Mobile Education in the United States

This document is part of a series of country specific reports which consider the demand for Mobile Education from the formal education sector perspective.

Foreword

For the Education sector, mobile connectivity provides an opportunity to offer new ways of teaching and learning that ultimately will improve performance and results whilst at the same time open up new markets for mobile operators across the world. Mobile will increase access to up-to-date materials, will enable collaboration and strengthen learner engagement. In response to this opportunity, the GSMA's Mobile Education initiative aims to accelerate the adoption of Mobile Education solutions; in particular, the use of mobile-enabled portable devices, such as e-Readers and tablets in mainstream education settings.

This document is part of a series of country specific reports which consider the demand for Mobile Education from the formal education sector perspective in each country. In each we describe the delivery models in place for the main types of education along with examples of activities already underway. To date country specific reports have been developed for the United States, United Kingdom, Spain, Japan and France.

The GSMA Mobile Education Landscape Report describes the market for Mobile Education from a global perspective, focusing on the supply side. It describes trends, key players and current initiatives in the emerging Mobile Education and related e-Textbook publishing markets. An accompanying background document; Education Systems – A Brief Introduction gives background on how education segments and systems function and describes flows of funding.

We encourage you to get involved, whichever part of the ecosystem you belong to, please contact **mobileeducation@gsm.org** to learn how.

Contents

1 Introduction

Background

This report on Mobile Education in the United States is one of a series of reports which collectively describe the emerging market for Mobile Education. At a country level, as well as this report on the USA, there are reports on the the United Kingdom, Japan, Spain and France. These country-specific reports focus primarily on the demand side of Mobile Education. The Mobile Education Landscape Report considers the development of Mobile Education from a global perspective, focusing more on the supply side. An accompanying primer on education systems gives background on how education segments and systems function and describes flows of funding.

Objective

The key objective of this report is to examine the current take-up and uses of Mobile Education technologies across different education segments in the US and to explore possibilities for their expected growth.

Structure

The report opens with a summary of the key takeaways, including the specific barriers facing Mobile Education in the US. This is followed by a high level overview of the education system.

The report then describes three different education segments: schools, technical and vocational education and training (TVET), and higher education. For each segment, we describe the education system and give context on use of technology. We then look at the development of Mobile Education, describing what is already in place in terms of a 'Mobile Education ecosystem', identifying and describing selected initiatives and drawing out lessons learned.

Target Audience

The target audience for this report is managers from:

- Mobile ecosystem organisations responsible for consumer devices, institutional customers or M2M services.
- Education content organisations looking to expand in to Mobile Education.
- System and software developers with an interest in developing Mobile Education solutions.
- Government departments or education institutions wishing to understand more about the landscape of Mobile Education in the US.

Definitions

The main focus of this report is Mobile Education, which is interpreted as:

- Use of individual, portable devices (e.g. e-Readers, tablets, Personal Digital Assistants (PDAs), and smartphones), which make use of the mobile network (i.e. are SIM-enabled).
- Used in mainstream education settings (e.g. primary, secondary, college, workplace, distance learning, professional qualifications), therefore aligning with curriculum objectives or used for high-stakes assessment, and will cover both learning (e.g. interactive learning), content (e.g. textbooks) and administration (e.g. school records, attendance, communications).

For the country reports, we describe the use of Mobile Education across the three main education segments, which can be defined as:

- **Schools:** learning is delivered only in formal education settings in specific institutions with clear flows of funding.
- **Technical and Vocational Education and Training (TVET):** learning is delivered in a wide variety of settings, including formal education institutions, the work-place, via distance learning and in casual or self-directed settings (the latter are informal learning settings). Activities can include learning for qualifications, training for specific tasks or skills, training for 'softer' management skills, leadership development skills, certifications, professional training, etc. Mostly formal settings are described in this report.
- **Higher Education (HE) (also referred to as tertiary education):** learning is delivered mostly in formal education settings in specific institutions with clear flows of funding, but can also be delivered as distance learning.

The school and higher education systems are generally clear and straightforward to describe, but the systems for TVET can be more complicated. In part this is because they typically overlap with the school and higher education sectors, but also the policy focus can be quite variable.

2 Key Takeaways

The main points about education and Mobile Education in USA are:

- The key actors across the system are States (not federal government), leading to significant variation. Suppliers need to address Directors of Education at the State level and adopt market strategies according to the regulations, policy or curricula of each State.
- The availability and use of technology is well-established in US education institutions and continues to evolve rapidly across all areas, including networking, computation and storage and in the main educational areas - administrative systems, teaching and learning, and community services.
- There are many programs rolling out 1:1 devices in schools and universities. A few institutions are making the shift to student's own devices and are instead focusing on issues of protocol, security and addressing problems with bandwidth and network coverage so that more devices can be properly supported. The digital divide recurs as an issue here, but often institutions find funding to supply additional devices. As is the case in many countries however, there is still a degree of scepticism around using mobile phones, especially in classroom settings, with legal enforcement in place in some States.
- There is a significant wave of Mobile Education activity in the US, mostly at an institution level. Often these are relatively small scale and narrowly focused, whilst the use of mobile technologies is not particularly sophisticated, with quite basic functions being adapted for educational purposes. They tend to be sustained because the aims are achievable, they are able to adapt to the needs of the institution, and because institution funding is more likely to be long-term. Equally, there are a growing number of more ambitious roll-outs, with more and more institutions looking to support students' use of their own devices and growing interest in mobile campus platforms and apps.
- Most Mobile Education activity is taking place in the schools and higher education segments (although both overlap with elements of the TVET system), which leaves the remaining parts of TVET (career and technical education and adult education) appearing relatively underserved. In schools, activity seems to focus mostly on specific enhancements of teaching and learning, whereas in higher education, aims and uses are broader and more comprehensive, linking with LMSs and other administrative systems, supporting off-campus and distance learning and building communities.
- The Digital Curriculum trial in the State of Virginia, developed with Pearson, stands out as a best practice example, although it is in the early stages. The starting point is the curriculum itself, so the product is clearly linked to learning outcomes, and the content and delivery is entirely mobile and digital, via an iPad. It includes some ongoing tests, although final assessment is not (yet) delivered in this way.

- The sector is the seedbed for the development of many commercial products and services, so leading players and more nimble innovators are active across the Mobile Education ecosystem and playing a key role in shaping it. Adoption and development of new Mobile Education products, for example mobile campus apps, takes place at an accelerated pace, with less effective solutions, such as the recent Kno tablet for education, quickly being withdrawn and replaced with an alternative, in this case, a Textbook app for iPads.
- The specific challenges for the development of Mobile Education in the US are:
  - Highly fragmented education system with 14,000 school districts all controlling budgets, which means large scale role outs are complicated.
  - State/district control over teaching resources used in many schools and so teachers are not always free to use different content.
  - No central policy focus to drive widespread change and few external stakeholders and enablers with funding to do anything other than lobby.
  - Distrust of mobile phones in classrooms, with blanket bans in some places.
  - Wide digital divide if students are required to use their own devices although, data has shown that the digital divide in terms of school students with access to mobiles may not be as strong as previously assumed.

