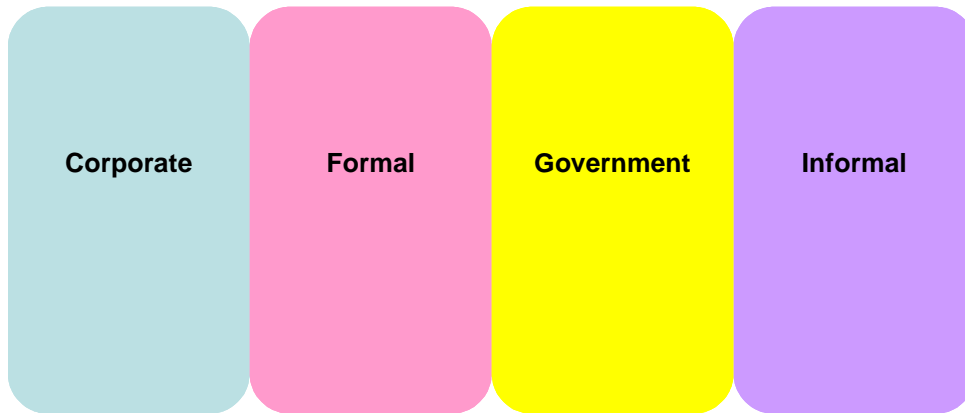


Figure 2: High-level market segments [Source: ITI Techmedia]

In Section 2.3 below, an overview of each of these high-level market segments is provided. In Section 3, major functional needs relating to the segments are identified and described. Supporting market revenue data for each segment is provided in Section 4.

2.3 Market Description

It is estimated that global expenditure on education and training was worth some USD2 trillion in 2001¹. Assuming that expenditure continues to grow in line with world GDP growth², global education and training expenditure could exceed USD2.3 trillion by 2008 (see Figure 3 below)³.

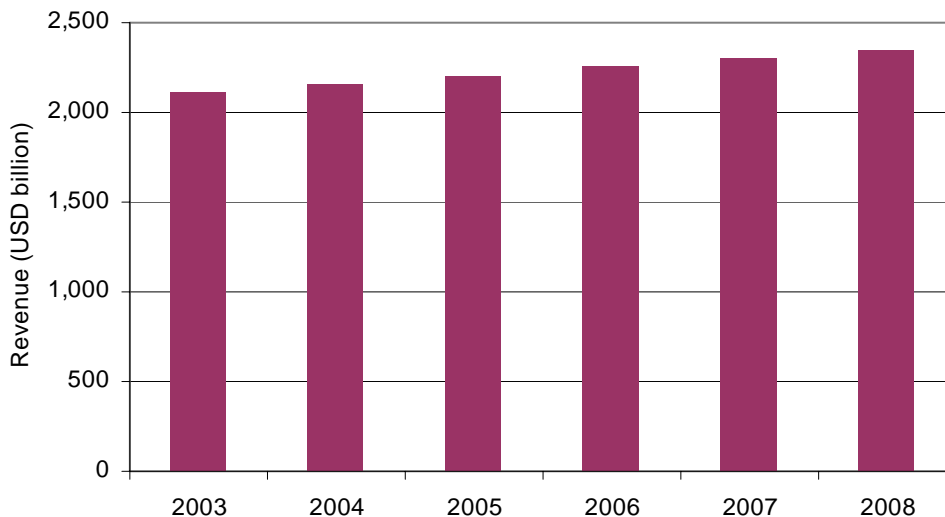


Figure 3: Global education and training revenue, 2003-2008 [Source: ITI Techmedia]

¹ ThinkEquity Partners and Eduventures, 2002
² GDP is assumed to grow at historic rates
³ World GDP is assumed to continue to grow at historic rates

The Learning sector has evolved significantly over the past decade. In the 1990s, the focus was upon the complete replacement of the classroom environment, but this has since evolved into the blending of traditional and electronic learning techniques to meet the 'just-in-time' education needs of learners. The importance of this blending of methodologies reflects the needs of learners and trainers. For example, in a survey of Learning providers within organisations, improved blending of Learning services and the classroom was, together with greater executive support, identified as a key factor in improving Learning service effectiveness (see Figure 4 below).

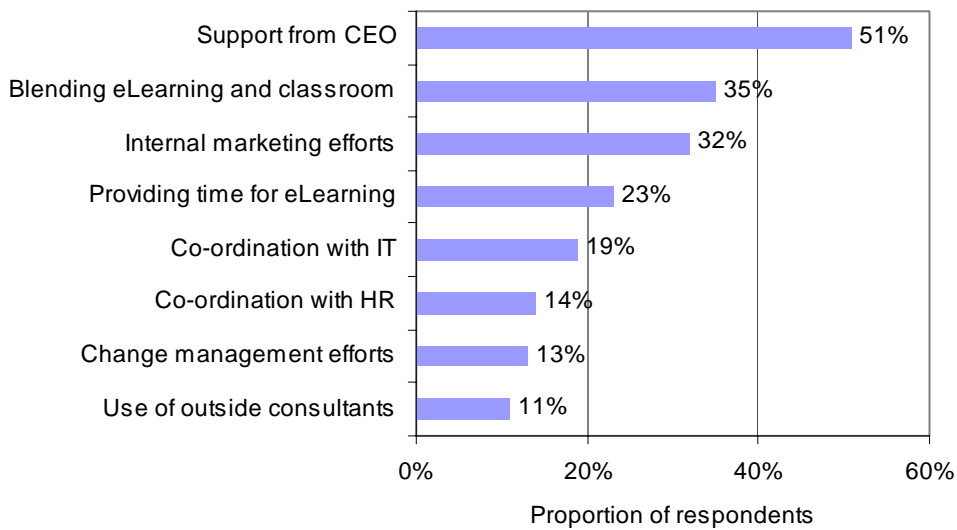


Figure 4: Factors identified as having the greatest impact on Learning service effectiveness
[Source: SRI-BC]

The development of the Learning sector in the short to medium term is driven largely by the requirements of the knowledge economy, and the need to update skills and information on demand in order to be able to compete in the marketplace. Driven by these needs, it is forecast that the value of the Learning sector will increase significantly in the short to medium term. As a result, the global value of the Learning sector is forecast to grow to USD140 billion by 2008, as illustrated in Figure 5 below. This represents an average annual growth rate of 46% over the period 2002 to 2008.

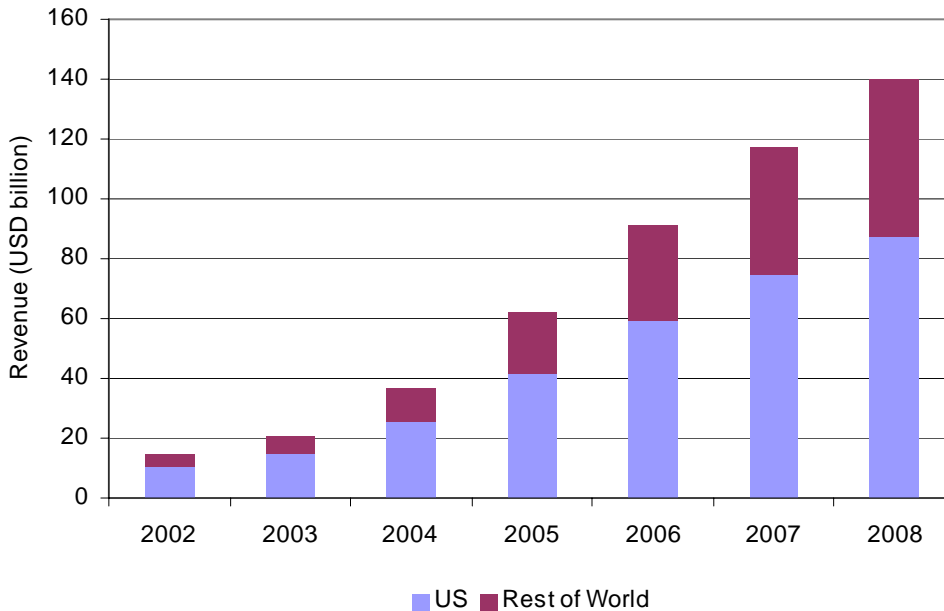


Figure 5: Global Learning sector revenue, 2002-2008 [Source: ITI Techmedia]

2.3.1 Corporate

The Corporate segment relates to the training and skills development of the workforce in order to support the goals of company strategy. There is a realisation at all levels of corporate management that the overall health and growth of the business necessitates the sharing and processing of new knowledge. Learning is beginning to be viewed as one key tool in this goal, increasing efficiency and maintaining the company's competitive edge. As such, the focus of corporate learning activities relates to the integration of learning activities within overall business processes in order that the necessary skills can be acquired as they are needed within the business.