3 Education System

Education in the US is highly decentralised and shaped by decision-making at a State and local level. This results in enormous disparity in access, quality, and financial provision, as well as in students' results and involvement in the educational process. Even compulsory education varies across States, but usually starts at 5 and ends between 16 and 18 years. States and communities, as well as public and private organisations of all kinds, establish schools and colleges, develop curricula, and determine requirements for enrolment and graduation.

The structure of education finance reflects this predominantly State and local role. Total education spend in the US for 2011 will be $880.2.6 billion, which is 6.2% of GDP. Of this, only $39.1 billion is federal government expenditure and $231.6 billion is State government expenditure – the remaining $609.5 billion is generated at a local level.[1]

Table: Education in the US[2]

Phase	Age	Number of Students	Expenditure	Types of Institution
Pre-School	0-5		$557.3 billion	■ Nursery schools ■ Kindergartens
Elementary Schools	5-11	34.7 million		■ Elementary schools ■ Home schooling
Middle Schools	10-14			■ Middle schools ■ Junior high schools (upper grades, age 12-14)
Secondary, Including Career and Technical Programs	14-18	14.7 million		■ Comprehensive high schools ■ Career and technical high schools ■ Community colleges ■ Public/private colleges ■ Technology institutes
Post-Secondary Education	18+	19.1 million	$224.7 billion	■ Vocational technical institutions ■ Junior or community colleges ■ Colleges and universities
Adult and Continuing Education		~40 million	$9.1 billion federal spend	■ Skill centres

1 US government spending statistics, http://www.usgovernmentspending.com
2 US Department of Education, www.ed.gov

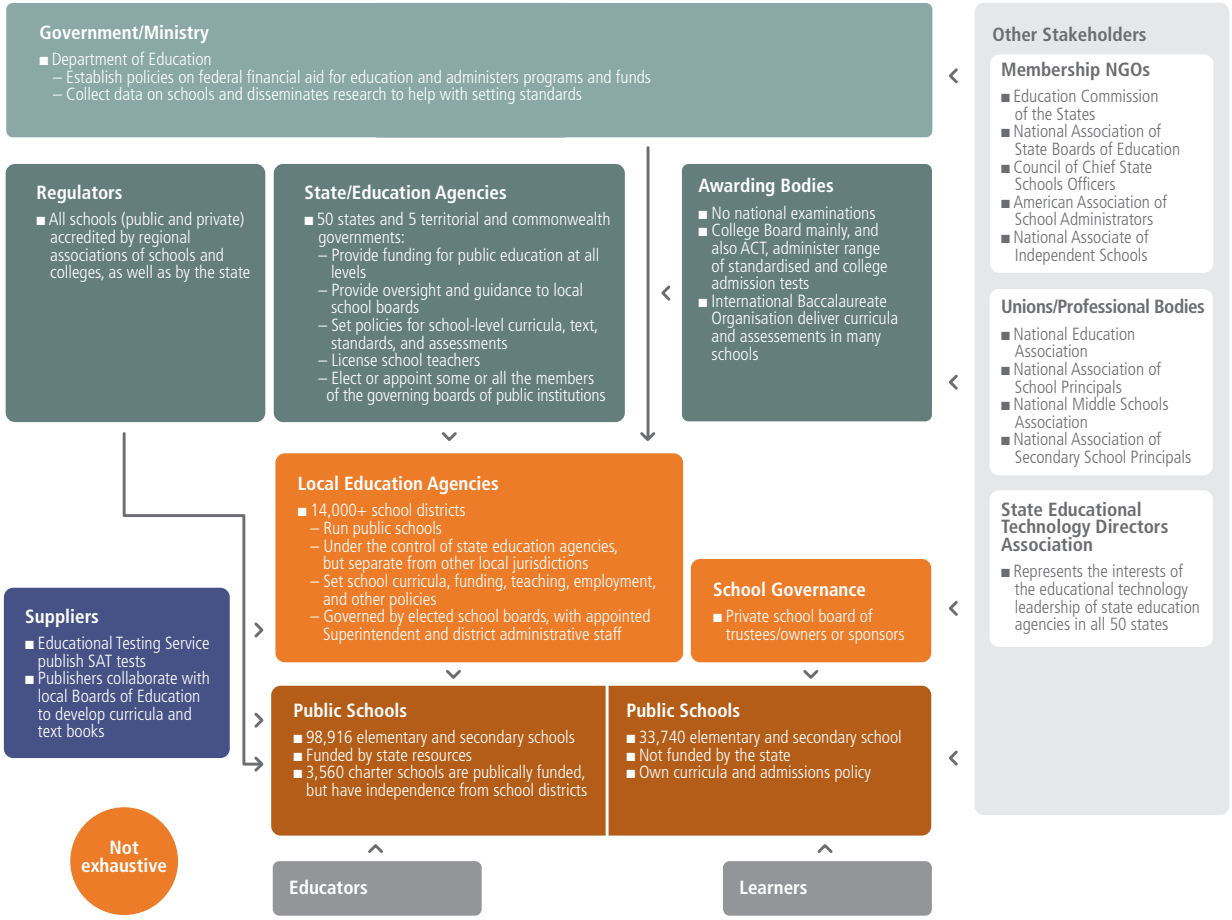
4 Schools

There are approximately 130,000 individual institutions in the US school system, including nearly 117,000 primary and secondary schools.

The main characteristics of the USA school system are:

- Highly decentralised, with elementary and secondary education provided by the State, where education is typically the largest budget item.
- Huge variation across the system, with school governance and control residing with 14,000 locally elected school boards, which in turn operate through school districts.
- Policy, leadership and assistance only from federal government, but this does include education technology policy and funding. However, spending decisions are made at a district and a school level.
- Charter schools have freedom from school districts – this is a growing sector with 3,560 currently registered.
- No national examinations but students must be tested to demonstrate progress which mostly happens through standardised evaluations and assessments. Students wishing to progress to higher education take college admissions tests.
- 9.5% (5.8 million) of students attended private schools in 2010/11.
- Distance education, including online distance education, seen as a way of addressing the challenges of overcrowding, student demand and individualised schedules. Notably, virtual schools are a small growth area, led by Florida Virtual School.
- Long history of home schooling - currently over 1 million students - and wide range of services, materials, and resources to assist homeschooling parents and children.
- Obama administration has indicated the intention to reform the No Child Left Behind policy (which is the current version of the Elementary and Secondary Education Act) which might impact in the structure of the system at State and local level.

Education Ecosystems - US Schools



Source: GSMA

4.1 Technology

Federal government has played a key role in developing flows of funding for technology for schools through successive programmes which have modernised schools, increased their technical capacity and introduced different types of technologies into the classroom. Unlike other national governments, the US is redoubling this investment, viewing educational technology as a key vehicle for reducing expenditure. However, on the whole, these policies have set out to fund and facilitate rather than lead and innovate.

Whilst schools are the main buyers, States are influential because they set curricula and they can also take a procurement role. Connecticut, for example, has negotiated state-wide contracts with Blackboard and WebCT, and set up a site on iTunes U for use by schools, colleges and universities, as well as distance learners in their area.

Table: Technology in US Schools

Aspect	Main Points		
Expenditure	■ $4.32 billion school annual district expenditure on education technology[1].		
	■ Average district spend was $577,100.		
Policy	■ Office of Educational Technology (OET) develops national educational technology policy.		
	■ Enhancing Education Through Technology, (EETT) established in 2002, provides funding and extensive support to State educational agencies.		
	■ New National Education Technology Plan (Nov 2010) focuses on learning, assessment, teaching, infrastructure and productivity. Includes aim of ensuring internet access via mobile devices.		
	■ New National Broadband Plan includes aim to modernize educational broadband infrastructure.		
	■ New Fund for the Improvement of Education (FIE) has $50 million earmarked for breakthrough developments in educational technology.		
	■ School district policies outlined in Technology Plans.		
Procurement	■ e-Rate programme currently funds telecommunications and internet access for schools and libraries via service providers. May change under National Broadband Plan?		
	■ States receive funding from EETT to distribute to schools according to various criteria – 5% retained for State-level activities.		
	■ Most schools responsible for purchasing products and services, but some expenditure must be approved at the district level by District Administrators.		
Penetration[2]			**All schools**
	At least one PC		97%
	One Internet-enable PC		93%
	Student to computer ratio		5.3 to 1
		Elementary	**High**
	Frequent use of computers in classroom	44%	34%
	Frequent use of computers elsewhere	31%	24%
	Interactive Whiteboards	23%	23%
	Classroom Response System*	7%	6%
	MP3 Player/iPod	4%	6%
	Handheld device	5%	2%

* Wireless systems allowing teachers to pose questions and students to respond using – clickers or hand-held response pads, with responses compiled on a computer

1 *Purchasing Technology,* District Administration http://www.districtadministration.com/viewarticle.aspx?articleid=1296

2 *Teachers' Use of Educational Technology in U.S. Public Schools: 2009*, National Center for Education Statistics, US Department of Education http://nces.ed.gov/pubs2010/2010040.pdf

4.2 Mobile Education

In US K-12, spending on mobile learning technologies is expected to increase from $70.9 million in 2009 to $143.3 million in 2014, representing a CAGR of 15.1%.[1] This is a relatively high growth rate, although overall expenditure is expected to be bigger in higher education where institutions have higher incentives and more freedom to invest in Mobile Education than schools.

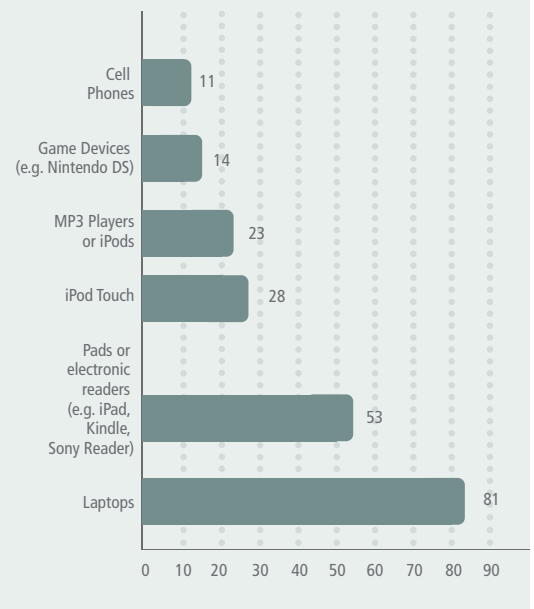
So far, there are no national or major regional Mobile Education initiatives for schools in the US – all activities are at a school or district level where there are a growing number of innovative initiatives. Many result from the personal interest of teachers or principals, although a few are supported by global education and technology providers, such as Apple and Pearson. Efforts are therefore described as *"fragmented and unsupported, and leaders have not yet developed a strategy on how Mobile Learning should be deployed, or even if it should be used at all."*[2]

One-to-one laptop programmes in K–12 schools are increasingly widespread and there is agrowing body of research which suggests a positive impact on test scores from laptop use as well as a range of other benefits.[3] A 2008 survey of 364 decision makers in school districts found that laptop programmes are growing steadily in schools and are being implemented at some level in more than 25% of districts. For districts without laptop programmes, cost was the main barrier, with doubts about the academic value of laptop programmes also being raised. Although it is accepted that mobile devices have the potential to transform children's learning processes, parents and teachers on the whole remain sceptical about their educational value. A 2008 study found that as much as teachers recognise the potential of mobile devices, students' ability to use them at school is severely limited so other devices are preferred.

Portable Technologies with Perceived Greatest Educational Potential

Percentage of teachers who rated these technologies an 8, 9 or 10 on a 10-point scale.

Portable Technologies with Perceived Greatest Educational Potential[4]



More specifically:

- Most personal student devices are off limits during school, with teachers reporting that cell phones, game devices, and MP3 players and iPods are largely banned.
- Teachers see the Internet, computer programs, and CD-ROMS as having more educational potential than mobile forms of digital media.
- More than half of teachers see MP3 players solely as entertainment devices (54%) and feel they have no place in school (69%).
- Almost all teachers (85%) see mobile phones as a distraction, with 64% agreeing they have no place in school.[5]

In places, negative attitudes to the use of mobile technologies are reinforced legally. For example, New York has had a blanket mobile phone ban in schools for many years which was upheld by a State appeals court in April 2011 after parents challenged it.

1 *The US Market for Mobile Learning Products and Services: 2009-2014 Forecast and Analysis*, Ambient Insight Research http://www.ambientinsight.com/Resources/Documents/AmbientInsight_2008-2013_US_MobileLearning_Forecast_ExecutiveOverview.pdf
2 *Pockets of potential: Using Mobile Technologies to Promote Children's Learning*, Joan Ganz Cooney Center, 2009 http://joanganzcooneycenter.org/upload_kits/pockets_of_potential_1_.pdf
3 *Emerging Technologies in Adult Literacy and Language Education*, National Institute of Literacy 2010 http://lincs.ed.gov/publications/pdf/technology_paper_2010.pdf
4 *Deepening Connections: Teachers' Increasingly Rely on Media and Technology*, PBS 2010 http://www.pbs.org/about/media/about/cms_page_media/182/PBS-Grunwald-2011e.pdf

4.3 Ownership of Mobile Devices

Almost all children in the US have access to a mobile device, with 93% of 6-to-9-year-olds living in a home with a mobile phone.[1] Smartphones are particularly popular among young consumers - about two-thirds of the children said that they have used an iPhone before.[2] There is, however, a significant portion of parents (20%) who rarely or do not allow their children to use their smartphones. It seem as though school demographics has little impact on this these high levels of ownership and exposure - a large national survey, Speak Up, saw few differences when results were analysed for such differences.