A United States survey⁴ showed that, in 2001, 10% of training time was delivered via electronic learning courses. This is forecast to grow to 25% in 2004. To facilitate this, organisations are deploying Learning Management Systems (LMS) which enable the administration of corporate training. In a 2001 survey of United States organisations⁵ 45% indicated that they were using a LMS, with a further 36% of organisations without a LMS indicating that they had plans to implement such systems within two years. The United States market for LMS is forecast to grow to USD3.6 billion by 2006⁶.

⁴ American Society for Training and Development, January 2003

⁵ Online Learning Magazine, 2001

⁶ IDC, 2002

United States businesses indicated⁷ that electronic learning was most often applied to:

- technical processes and procedures
- information technology skills
- managerial/supervisory skills.

According to Gartner, the demand for custom content is growing as business units need content which is focused on what they do or offer. Vendors are positioning to respond to this need and, for example, DigitalThink has amended its strategy from off-the-shelf content development to custom content development.

However, the cost of content remains a significant inhibitor to the development of Learning services. Shareable Content Object Reference Model (SCORM) is quickly evolving into the de facto standard for Learning content. Corporate enterprises, higher education institutions and even pre-university (K-12) school systems are beginning to make it one of their mandatory requirements for their Learning content and software vendors, and this should reduce the cost of acquiring Learning content.

ITI Techmedia estimates that the global Corporate Learning sector was worth some USD7 billion in 2002, and this is forecast to grow to USD34 billion by 2008 (see Figure 6 below).

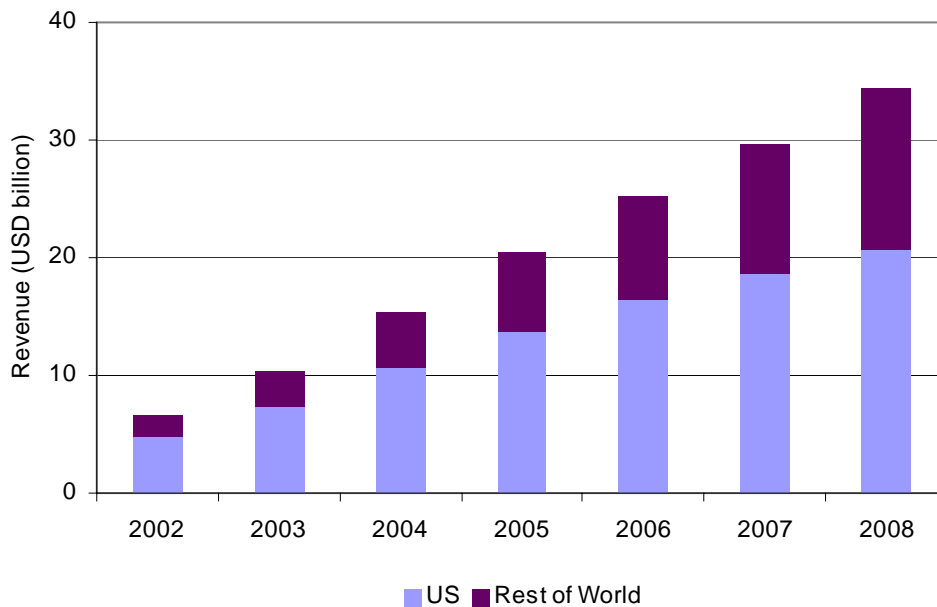


Figure 6: Global Corporate Learning sector revenue, 2002-2008 [Source: ITI Techmedia]

⁷ American Society for Training and Development, January 2003

2.3.2 Formal

The Formal education sector includes all of the layers of the education system ranging from pre-school through to university, and is the single largest segment of the market for education and training. This segment is facing many difficulties over the coming years as the cost of providing education continues to rise. As governments attempt to manage the burden that state-funded education places on economies, students are increasingly asked to finance their own education, and educational establishments are clearly being driven to adopt new solutions in order to lower costs and improve efficiency.

The importance of IT proficiency in education is widely recognised. In 2001, 99% of United States public schools had Internet access, and the number of students per Internet-connected computer had been reduced from 6.3 in 1998 to 3.8 in 2002⁸. There has also been significant growth in 'virtual schools'. Virtual schools apply new technologies to best serve and enhance traditional education. As such, these schools expand the role of the Internet in the formal learning process and are at the forefront of technology integration in education. In 2002, almost 180,000 United States school pupils enrolled in virtual courses⁹.

In developed countries, the shift from an industrial economic base to a knowledge-based economy has had huge ramifications, including increasing the pressure on tertiary education services. Between 1950 and 2000, the proportion of jobs requiring skilled workers increased from 28% to 65%, and is forecast to reach 85% by 2005¹⁰. As a result, the number of university students continues to grow and is expected to double in the next 25 years to some 170 million students worldwide. However, demand continues to exceed supply, and accommodating such a huge expansion in the number of university students will be a challenge.

If Learning services are to become a success in the Formal education environment, a key issue to be overcome is how to integrate this technology into the classroom environment. This will require tutors to become sufficiently IT-literate, particularly as a high proportion of school-age pupils are immersed in such technologies from an early age.

As a result of these pressures, Learning is forecast to play a larger role in the provision of formal education. As a result the global value of the Formal Learning sector is forecast to increase to USD80 billion by 2008, as illustrated in Figure 7 below.

⁸ Education Week, May 2003

⁹ Peak Group, 2002

¹⁰ ThinkEquity Partners, 2002

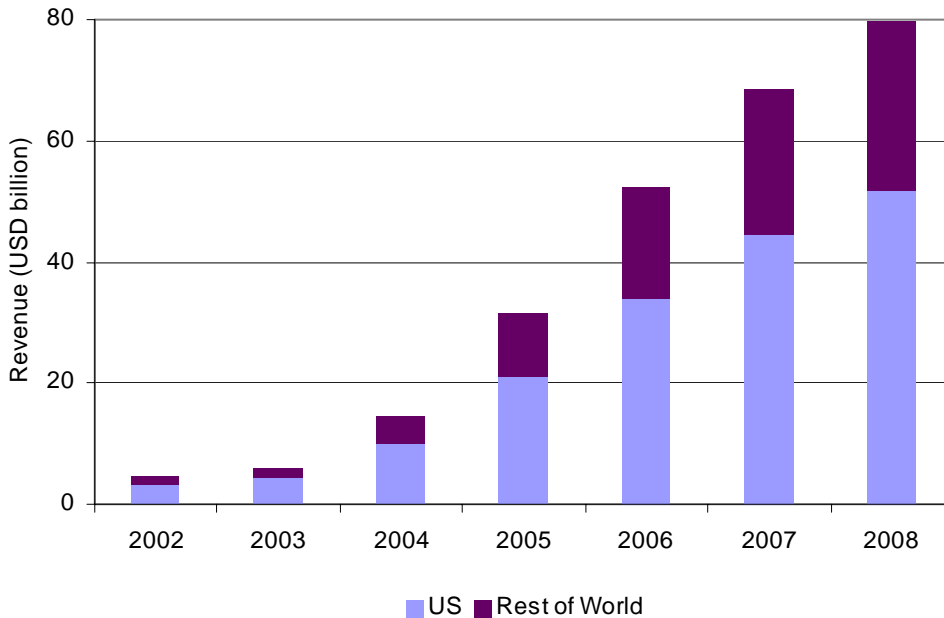


Figure 7: Global Formal Learning sector revenue, 2002-2008 [Source: ITI Techmedia]

2.3.3 Government

This segment covers all training and education carried out by Government or its agencies, but not included in the Formal segment, including amongst others:

- civil service
- military
- health
- police

There is a general trend towards eGovernment within developed economies, and this is influencing the take-up of Learning services within this segment. As the legislative environment continues to evolve, there will be a need to update the skills of government employees on an ongoing basis. Since the number of workers employed in this sector is enormous (20 million in the United States alone) there is a requirement to use lower-cost training solutions to meet these evolving requirements. For example, the United States federal government has adopted Learning solutions¹¹ which are estimated to save taxpayers more than USD1 billion over 10 years.

For the military, training to enable combat readiness is a continuous activity and Learning services are becoming an increasingly important aspect of the training process.

¹¹ <http://www.golearn.gov>

As a result of these drivers, the global value of the Government Learning sector is forecast to grow to USD12 billion by 2008 as shown in Figure 8.

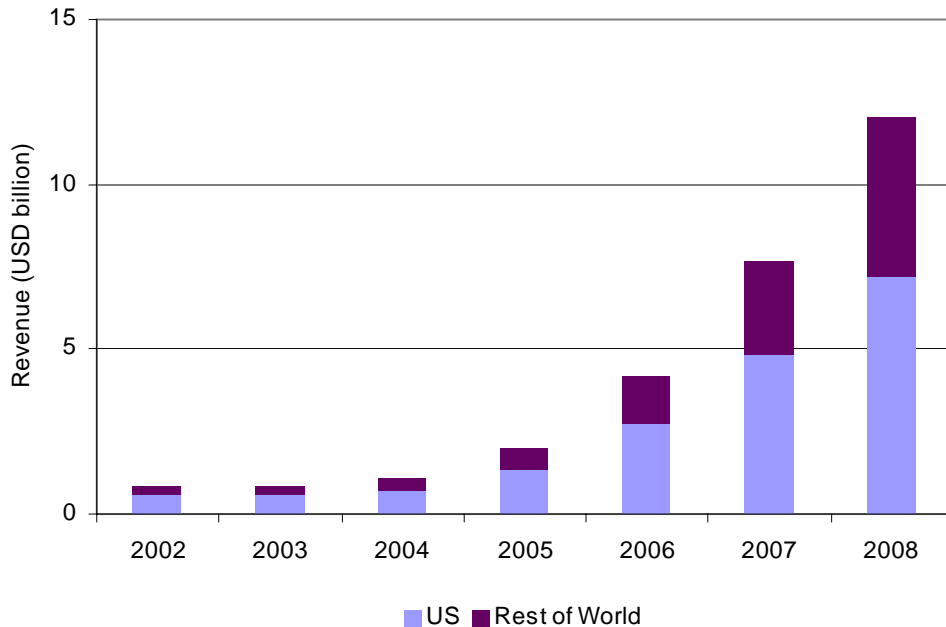


Figure 8: Global Government Learning sector revenue, 2002-2008 [Source: ITI Techmedia]

2.3.4 Informal

The informal sector relates to the provision of education services that are driven by a desire for personal enrichment. The learning model will shift to continuous demand for new skills and new content through life-long engagement. Changes in the electronic learning marketplace and delivery technologies, such as the introduction of mobile devices and portable electronic books, will speed up this transition.

In the United States, there is a correlation between personal income, broadband service adoption and informal learning participation as shown in Figure 9 below. As with broadband service take-up, the Informal education participation rate increases as income increases. Increasing take-up of broadband services within high-participation segments will serve as a key enabler for the delivery of Learning services within the Informal sector.

Income	Broadband take-up	Informal education participation rate
Less than USD30,000	6%	16%
USD30,000 to USD50,000	14%	21%
USD50,000 to USD75,000	20%	24%
Over USD75,000	45%	26%

Figure 9: United States broadband take-up and informal education participation by income group [Source: eMarketer]

This market segment is growing as increasing numbers of learners pay for their own personal development. Although it is subject to significant cultural barriers, the adoption of electronic learning is predicted to have a significant impact on the informal education segment. As a result, the global value of the Informal Learning sector is forecast to reach USD14 billion by 2008 as illustrated in Figure 10 below.

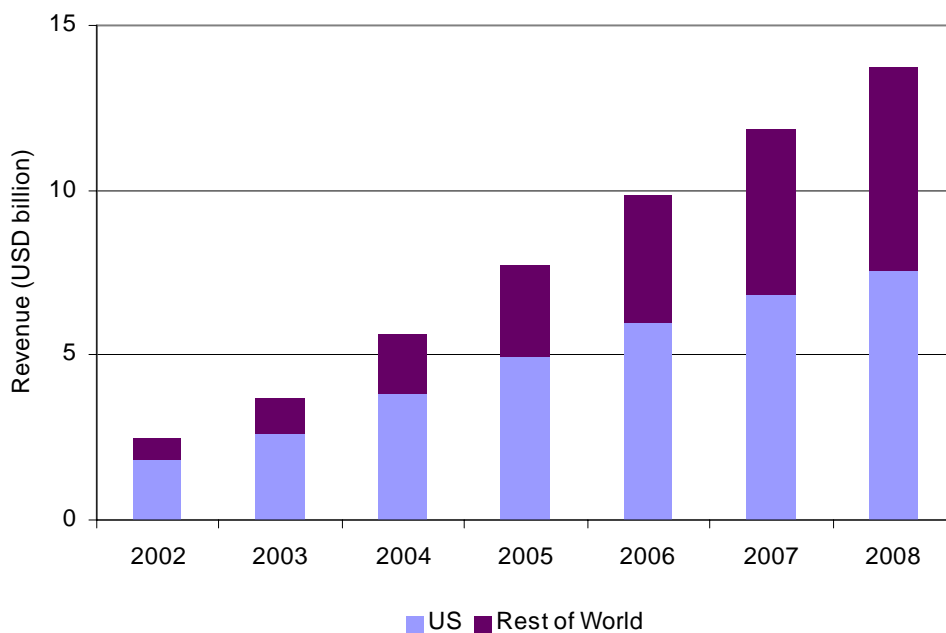


Figure 10: Global Informal Learning sector revenue, 2002-2008 [Source: ITI Techmedia]

2.4 Market Trends and Drivers

A number of trends and drivers are affecting, or will affect, the Learning sector.

*A **trend** is a discernible pattern of change, which can be linear, accelerating or decelerating. An example of a trend is: the average age of the UK population is increasing.*

*A **driver** is a factor which directly influences or causes a change in a specific market. An example of a driver based on the above trend is: the need for easier to use interfaces in mobile phones making them accessible to the ageing population.*

The overall major trends and drivers impacting the sector are discussed below.

2.4.1 Current Trends and Drivers

Important trends visible within the Learning market include:

1. Traditionally high drop-out rates are being addressed by the development of collaborative environments designed to allow learners to feel part of an extended community
2. Movement away from simple access to knowledge to 'learn by doing' techniques, fuelling the growth in the use of simulations drawn from gaming industries
3. The landscape for providers is shifting from a large number of fragmented, small scale innovative start-ups to a more mature market dominated by large players
4. Providers must create solutions which are not bounded by geography. Flexibility with respect to language, assessment and format should be inherent in the designs
5. Providers have to consider the stringent laws and government guidelines on accessibility and the web, software and content
6. Entry costs are high especially in respect of content development and implementation, and training is viewed as a soft target for expenditure cuts in difficult economic times
7. The current generation of content is poor quality and one dimensional, compounded by fragmented delivery channels.