Table: Ownership of Mobile Devices by American School Students[3]

Device	K-2	Gr 3-5	Gr 6-8	Gr 9-12
Mobile Phone (Without Internet Access)	21%	29%	51%	56%
Smartphone	16%	19%	34%	44%
Laptop	37%	42%	60%	67%
MP3	37%	55%	79%	85%
Tablet Device	10%	8%	13%	10%

1 *Pockets of potential: Using Mobile Technologies to Promote Children's Learning*, Joan Ganz Cooney Center, 2009 http://joanganzcooneycenter.org/upload_kits/pockets_of_potential_1_.pdf
2 *Learning: Is there an app for that? Investigations of young children's usage and learning with mobile devices and apps*, Joan Ganz Cooney Center, 2010 http://www.joanganzcooneycenter.org/upload_kits/learningapps_final_110410.pdf
3 *Speak Up National Findings, K012 Students and Parents Report, Project Tomorrow,* April 2011 http://www.tomorrow.org/speakup/pdfs/SU10_3EofEducation(Students).pdf

4.4 Case Studies

Bring Your Own Technology (BYOT) Projects

Bring Your Own Technology (BYOT) projects seem to be growing across school districts in the US, driven by the potential cost savings. One example is BYOT in Forsyth County:

Case Study – BYOT in Forsyth County	
Aim	Allow students to use their own, familiar technology and save money.
Scale	34,000 students in High schools across Forsyth County.
Description	■ Students encouraged to bring their own devices to schools, having signed a Student Code of Conduct. ■ Devices connect to the district network provided by school system. They are not permitted to use own devices to access the internet via personal Wi-Fi or other manner.
Partners	Forsyth County, Cumming Georgia.
Funding	Infrastructure such as network access funded by district, devices provided by students. District invested in some 'spare' devices.
Technologies	Student's own mobile devices.
Impact on Learning	■ 80-90% of students in pilot classrooms brought their own devices. ■ Reduced spend on textbooks.
Lessons Learned	■ Engage students from the beginning of the project. ■ Need a robust network that allows data to travel to and from students. ■ Ensure adequate provision for students without their own devices.
Sustainability	■ Supported by school district, so sustainable in the long term. ■ Cost saving from textbook budgets being spent shoring up the network.

Escondido Union School District's Project iRead

A group of pilot teachers in Escondido Union School District are exploring the use of mobile devices and products to improve student comprehension and reading. This case is interesting because it was first implemented on a small scale, which guaranteed goals being met, and then slowly escalated. Different strategies were tried out, including the provision of different types of devices (iPods, iPads) to identify best practice.

Case Study - Escondido Union School District's Project iRead	
Aim	Improve fluency and comprehension of English as a second language.
Scale	160 Escondido Classrooms with iPod devices, 3000+ iPod Touch devices in schools, 70+ 1:1 iPod classrooms, 6 iPad classrooms.
Description	■ Entirely teacher-led. Teachers apply to be part of the iRead Community, are trained and meet on a monthly basis for further training and collaboration. ■ Large ongoing collaboration via teacher and student blogs to monitor progress and share ideas. ■ Phase 1. – Purchased one iPod touch cart per classroom, providing one device for each student to use at school for the entire year. – Teachers chose a handful of apps as an initial collection. – Used the iPod's voice memo and a Belkin recorder for students to record and hear themselves reading to improve motivation, fluency and comprehension. – Teachers then imported student recordings into iTunes library and created time-stamped digital portfolios to track progress. ■ Phase 2 – focused on comprehension and Language Arts. Again, voice memos were recorded transferred to the computer upon sync. ■ Phase 3 (2009-10) - teachers added multiple 1:1 classrooms representing various populations and configurations to examine them.
Partners	Apple, Escondido Union School District.
Funding	■ Funded from existing technology budget at School District for pilots. ■ Following initial success, school board made ongoing financial commitment to the program. Funding was allocated and a line item in the annual budget established, which was critical to expand the programme.
Technologies	IPod Touch, Belkin recorders, iTunes.
Impact on Learning	■ In a six-week period, students' reading fluency increased at six times the rate considered normal for that period of time. After six months, students gained almost two years of reading comprehension. ■ Teachers found that when students were able to record and hear themselves read, they became more engaged and motivated. Getting instant feedback especially changed the way they learned.
Lessons Learned	■ Small scale and specific focus helps strategy be clear and goals easier to achieve. ■ Central deployment but local management of devices seen as key, including teacher-managed iTunes accounts, Google site for teachers to manage their own classroom iPod devices and professional learning community for added support.
Sustainability	■ Project seems sustainable in the long term as it is expanding rapidly with various grants and district funding. ■ In 2011, iPod touch devices will be given to all students K-5 as part of a restructured school plan, 5 iPad 1:1 pilot classrooms will be tested at Pioneer Elementary.

iREAD

Sesame Workshop's iREAD (Interactive Reading Experience with Adaptive Delivery) project assesses a student's literacy challenges to develop an individualised intervention, made up of classic video footage from Sesame Workshop's series, The Electric Company, and interactive games based on that footage. Although the project is still under development and was piloted with a very small group of students, it is interesting because it focuses on content development and is one of the very few private initiatives funded by the US Department of Education.

Case Study - iREAD	
Aim	Develop a personalised, media-based literacy intervention system that targets the instructional needs of individual students.
Scale	First grade students in New York, Las Vegas, and Fayetteville, Arkansas.
Description	■ Started with a web-based prototype, called Multimedia Reading Environment with Adaptive Delivery (mREAD), used to conduct formative research and pilot testing. ■ Prototype adapted to run on the iPod Touch so was then called Interactive Reading Environment with Adaptive Delivery (iREAD).
Partners	Sesame Workshop, Wireless Generation, Jersey Cow Software, Atimi Software.
Funding	Funded under the U.S. Department of Education's Ready to Learn. initiative through the Corporation for Public Broadcasting and PBS.
Technologies	iPod touch.
Impact on Learning	No impact assessments have been conducted to date.
Lessons Learned	States the importance of formative research conducted on the interactive games included in the iREAD application as they were in development.

Million Motivation Campaign

Although the project was recently discontinued due to insufficient funding, this is interesting because the aim was not to improve traditional learning outcomes (as most projects do) but to encourage other types of learning processes in relation to life chances and personal development. Technology in this case is seen as the means and not as an objective in itself.

Case Study – Million Motivation Campaign	
Aim	Help students internalise connections between education and success.
Scale	2,500 students, 7 middle schools in New York
Description	■ Students received a free cell phone, with opportunities to earn minutes and other rewards by achieving goals established by school principals. ■ Phones were also used as a platform to communicate directly with students by teachers and administrators and to "rebrand" achievement through a mentoring programme. Mentoring spotlighted successful professionals in a range of occupations who served as role models to students. Students got workplace experience, coaching, and academic help.
Partners	New York City Department of Education, in conjunction with Harvard.
Funding	Funded by the New York City Department of Education and private donations.
Technologies	Mobile phones.
Impact on Learning	Assessments were not conducted as funding was discontinued.
Lessons Learned	■ Ban on mobile phones in NY schools did not help acceptance of project. ■ Depended too much on funding from private donors. ■ Goals of the project were too broad and too focused on the longer-term, so not enough private actors became involved.
Sustainability	Project was recently discontinued due to insufficient funding.