Important drivers affecting the development of the Learning sector include:

1. The industry is increasingly being driven by the needs of the learner, rather than by technology vendors through 'buy a learning management system (LMS) and select from a catalogue of content' approach
2. Maturing user demands leading to the provision of engaging learning services and rich content
3. Integration of learning platforms with other enterprise applications such as human resources and knowledge management will enable possible cost reductions
4. Growing acceptance of electronic learning beyond the corporate sector, driven by the need for new revenue sources, cost savings and increased learning access and flexibility for the learner
5. State funding has sustained the industry to date and will continue to have a major role in facilitating adoption
6. Take-up of technologies such as the Internet, mobile data services and interactive television will greatly expand the available delivery channels

-
7. Corporate culture, learner acceptance and change management implications; a culture of learner acceptance and dedicated training priorities will be required in order for the deployment of a learning solution to be successful.

2.4.2 Key Trends and Drivers – Identified by an Expert Foresighting Group

The general sector trends identified in Section 2.4.1 above have been complemented by the opinions of an expert group convened by ITI Techmedia in January 2004. The group, which included organisations such as Scottish private companies, universities and public sector organisations, identified the following additional key trends likely to impact the sector:

1. Government strategy towards the adoption of electronic government
2. Increasing staff mobility in developed markets
3. Ageing population, requiring the development of accessible services
4. Skills shortages in key areas
5. Political pressure to reduce the number of sub-literate adults
6. Digital divide acting as a barrier to availability in some sectors of the population
7. Creation and adoption of standards-based solutions
8. Internationalisation of content.

2.4.3 Barriers to Market Entry

Standards for learning objects and related technologies have been under development on a global dimension in recent years, e.g. IEEE Learning Technology Standards Committee (LTSC). These standards are targeted to enable re-use and interoperability. Learning content can be re-used by others, facilitated by an accurate description of that content provided by metadata, e.g. target educational level. An accurate and useful description of information about content can then be held in a searchable database for others to browse and identify useful resources. Interoperability with other resources (such as assessment engines or administration tools) necessitates departure from specific file formats and towards creating descriptions written in accepted languages.

The first and most widely applicable standard specifications have emerged in the last year and these have been adopted by some key players within the industry. The evolution of specifications into standards signifies a change in attitude; however the attainment of universally accepted standards is still some way away, and this is unlikely to resolve itself in the short term due to:

- legacy systems
- technologies to deliver new learning methods are still in their infancy.

As the market matures and expands the quantity of learning objects offered and the number of available tools for content creation, delivery and management will grow. Under this scenario, learning technology standards become increasingly critical to the success of the industry enabling:

- mixing and matching of content from multiple sources
- ability to develop interchangeable content that can be reused assembled/disassembled quickly and easily
- freedom to choose from multiple providers
- a reduction of investment risks.

2.5 Value Chain Analysis

Value chain analysis is a widely applied technique that is used to explore the specific activities through which entities can generate revenue within a particular industry sector. The techniques of value chain analysis can be applied to all sectors of the economy, although the nature of the value chain will differ between sectors. In this analysis, the value chain concept is used to illustrate the way in which:

- the introduction of new services creates opportunities across value chain elements
- functional needs can have impact across different value chain elements.

A generic Learning value chain is shown in Figure 11 below.



Figure 11: Learning value chain [Source: ITI Techmedia]

The elements in the value chain are briefly described in Figure 12 below.

Content Creation	Origination of the content used within the application used by the end user
Application Creation	Development of the applications used to deliver network-based IT services and content to the end user, including content packaging and content management applications etc.
Content Aggregation	Bundles content from different sources for presentation to the end-user
Application Hosting	Environment where the servers hosting a variety of end user applications and content reside
Learning Management	Manages the administration of the student training process, including the management and publication of content
Learning Delivery	Environment in which learning is delivered
Customer Equipment	Device that allows the end user to interact with applications and access content

Figure 12: Elements in the Learning value chain [Source: ITI Techmedia]

The value chain described above is too complex for an initial analysis of functional needs as described in this report. As a result, a simplified value chain has been produced, comprising three key segments:

- **Production**, encompassing the creation and aggregation of learning material
- **Management**, encompassing the whole range of information systems and processes that contribute directly, or indirectly, to the provision of learning services
- **Delivery**, encompassing the creation of the environment in which learning activities are undertaken.

The mapping of the key segments to the Learning value chain to the elements in the simplified value chain is illustrated in Figure 13 below.

Service	Content Creation	Application Creation	Content Aggregation	Application Hosting	Learning Management	Learning Delivery	Customer Equipment
Production	✓	✓	✓				
Management				✓	✓		
Delivery						✓	✓

Figure 13: Simplified value chain mapping [Source: ITI Techmedia]

The application of the simplified value chain to the analysis of functional needs is provided in Section 3.

3 MARKET ASSESSMENT

This Section summarises the different market segments described in Section 2.3. These market segments have been explored based on:

- the views of experts who were asked to consider a ten-year horizon
- market research reports from ‘conventional’ analysts assessing a five-year horizon.

For each of the market segments, the following is described:

- brief description of the nature of the segment
- key trends that affect the development of the market segment
- drivers and inhibitors that will impact upon the rate of market growth
- functional needs that support market growth, together with an illustration of the area of the value chain impacted by the functional need.

Functional needs have been identified for the different market segments, and there is a high degree of commonality of these needs between the different segments. Those needs that are common to all market segments are described in Section 3.1.

3.1 Market Opportunities

Even though the four segments have differing characteristics, the market opportunities in each segment fall broadly into areas which are similar and complement the value chain described in Section 2.5. These opportunities are:

- **content creation** which covers the development and production of the information and materials used in the teaching process
- **learning management** which covers the aggregation and packaging of content, payment systems and tools for the provision of guidance, expertise and scaffolding including computer based competence assessment
- **learning delivery** which covers the distribution and delivery of content and services to trainers and/or learners, including channel and access control.

For these market opportunities, roadmaps highlighting the indicative timing (i.e. when the particular need is required by the mass market) of some of the identified functional needs are provided in Section 3.6.

The functional needs required to support those market opportunities that are common to all market segments are described, together with their area of application within the value chain, in Figure 14 below.

<i>Functional needs</i>	<i>Production related</i>	<i>Management related</i>	<i>Delivery related</i>
Accessibility technologies			✓
AI technologies	✓	✓	✓
ASP toolsets		✓	
Assessment tools		✓	✓
Authentication			✓
Authentication assessment technology		✓	
Automated generation of metadata	✓		
Automated trust systems		✓	
Automatic generation of personalised modules			✓
Certification validation and verification tools		✓	✓
Collaborative tools		✓	✓
Conferencing			✓
Content management		✓	
Content protection		✓	✓
Course delivery technology		✓	✓
Design rationale representation technologies	✓		
Games/modelling technologies	✓		✓
Individualisation technology			✓
Intelligent adaptive tutor and personalisable tutor		✓	✓
Intelligent agents		✓	✓
Interactive textbooks/eBooks			✓
Knowledge bases/answer gardens		✓	
Learner annotation and personalisation of material			✓
Localisation of material	✓		✓
Payment schemes		✓	✓
Portfolio management		✓	✓
Question bank management		✓	
Simulations	✓		✓
Skills mapping tools		✓	
Streaming platforms and			✓

standards		
Tools for feedback, guidance, remediation and scaffolding to trainees	✓	✓
Virtual reality and other immersive technologies	✓	✓

Figure 14: Identified functional needs, common to all segments [Source: ITI Techmedia]

A brief description of the various functional needs described in this Section is provided in Appendix 3.