Project K-Nect

Project K-Nect is an ongoing pilot project in rural North Carolina where high school students received algebra problems on smartphones (the phones were provided by the project). Outcomes so far are very promising, with classes using the smartphones consistently achieving significantly higher results in their end of course exams. Project K-Nect is now expanding beyond North Carolina to Virginia and Ohio with approximately 4,500 additional students.

Case Study – Project K-Nect	
Aim	Create a resource for secondary students to focus on improving math skills by using mobile smartphones.
Scale	Initially, 150 smartphones to four high schools in three school districts across the State of North Carolina.
Description	■ 150 qualified students in 8th-12th grade were given 3G-enabled smartphones to wirelessly connect to educational resources on the Internet and each other both on and off school campus. ■ The phones provide access to supplemental math content aligned to their teachers' current lesson plans and also allow students to collaborate and contact after-school tutors who can assist them with mastering a targeted skill set. ■ The program only allows authorised users to communicate electronically within the secure system and is monitored by teachers to ensure acceptable use policies are not violated. ■ Teachers use software applications on their laptops to send messages to students on their phones, giving them homework assignments and viewing their collaborative work. Teachers can manage assignments and provide real-time support and training through remote control technology.
Partners	■ Qualcomm is primary sponsor through its Wireless Reach™ initiative. ■ North Carolina Dept of Public Instruction implementing the program. ■ Digital Millennial Consulting, managing technology, professional development and monitoring and evaluation of the project. ■ Drexel University, through its Math Forum, is responsible for content. ■ Choice Solutions providing technology resources. ■ MobiControl tool from SOTI monitors activities undertaken by the students on their designated devices. ■ Florida Center for Interactive Media at Florida State University, ■ developing all multimedia for the mathematics content.
Funding/Business Model	■ Grant provided by Qualcomm gives free smartphones and services to students.
Technologies	■ 3G enabled smartphones HTC 6800. ■ Phones use Qualcomm's 3G EV-DO Re, a mobile technology which allows them to access broadband wireless services with a maximum peak data rate of 3.1 Mbps, which is comparable to a digital service line.
Impact on Learning	■ There was a positive correlation between students who actively participated in Project K-Nect and their final algebra I proficiency level on a standardised exam given by the State of North Carolina. ■ Students at one of the participating Project K-Nect schools, increased their proficiency rates by 30 percent on the State of North Carolina's End of Course exam, compared to classes not in Project K-Nect but taught by the same teacher. ■ Students discovered creative ways to use the phones and the 24/7 Internet connectivity to increase their understanding of algebra I, especially with social networking tools such as blogging and instant messaging. ■ According to the students, one of the most helpful applications was the use of the video capability on the smartphones. Students would record each other working out problems on a white board then post the videos on blogs, so all students within the network could access them.
Lessons Learned	■ Self-selection for participating teachers helped motivation. ■ Personalised digital content meant students could not copy results, but encouraged to discuss solutions. ■ Use of MobiControl software addressed early concerns over safety and security.
Sustainability	Expanding to Virginia and Ohio with approximately 4,500 students.

Social Studies Digital Curriculum on iPad

This is a high profile pilot involving Pearson and the Virginia Department of Education. Pearson has developed a bespoke mobile curriculum in line with the State's learning objectives, underlining Pearson's investment in developing content for Apple devices. The pilot began in November 2010, so is in the early stages.

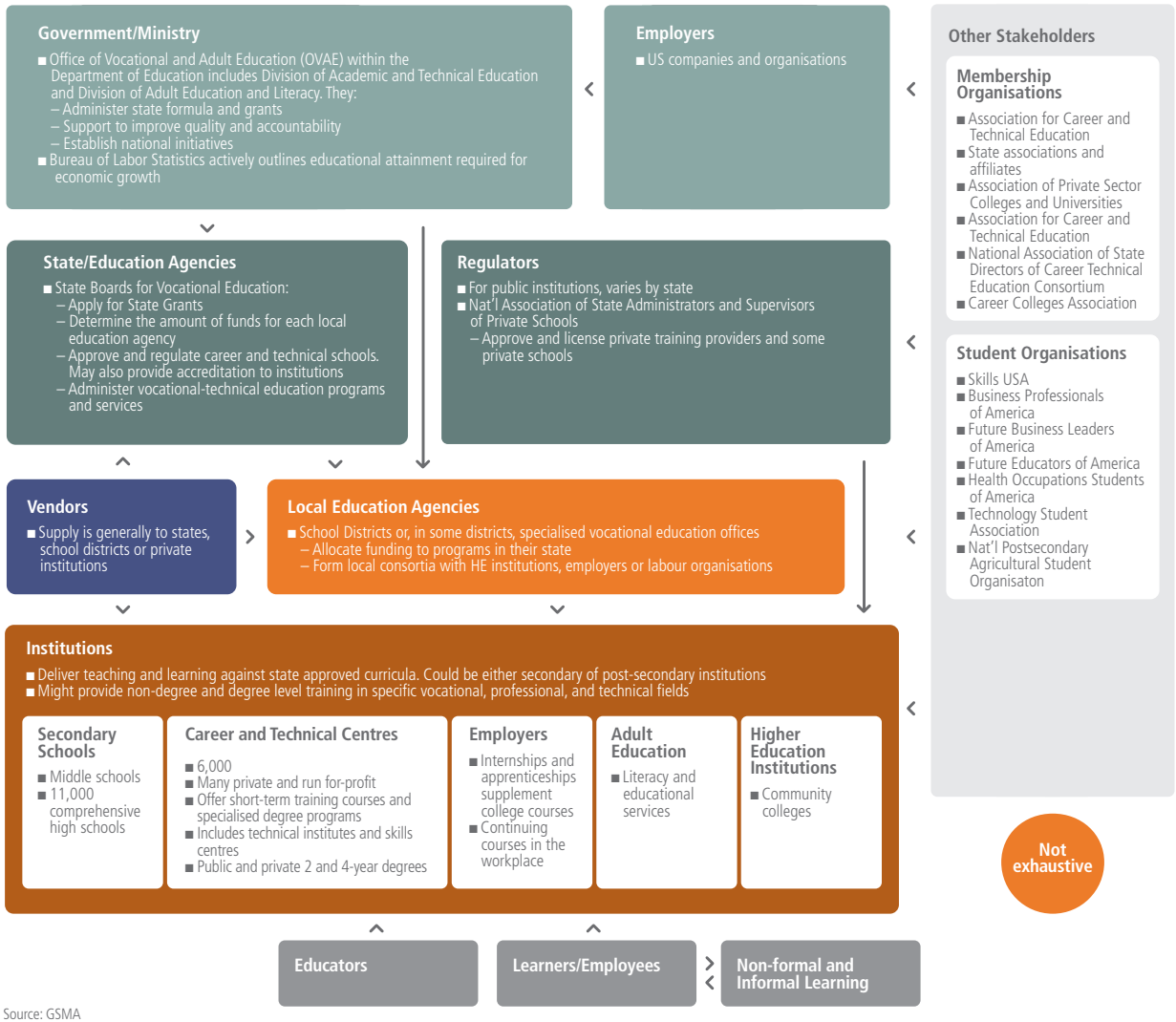
Case Study – Social Studies Digital Curriculum on iPad	
Aim	Deliver complete digital curriculum mapped to State Standards of Learning.
Scale	More than 260 students in several High schools (at least six).
Description	Pearson created iPad apps plus digital content designed to align with Virginia editions of Pearson's U.S. History and World History programs for seventh and ninth graders. The program includes: ■ App with interactive learning games that introduces concepts to students through puzzles and fast-action challenges. ■ e-Text on iPad where students access the social studies curriculum and take control of their learning by creating their individualised texts. ■ Personalised assessment with remediation App for students to review and self-test.
Partners	Pearson and Virginia Department of Education.
Funding	State provided $120,000 for purchase of iPads.
Technologies	iPad.
Impact on Learning	Will be evaluated by Radford University.
Lessons Learned	Will be evaluated by Radford University.
Sustainability	Content is now developed but the key will be in the provision of technology to enough pupils.