3.2 Corporate

Corporate learning comprises training and education activity carried out by corporate companies for their staff or for corporate responsibility reasons. Corporate training activities include:

- use of IT
- management, business and technical skills and knowledge
- soft skills, e.g. interpersonal, customer facing, team-working
- product or service training for staff, customers and agents

A number of key trends are visible within this segment:

- government spend on Learning at school implies that next generation of workers will be more comfortable with the ongoing use of Learning services
- embedding of learning in enterprise systems and in soft products e.g. online help
- move to accredit trainers
- corporate outsourcing of learning needs
- in the information society, there is a requirement for the continuous updating of skills and across all roles
- move towards hosting services¹².

In addition to the common opportunities outlined in Section 3.1, the Corporate market has specific opportunities in:

- content and services that enable 'Just in Time' Learning, and encompasses the embedding of learning material by providing online, adaptive (navigable) manuals for service staff or information from a knowledge base
- service provision including the aggregation and re-sale of content from range of suppliers.
- learner support tools for the provision of self-guided learning.

¹² SRI LOD Report eLearning Industry Update 2002

Drivers and inhibitors

Major drivers and inhibitors that will affect the take-up of Learning services in the Corporate segment are described in Figure 15 below.

<i>Drivers</i>	<i>Inhibitors</i>
Fast moving business environments requiring ongoing improvement in competence	Initial and ongoing investment costs of Learning services may not gain significant prioritisation for investment
Operations in global markets requiring global procedures and common training	Current generation of content is perceived to have low levels of engagement, leading to low perceived benefit
Drive to improve effectiveness of business via enhanced soft-skills	Corporate culture and change management issues may lead to employee resistance
Improved career progression within organisations	Buyers are not aware of the range of Learning services, tools and content available, or aware of best practice in adoption
Ongoing need to understand increasing legislation and regulation	Lack of knowledge on access to and understanding of local cultural issues in the global market
	Lack of Digital Rights Management

Figure 15: Corporate Learning, drivers and inhibitors [Source: ITI Techmedia]

Functional needs

The functional needs relating to the Corporate sector with their area of application within the value chain are described in Figure 16 below.

<i>Functional needs</i>	<i>Production related</i>	<i>Management related</i>	<i>Delivery related</i>
Avatars	✓		✓
Evidence gathering technologies		✓	✓
Human computer interface			✓
Individualisation technology			✓
Secure examinations		✓	✓

Figure 16: Identified functional needs, Corporate segment [Source: ITI Techmedia]

3.3 Formal

The Formal learning sector represents the traditional learning system consisting of:

- kindergarten and pre-primary
- primary
- secondary
- further education
- higher education

A number of key trends are visible within this segment:

- standardisation of learning content
- increasing higher education population
- increasing sophistication of assessment

In addition to the common opportunities outlined in Section 3.1, the Formal market has specific opportunities in:

- creation and customisation of learning objects
- provision of sophisticated computer aided assessment tools for competence and potential

Drivers and inhibitors

Major drivers and inhibitors that will affect the take-up of Learning services in the Formal segment are described in Figure 17 below.

<i>Drivers</i>	<i>Inhibitors</i>
The supply of learning at a distance, especially in rural areas	Staff reluctance to understand and adopt new teaching methodologies; a need to provide 'pedagogic engineering'
Reduction of costs through re-use of content	Preference to find local content
Demand for higher quality content and richer learner experience	High entry cost may be beyond education budgets; public sector business models cannot aggregate entry costs
Increased need to learn anyplace, anytime	Conservative marketplace
Reduced delivery costs encourage many to study at home or part-time	Trust and authentication issues
Awarding bodies' demand for increased use of Learning services	Government policy with regard to assessment and measurement
Increased need for standardised and consistently delivered content	Immature technical standards
	Need to assess online

Figure 17: Formal Learning, drivers and inhibitors [Source: ITI Techmedia]

Functional needs

The functional needs relating to the Formal sector, with their area of application within the value chain, are described in Figure 18 below.

<i>Functional needs</i>	<i>Production related</i>	<i>Management related</i>	<i>Delivery related</i>
Evidence gathering technologies		✓	✓
Open source technology			✓
Plagiarism detection		✓	
Secure examinations		✓	✓
Secure proctored examination environment		✓	✓

Figure 18: Identified functional needs, Formal segment [Source: ITI Techmedia]

3.4 Government

A number of key trends are visible within this segment:

- roll out of military applications
- centrally provisioned services e.g. NHSU (UK National Health Service University).

Drivers and inhibitors

Major drivers and inhibitors that will affect the take-up of Learning services in the Government segment are described in Figure 19 below.

<i>Drivers</i>	<i>Inhibitors</i>
Government policies encourage increased adoption of Learning services	Possible future changes in government policy towards Learning services in different areas
Changes in regulatory, measurement and updating frameworks	Lack of international standards
Lower cost solutions for public sector training	Difficulty in managing public/private partnerships
Mobile workforce	
Military applications	

Figure 19 : Government Learning, drivers and inhibitors [Source: ITI Techmedia]

Functional needs

The functional needs relating to the Government sector, with their area of application within the value chain, are described in Figure 20 below.

<i>Functional needs</i>	<i>Production related</i>	<i>Management related</i>	<i>Delivery related</i>
Evidence gathering technologies		✓	✓
Human computer interface			✓
Open source technology			✓
Secure examinations		✓	✓

Figure 20: Identified functional needs, Government segment [Source: ITI Techmedia]

3.5 Informal

The Informal segment covers all education and training carried out by individuals, under their own direction for their own goals, including amongst others:

- distance learning and other knowledge-based programmes similar to formal learning
- accredited skills based learning
- leisure programmes of learning.

A number of key trends are visible within this segment:

- government support for Learning services
- merging of technologies used for leisure and learning, enabling a rich learning environment.

In addition to the common opportunities outlined in Section 3.1, the Informal market has specific opportunities in:

- production and customisation of leisure learning objects
- provision of soft and life skills training, and skills updating
- certification, both for professional and non-professional applications.

Drivers and inhibitors

Major drivers and inhibitors that will affect the take-up of Learning services in the Informal segment are described in Figure 21 below.

<i>Drivers</i>	<i>Inhibitors</i>
Increasingly mobile workforce	Service accessibility
Portfolio workers	Delivery at reasonable cost
Consumer service offering 'free' learning opportunities	
New distribution channels	
Demand for leisure learning	

Figure 21: Informal Learning, drivers and inhibitors [Source: ITI Techmedia]

Functional needs

The functional needs relating to the Informal sector, with their area of application within the value chain, are described in Figure 22 below.

<i>Functional needs</i>	<i>Production related</i>	<i>Management related</i>	<i>Delivery related</i>
Avatars	✓		✓
Human computer interface			✓

Figure 22: Identified functional needs, Informal segment [Source: ITI Techmedia]

3.6 Roadmaps

Roadmaps illustrating the timing of selected functional needs are provided for the following areas of opportunity:

- content creation
- learning management
- learning delivery.

Figure 23 below illustrates the timing of the key content creation functional needs identified above, from 2003 to 2008.

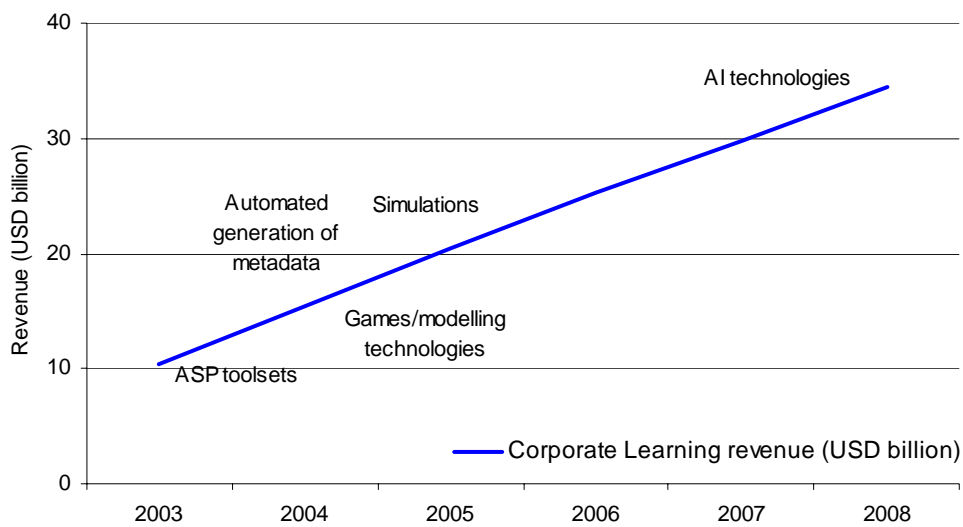


Figure 23: Content creation functional needs, 2003-2008 [Source: ITI Techmedia]

Figure 24 below illustrates the timing of the key learning management functional needs identified above, from 2003 to 2008.