5 Technical and Vocational Education and Training

The organisation of TVET is complex, because it is offered in a wide range of organisations and provides varying levels of education - including industry-recognised credentials, postsecondary certificates, and two- and four-year degrees. A large proportion of this is delivered within the school and higher education segments - almost all high school students take at least one career and technical education (CTE) course and one in four students take three or more CTE courses. This leaves CTE delivery in colleges and adult education as the main segments to describe in this section.

The picture of the system is further complicated by the fact that each State administers CTE in a different manner. Therefore, there are multiple stakeholders and models involved in its provision and their description here is not exhaustive.

Education Ecosystems – US Technical and Vocational Education



Source: GSMA

The main features of the of the US TVET education system are:

- Deficit of skilled workers and the need to get people in and through postsecondary education and training is recognised.
- Around 40 million adults thought to engage in short-term postsecondary occupational training.[1]
- Highly fragmented segment, particularly in purchasing/ curriculum decisions.
- Community and Junior Colleges provide adult education, postsecondary CTE and academic and professional studies leading to transfer to higher level studies.
- Most colleges are private and operate on a for-profit basis.
- Public provision is under control of school districts or specialised vocational education offices, and delivered mostly through high schools - these can be "comprehensive" high school or in separate "area career and technical schools."
- Most colleges are in need of better retention and more efficient solutions – even "best-in-class" programs suffer from high drop-out rates.
  - *"If it works, we're all for it; the more people we can help, the better"* – Israel Mendoza, Washington State.
  - *"You will find less loyalty to curriculums; if there's something that can move more people through the system, we'll embrace it."* – City College of San Fransisco (CCSF).
- Career and technical student organisations play an important role by providing programmes of career and leadership development, motivation, as well as recognition for students enrolled in CTE programs.
- Large adult education need, covering a variety of ethnic backgrounds, especially non-native English speakers. Many are young learners – 41% are younger than 25.[2] This population is also less likely to have access to home PCs and internet creating a huge digital divide.
- Federal funding for vocational and technical education in 2010-11 is $1.1 billion, which covers 8-10% of budgets – the remaining funding is from local and State revenue. However, federal CTE funding is being cut for 2011-12 by 11%, with further funding cuts across education and workforce programmes proposed.

1 Department of Education's Office of Vocational and Adult Education (OVAE)
2 Emerging Technologies in Adult Literacy and Language Education, National Institute of Literacy 2010 http://lincs.ed.gov/publications/pdf/technology_paper_2010.pdf

5.1 Technology

As we have indicated, a lot of CTE provision takes place in schools and higher education institutions, which is covered in other sections. Looking at technology within the college and adult education segments yields little in terms of hard data and insight, and there are no specific policies or strategies in place to promote technology. The focus is more likely to be on incorporating the subject of technology into curricula and programmes, as technology skills are considered critical for the workplace. This can give the probably misplaced impression that there is little going on in the segment in terms of technology-driven support and teaching and learning.

It is clear that the segment faces budgetary pressures and indications are that technology is an area that might be targeted. A growing number of community colleges experienced reductions to central IT budgets - 46% in 2010-11 compared to 38% in 2009.[1] This is in contrast to higher education technology budgets which have begun to recover and school budgets where cuts are partly mitigated by increased federal programmes.

A report by the National Institute for Literacy suggests that new technologies have not yet been adequately integrated in adult education programmes,[2] although it does describe many good uses of technology, especially for ESL (English as a Second Language). A national survey found that 53% of adult educators' wanted to learn to incorporate technology into instruction. The report looks to emerging technologies, especially where they are low-cost (i.e. low-cost laptops and mobile phones), to address the diverse learning needs of adult learners, especially *"autonomous learning tools that can be placed in the hands of each individual learner."*

Distance education is a growth area, with 76.3% of community colleges offer some form of distance learning in CTE.[3] One means of facilitating this is with content distributed by sites in iTunes U. This is less prevalent for CTE than higher education, with around 30 colleges having sites, and a few State-wide or school district sites, that can be used by colleges.

Table: Technology in US Technical Educational Vocational Training (TVET)

Aspect	Main Points
Expenditure	■ Largely covered by school and higher education, otherwise unclear.
Policy	■ Delivery of CTE in public schools means that main school district technology policies cover the segment. ■ Delivery on continuing education in higher education means the institution-level plans cover the segment. ■ New National Education Technology Plan emphasises the need for students to use the same technology in schools as they would use as professionals in the workplace.
Procurement	■ Same as public schools. ■ Most career and technical colleges are private and are directly responsible for funding their own educational technology initiatives.