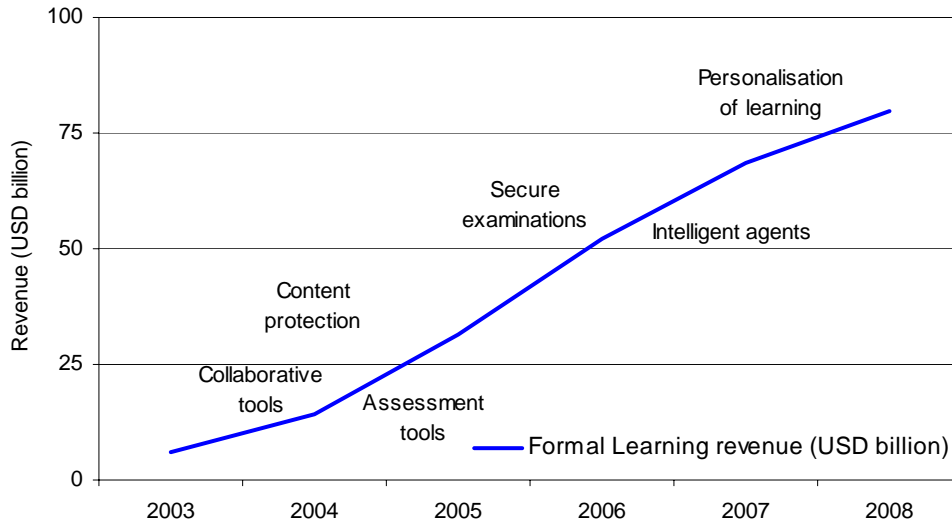


Figure 24: Learning management functional needs, 2003-2008 [Source: ITI Techmedia]

Figure 25 below illustrates the timing of key learning delivery functional needs identified above from 2003 to 2008.

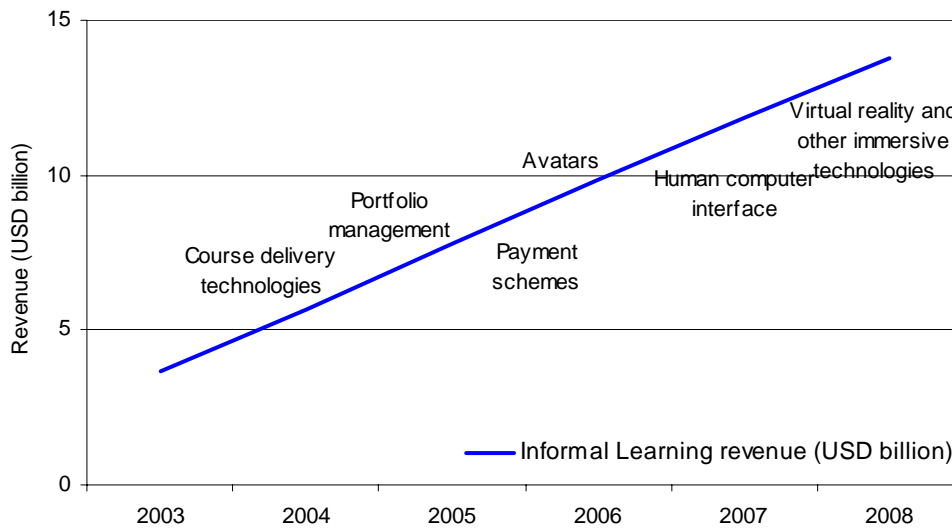


Figure 25: Learning delivery functional needs, 2003-2008 [Source: ITI Techmedia]

4 SUPPORTING MARKET DATA

The Learning sector is a relatively undeveloped market. As such, the quantity and granularity of market data available is limited, and it has not been possible to source market data for the various areas of opportunity identified within each market segment. Instead, the following market size information is provided for each market segment:

- global and United States education and training revenue forecast
- global and United States Learning revenue forecast.

Due to the lack of published sources, ITI Techmedia has developed market forecasts for the various segments. These forecasts have been developed using a ‘top-down’ modelling approach in which:

- world and United States GDP growth has been forecast
- education and training expenditure, both in the US and globally, have been assumed to remain in line with GDP growth
- growth in education and training revenue by segment has been divided based upon existing expenditure levels within each segment
- Learning sector growth has been developed based upon a number of third party forecasts, and these have been reviewed by using Learning revenue as a proportion of total education and training revenue as a cross-check.

4.1 Global Market Trends

Like many technology markets, the Learning sector has experienced a slowdown as a result of global recession and 9/11. The result of the market slowdown is that the adoption of Learning services has not been as rapid as was previously forecast by market analysts, and there has been a significant revision in the future expectations for the Learning sector. For example, Figure 26 below illustrates the significant difference in growth rate projections for a 5 year period made for the Corporate Learning segment in 2001 and 2002.

CAGR Projection %	Asia Pacific	Western Europe	USA	Canada	Latin America
2001	97	97	67	59	72
2002	15	49	36	47	44

Figure 26: Corporate Learning average annual growth rate projections over five years by region
[Source: IDC]

The downturn has led to a “sharp decline in access to venture capital” (SRI 2003). However, there continue to be developments in the use of Learning services and, more recently, there is evidence of return on investment in the Learning sector. The American Society for Training and Development reports a correlation between the financial performance of large organisations and the amount spent on training and eLearning (SRI 2003).

4.1.1 Education and Training

The Global education and training market is estimated to grow from USD2.1 trillion in 2003 to over USD2.3 trillion in 2008 as illustrated in Figure 27 below.

<i>Revenue (USD billion)</i>	2003	2004	2005	2006	2007	2008	CAGR
United States	890	931	974	1,019	1,066	1,115	4.6%
Rest of World	1,225	1,229	1,231	1,233	1,233	1,232	0.1%
Total	2,115	2,160	2,205	2,251	2,299	2,347	2.1%

Figure 27: Global education and training revenue, 2003-2008 [Source: ITI Techmedia]

The United States is currently the largest geographic market for education and training, and was worth almost USD1 trillion, or 9 percent of GDP in 2003. This is forecast to grow to over USD1.2 trillion, or 40% of global education and training revenue, by 2008 (see Figure 28 below).

<i>Revenue (USD billion)</i>	2003	2004	2005	2006	2007	2008	CAGR
Corporate	71	74	78	81	85	89	4.6%
Formal	719	752	787	823	861	901	4.6%
Government	44	46	48	50	52	55	4.6%
Informal	56	59	61	64	67	70	4.6%
Total	890	931	974	1,019	1,066	1,115	4.6%

Figure 28: United States education and training revenue by segment, 2003-2008 [Source: ITI Techmedia]

4.1.2 Learning

Learning by market segment

The Global Learning market is estimated to grow from over USD20 billion in 2003 to USD140 billion in 2008 as illustrated in Figure 29 below.

Revenue (USD billion)	2003	2004	2005	2006	2007	2008	CAGR
Corporate	10	15	20	25	30	34	27.1%
Formal	6	14	32	52	68	80	68.1%
Government	1	1	2	4	8	12	69.6%
Informal	4	6	8	10	12	14	30.1%
Total	21	37	62	92	118	140	46.3%

Figure 29: Global Learning revenue, 2003-2008 [Source: ITI Techmedia]

The United States Learning market is expected to continue to be the single largest market for Learning services. As such, it is forecast that the United States Learning market will grow from USD15 billion in 2003 to almost USD90 billion by 2008 (see Figure 30 below).

Revenue (USD billion)	2003	2004	2005	2006	2007	2008	CAGR
Corporate	7	11	14	16	19	21	22.9%
Formal	4	10	21	34	44	52	65.2%
Government	1	1	1	3	5	7	64.0%
Informal	3	4	5	6	7	8	23.9%
Total	15	25	41	59	75	87	42.7%

Figure 30: United States Learning revenue by segment, 2003-2008 [Source: ITI Techmedia]

4.2 Corporate

4.2.1 Education and Training

The global market for Corporate education and training services is forecast to reach almost USD190 billion by 2008 as illustrated in Figure 31 below. Of this total, the United States is forecast to comprise around 59% of revenues by 2008.

Revenue (USD billion)	2003	2004	2005	2006	2007	2008	CAGR
United States	71	74	78	81	85	89	4.6%
Rest of World	98	98	98	98	99	98	0.1%
Total	169	173	176	180	184	188	2.1%

Figure 31: Global Corporate education and training revenue by region, 2003-2008 [Source: ITI Techmedia]

4.2.2 Learning

The global Corporate Learning market is forecast to reach USD34 billion by 2008 as illustrated in Figure 32 below.

Revenue (USD billion)	2003	2004	2005	2006	2007	2008	CAGR
United States	7	11	14	16	19	21	22.9%
Rest of World	3	5	7	9	11	14	35.6%
Total	10	15	20	25	30	34	27.1%

Figure 32: Global Corporate Learning revenue by region, 2003-2008 [Source: IDC, ITI Techmedia]

4.3 Formal

Formal education consists of kindergarten to grade 12 (K12) students and post-secondary students. Learning within the formal education sector is growing rapidly with a number of initiatives intended to increase penetration¹³.

4.3.1 Education and Training

The global Formal education and training market is forecast to reach USD1.9 trillion by 2008 as illustrated in Figure 33 below.

Revenue (USD billion)	2003	2004	2005	2006	2007	2008	CAGR
United States	719	752	787	823	861	901	4.6%
Rest of World	990	993	995	996	996	996	0.1%
Total	1,709	1,745	1,782	1,819	1,857	1,896	2.1%

Figure 33: Global Formal education and training revenue by region, 2003-2008 [Source: ITI Techmedia]

4.3.2 Learning

According to Gartner¹⁴, in 2003, over 50% of all higher educational institutions globally offered Learning programmes to students; by 2004, 80 percent of the leading U.S. and

¹³ *European Commission*. On 20 June 2000, the European Commission formally integrated e-learning into its global plan for 2000-2003 entitled eEurope.

United Nations. The United Nations Public-Private Partnerships for the Urban Environment offer distance learning as part of their Global Learning Network.

The United States. The U.S. Department of Education updated its national educational technology plan in late 1999

¹⁴ E-Learning: Ten Big Trends Worth Watching, Gartner Group, 2001

European universities (the top-rated 25 in each region) are expected to offer global higher education courses.

The global Formal Learning market is forecast to reach USD80 billion by 2008 as illustrated in Figure 34 below.

<i>Revenue (USD billion)</i>	2003	2004	2005	2006	2007	2008	CAGR
United States	4	10	21	34	44	52	65.2%
Rest of World	2	4	10	18	24	28	74.6%
Total	6	14	32	52	68	80	68.1%

Figure 34: Global Formal Learning revenue by region, 2003-2008 [Source: ITI Techmedia]

4.4 Government

This sector covers all Government-related activities, including military services.

4.4.1 Education and Training

The global Government education and training market is forecast to reach USD115 billion by 2008 as illustrated in Figure 35 below.

<i>Revenue (USD billion)</i>	2003	2004	2005	2006	2007	2008	CAGR
United States	44	46	48	50	52	55	4.6%
Rest of World	60	60	61	61	61	61	0.1%
Total	104	106	108	111	113	115	2.1%

Figure 35: Global Government education and training revenue by region, 2003-2008 [Source: ITI Techmedia]

4.4.2 Learning

The global Government Learning market is forecast to reach USD12 billion by 2008 as illustrated in Figure 36 below.

Revenue (USD billion)	2003	2004	2005	2006	2007	2008	CAGR
United States	0.6	0.7	1.3	2.7	4.8	7.2	64.0%
Rest of World	0.2	0.3	0.7	1.5	2.8	4.8	80.9%
Total	0.9	1.1	2.0	4.2	7.7	12.0	69.6%

Figure 36: Global Government Learning revenue by region, 2003-2008 [Source: ITI Techmedia]

4.5 Informal

In the context of this report, the Informal sector is considered to comprise all revenue outwith the Corporate, Formal and Government sectors.

4.5.1 Education and Training

The Global Informal Education and Training market is forecast to reach almost USD150 billion by 2008 as illustrated in Figure 37 below.

Revenue (USD billion)	2003	2004	2005	2006	2007	2008	CAGR
United States	56	59	61	64	67	70	4.6%
Rest of World	77	77	77	78	78	78	0.1%
Total	133	136	139	142	145	148	2.1%

Figure 37: Global Informal education and training revenue by region, 2003-2008 [Source: ITI Techmedia]

4.5.2 Learning

The global Informal Learning market is forecast to reach USD14 billion by 2008 as illustrated in Figure 38 below.

Revenue (USD billion)	2003	2004	2005	2006	2007	2008	CAGR
United States	2.6	3.8	5.0	6.0	6.9	7.6	23.9%
Rest of World	1.1	1.9	2.8	3.8	5.0	6.2	41.0%
Total	3.7	5.7	7.8	9.8	11.8	13.8	30.1%

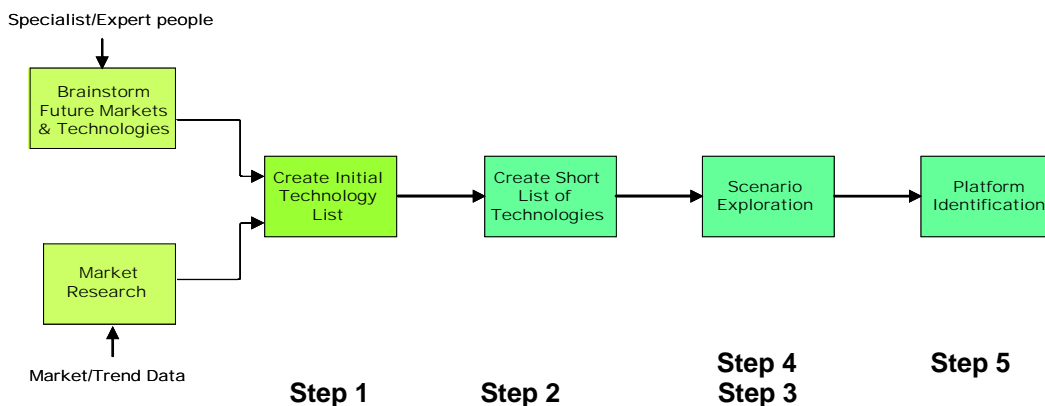
Figure 38: Global Informal Learning revenue by region, 2003-2008 [Source: ITI Techmedia]

APPENDIX 1: THE MARKET FORESIGHTING PROCESS

The foresighting process for market identification, which is at the heart of the ITI activity, has been established to meet three main objectives:

- to identify and define the potential for new and emerging global markets, over a three to ten year horizon
- to provide an objective basis for assessment and comparison of any defined markets
- to identify and define key functional needs and platforms which will support market development.