1 Campus Technology 2010 Survey http://campustechnology.com/Articles/2011/04/01/Moving-to-Mobile.aspx?Page=2
2 *Emerging Technologies in Adult Literacy and Language Education*, National Institute of Literacy 2010 http://lincs.ed.gov/publications/pdf/technology_paper_2010.pdf
3 Distance Learning in Postsecondary Career and Technical Education: A Comparison of Achievement in Online vs. On-campus e-courses. http://136.165.122.102/UserFiles/File/pubs/DistLrng5_Benson.pdf

5.2 Mobile Education

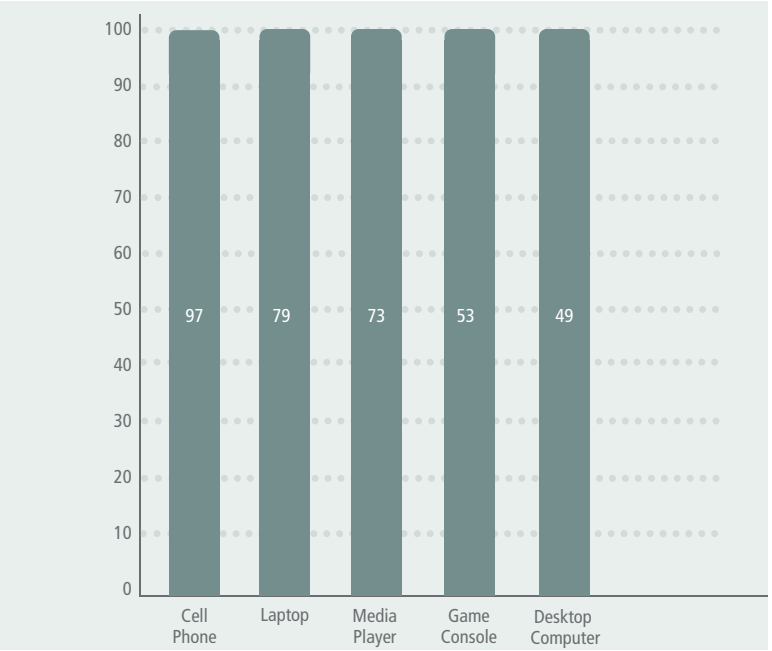
On balance, there seems to be little evidence of Mobile Education taking root in the CTE or adult education segments in the US, and this segment comes across as the poor relation of schools and universities. In part, this picture emerges because of CTE provision in school and higher education settings, where, as we have described, a wide range of Mobile Education activity is taking place. Another structural reason is that CTE institutions are mainly private, so while there are few examples, it is usually at a very small scale.

Whilst the use of mobile apps is taking hold in the higher education sector, it is less prevalent in CTE. 5% of community colleges had mobile apps tied to their LMS active in fall 2010, with a further 7.4% expecting to activate them within the academic year and a quarter having plans in place – however, 63% had no plans to go down this route. The picture was more encouraging in public 4-year colleges, and stronger still in private 4-year colleges, where 15% had mobile LMS apps in place in fall 2010, and 10% expect to activate them this academic year.[1]

In adult education, it seems basic literacy skills such as reading and writing take precedence over technology skills. However, some uses of Mobile Education are promoted within ESL teaching, for example, in student created audio podcasts for sharing and reviewing. According to a study, conducted by the Bill and Melinda Gates Foundation, mobile technology is well suited to this segment of the adult student population as 42% of them own a mobile phone and 33% have access to one through a family member, but this opportunity is yet to be fully developed.[3]

There are signs that Mobile Education is beginning to have an impact in the workplace in the US, as many employers look to increase the return on their investment in mobile devices for employees. It is estimated that *"corporate and business expenditures for mobile learning products and services in the US will reach over $246.9 million by 2011."*[4] Organisations

Activating Mobile LMS Apps, Fall 2010[2]



such as Merrill Lynch (see case study), Sun Learning Services, Chrysler, Microsoft, 3Com, and Valero Energy all have active Mobile Learning programmes. Podcasting has also become widely deployed in US corporations.

1 *Campus Technology 2010 Survey* http://campustechnology.com/Articles/2011/04/01/Moving-to-Mobile.aspx?Page=2
2 Idem
3 Source: Innovation in ESL Education: Mobile Learning Technology, Bill and Melinda Gates Foundation http://www.gatesfoundation.org/learning/Documents/innovation-esl-education-mobile-learning-technology.pdf
4 *The US Market for Mobile Learning Products and Services: 2008-2013*, Ambient Insight http://www.ambientinsight.com/Resources/Documents/AmbientInsight_Healthcare_MobileLearning_ExecOverview.pdf

A small survey of employers,[1] as far back as 2008, suggested that 70% supported the use of personal devices for Mobile Learning and 24% currently deploy some Mobile Learning in their organisations. In addition:

- 52% of respondents use in-house resources to develop Mobile Learning.
- 73% of Mobile Learning today is not integrated with an LMS.
- 53% of Mobile Learning initiative funding comes from a Training department.
- 26% are currently building a business case for Mobile Learning, but 38% are not planning any.
- Future plans for mobile devices include assessments/surveys (77%), performance support (73%), and study aids (70%). Voice recognition also generated interest.

A wide range of implementation challenges served as obstacles to implementing a Mobile Learning initiative, including limited resources (11%), organisational acceptance (11%), and access to mobile devices (10%). Lack of standards was an issue raised as well as easy integration with an LMS. Other issues cited were hardware related including battery life, screen size, input usability and security.

Another development in the corporate sector is the launch of cross-platform internal app stores. IBM, Google, Sap, Kraft, Pepsi, and Accenture now have internal app stores stocked with commercial content and apps developed in house. Apple offers an enterprise license to organisational buyers allowing them to host their own iTunes app store behind the firewall.

5.3 Ownership of Mobile Devices

Nine in ten 18-29 year olds own a mobile phone,[2] and these young mobile owners are significantly more likely than those in other age groups to use mobile data applications such as playing games, social networking or making a purchase - 65% access the internet on their mobile device and 52% have used their phone to send or receive email. African-Americans and Latinos also outpace whites in their use of data applications on handheld devices.

1 *Mobile Learning Update*, Elliot Masie's Learning Consortium http://masieweb.com/p7/MobileLearningUpdate.pdf
2 *Mobile Access 2010*, Pew Research Center 2010 http://www.pewinternet.org/~/media//Files/Reports/2010/PIP_Mobile_Access_2010.pdf

5.4 Case Studies

Bucks County Community College Mobile App

Bucks County Community College, in Newtown, Pennsylvania, has developed a mobile application for the campus community. Early features focus on library use, allowing users to browse the library collections, map a route to BCCC campus locations, and communicate with library staff. The application will be expanded to include course offerings and other campus resources. It is compatible with Android, BlackBerry, J2ME, Palm OS, Symbian S60, Windows Mobile and iPhone.

Merrill Lynch GoLearn

Merrill Lynch has a highly mobile, global workforce, with employees often struggling to find time for learning and development activities, especially time-consuming and inconvenient classroom-based learning. Following a successful trial, their Blackberry GoLearn product was rolled out to 22,000 devices provided for their employees and is on track to be the first custom, firm-wide mobile application since e-mail in the financial services industry.