A market foresighting process has been created and adopted by ITI Techmedia. Using the experience and expert advice of organisations recognised as having best practice capabilities in this field, it is designed not only to meet the objectives detailed under 'Market Identification' above, but also to take into account other relevant factors including sector specifics, timescales and resource needs. The main elements of the process are shown in simplified format below.



Step 1 identifies a vision for the market opportunity, the challenges, key drivers and market and technology barriers. This is achieved using specialist market knowledge, input from expert individuals in organisations across the sector, product and service companies, research organisations through to regulatory and other government offices. This is then enhanced by existing market knowledge to estimate the possible market size, timing, geographies and demographics to create views of the value chain, the main stakeholders and resultant business models.

Step 2 creates a long technology list relevant to the individual sectors, which is in turn reduced in Step 3 to a shortlist, using input from technology experts. The process so far identifies the functional needs that best fit the market characteristics and hence highlight the most likely technology winners.

The functional needs and markets are validated in Step 4 via a process of scenario planning, a common tool used in foresighting environments. This uses example events to test if market and functional needs meet overall objectives and targets.

Step 5, the final step, identifies a resultant technology platform. A technology platform is defined as a cluster of connected technological capabilities comprising discrete technologies which together define a system with multiple potential applications.

The market foresighting process and the usefulness of functions within it are subject to ongoing evaluation and refinement throughout, based on experience gained in the first phase.

APPENDIX 2: GLOSSARY

9/11	11 September 2001 - Date of the attack on the United States by Al Qaeda, seen as a significant event precipitating the market downturn
AI	Artificial Intelligence - The subfield of computer science concerned with the concepts and methods of symbolic inference by computer and symbolic knowledge representation for use in making inferences. AI can be seen as an attempt to model aspects of human thought on computers. It is also sometimes defined as trying to solve by computer any problem that a human can solve faster
ASP	Application Service Provider - a third-party entity that manages and distributes software-based services and solutions to customers across a wide area network from a central data centre
Biometrics	The science of using biological properties to identify individuals; for example, finger prints, a retina scan, and voice recognition
CAGR	Compound Annual Growth Rate
EML	Educational Modelling Language - EML describes not just the content of a unit of study (texts, tasks, tests, assignments) but also the roles, relations, interactions and activities of students and teachers. EML is neutral with respect to the pedagogy and mode of delivery used
HCI	Human Computer Interaction - a discipline concerned with the study, design, construction and implementation of human-centric interactive computer systems.
HND	Higher National Diploma - (United Kingdom) a diploma given for vocational training that prepares the student for a career in a particular area; good students may progress to a course leading to a degree
IEEE	Institute of Electrical and Electronic Engineers
IMS	Instructional Management Systems
IPR	Intellectual Property Rights
K-12	Kindergarten to Grade 12, a term used to describe the formal elementary and secondary education systems
KM	Knowledge Management
LAMS	Learning Activity Management System - LAMS is inspired by, and heavily based on, IMS Learning Design and EML
LCMS	Learning Content Management System
LMS	Learning Management System
LO	Learning Object - any digital resource that can be reused to support learning

LRN	Learning Resource iNterchange - is a commercial implementation of industry specifications and emerging standards that address the description, packaging, and runtime execution of learning resources to enable widespread interchange and interoperability
MLE	Managed Learning Environment
NHSU	United Kingdom National Health Service University - NHSU is the corporate university for the NHS
Pureplay	A Company involved in only one line of business
QoS	Quality of Service
QTI	Question and Test Interoperability - The data structures used to provide interoperability between question and test systems. The model includes test items and assessment structures
ROI	Return on Investment
SCORM	Shareable Content Object Reference Model - an XML-based framework used to define and access information about learning objects so they can be easily shared among different learning management systems
USD	United States Dollar
VLE	Virtual Learning Environment - a set of teaching and learning tools designed to enhance a student's learning experience by including computers and the Internet in the learning process
XML	eXtensible Markup Language

APPENDIX 3: FUNCTIONAL NEEDS DESCRIPTION

Accessibility technologies	Innovative methods for the representation of information such as images and to the visually impaired, including natural interfaces
AI technologies	Future intelligent content which allows for AI based interactions. Includes technologies to index image and video content, semantic networks and text-based frameworks
ASP toolsets	Technology used to enable the delivery of hosted applications by third parties
Assessment tools	Advanced tools to enable computer aided assessment of complex content
Authentication	Authentication techniques including the use of techniques that rely on physical measurable characteristics that can be electronically verified (e.g. fingerprint, iris, voice print)
Authentication assessment technology	Assessment technology in which students are asked to perform real-world tasks that demonstrate meaningful application of essential knowledge and skills
Automated generation of metadata	Service and distribution technology which is used to make content discoverable by third parties
Automated trust systems	Content certification and access control technologies including digital signatures
Automatic generation of personalised modules	Ability to create learning information specific to an individual based upon existing skills and learning needs
Avatars	Technologies for expressing a representation of a user in a shared virtual reality, including virtual personalities
Certification validation and verification tools	Techniques to enable the validation of the learning portfolios and accreditation of individuals between third parties
Collaborative tools	Techniques to enable the creation of collaborative learning environments including peer-to-peer social networking and weblogs
Conferencing	Techniques to enable the real-time sharing of video, audio, textual and graphical information across physically-remote locations
Content management	Techniques to enable the management, delivery and tracking of training content
Content protection	Application of digital rights management techniques to protect content copyright
Course delivery technology	Techniques for the creation of environment for the delivery of learning information including virtual learning environments
Design rationale representation technologies	Techniques for the creation of abstractions that represent the functions provided by systems
Evidence gathering technologies	Application of database and mining techniques used for the measurement of competency and skills of learners

Games/modelling technologies	Application of games and modelling techniques for the creation of compelling teaching content
Human computer interaction	Novel technologies that extend the capabilities of the user interface including touch or force feedback and gesture recognition
Individualisation technology	Personalisation technology to handle and incorporate learner information profiles (LIPs) and methods for users to adapt and personalise systems based upon such criteria as expertise and reading level
Intelligent adaptive tutor and personalisable tutor	Technology that enables the creation of virtual tutors that adapt to the needs of individual learners
Intelligent agents	Identify, locate and deliver relevant information from an information source to the end user based upon such factors as context and criteria specified by the end user
Interactive textbooks/eBooks	Incorporation of interactive learning capabilities to standard texts
Knowledge bases/answer gardens	Repositories for the storage and dissemination of learning information
Learner annotation and personalisation of material	Ability for the learner to customise learning materials to suit individual requirements
Localisation of material	Ability to adapt learning material based upon the local environment including culture, language and collaborative capabilities
Open source technology	Initiatives to enable the development of cost effective Learning software through the ability to share content amongst many learners
Payment schemes	Innovative tariffing schemes that support the new patterns of consumption of learning services
Plagiarism detection	Ability to highlight plagiarism within assessments
Portfolio management	Ability to administer and manage the learning modules undertaken and/or completed by individual learners
Question bank management	Content management for the generation of examination and test materials
Secure examinations	Ability to provide authorised users with access to examination material
Secure, proctored examination environment	Ability to oversee the conduct of examinations to ensure that they are conducted in a fair manner
Simulations	Technologies that enable experiential-based learning that may model physical behaviour e.g. flight simulator
Skills mapping tools	Ability to match the capabilities and requirements of individual learners with available learning material

Streaming platforms and standards	Ability to deliver a continuous flow of protected information to an end-user device in a multi-vendor environment
Technology to deliver learning via Multiplatform multi profile content authoring, delivery, management and consumption tools	Ability to integrate new communications technologies to provide seamless content creation, management and delivery irrespective of end user platform
Tools for feedback, guidance, remediation and scaffolding to students	Tools to enable the provision of constructive feedback and support to learners throughout the learning process based upon individual needs