Case Study – GoLearn at Merrill Lynch	
Aim	■ Prove the access, usage and effectiveness of learning delivered via the BlackBerry to a global workforce. ■ Determine additional uses, beyond email, for BlackBerry devices and increase their return on investment.
Scale	Initial pilot to 2,100 investment bankers, then rolled out to 22,000 devices.
Description	■ Initial pilot over a seven-week period and involved wirelessly pushing the content out to over 2,100 devices over a seven-week period. ■ Content was relatively formal: three mandated compliance courses, accessible via both BlackBerry smartphones and traditional laptop and desktop computers. ■ Employees were able to access learning materials during naturally occurring down time, such as, the daily commute or while travelling on business.
Partners	Intuition (leading professional education provider).
Funding	Merrill Lynch.
Technologies	BlackBerry® smartphone.
Impact on Learning	■ No degradation to learning effectiveness (comparable average score to the traditional e-Learning control groups) and zero delinquency. ■ Users completed their compliance training 20 days ahead of the deadline. ■ Pilot group estimated to have gained 4,270 hours of extra productivity, which was about 4-6 hours per participant. ■ Higher scores were achieved than the remainder of the firm. ■ 32% completed the learning during business travel, 24% while commuting to work, 26% at home and 18% in the office or elsewhere. ■ 99% felt the format and presentation supported the learning. ■ 100% would complete more training in this format and more than 75% praised the benefits of convenience, time management and training with no distractions.
Lessons Learned	■ Engaged a wide range of internal and external partners. ■ Clear marketing and communications strategy to leadership and key adopter groups.
Sustainability	■ Success led to a global rollout of mobile learning to some 22,000 devices. ■ Mobile learning now embedded and strategically positioned other HR processes and systems. ■ Developed an additional three mobile courses, with 11 more on the way, covering issues such as on boarding for new hires, ethical decision-making, performance management, market abuse, and sexual harassment.

The Hotel TEACH Project

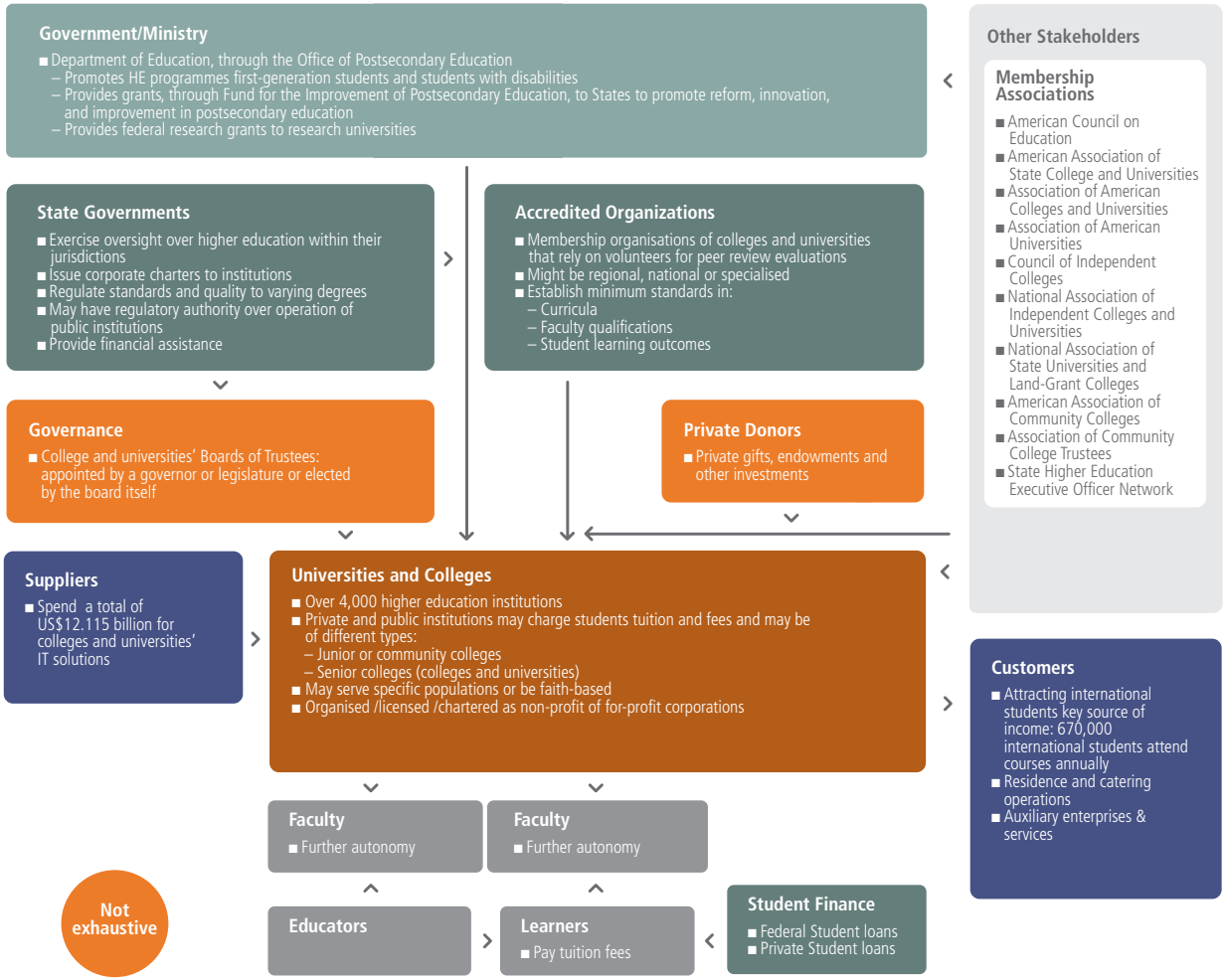
The Teaching English and Careers in Hospitality – known as the Hotel TEACH Project – used podcasts on MPS players in adult education, as part of developing a contextualised English as a Second Language (ESL) curriculum for immigrant workers.

Case Study Description – The Hotel TEACH Project	
Aim	Targets developing English language skills, soft skills and technology skills with the goal of helping learners acquire jobs in the hotel industry.
Scale	Two classes run so far, one with incumbent workers and one with non-incumbent workers, at LaGuardia Community College in New York City.
Description	■ Curriculum aims incorporated use of a wide range of technology, including using a Blackboard site and uploading podcasts. ■ All students were provided with MP3 players to "extend the class" beyond normal instructional hours, "address varying skill levels," and "individualise lessons" for students who worked in different hotel areas. ■ Podcast lessons included pronunciation or listening exercises geared to the particular needs of students, such as lessons on wines and spirits designed for a student who worked as a banquet server.
Partners	Developed by the Centre for Immigrant Education and Training Industry partner was Sheraton Manhattan Hotel.
Funding	U. S. Department of Labor.
Technologies	MP3 players.
Impact on Learning	■ Formal evaluation indicated that students in the programme made substantial gains in both English and computer skills, resulting in many cases in increased career opportunities.
Sustainability	■ Ongoing.

6 Higher Education

Nearly a quarter of all higher education institutions in the world are located in the US, including some of the most prestigious institutions - 103 US universities are in the Top 200.[1]

Higher Education System in the US



Source: GSMA

1 2010 Webometrics Ranking of World Universities http://www.webometrics.info/

The main characteristics of the higher education sector in the US are:

- Size and diversity, with just under 4,000 degree-granting institutions, all varying widely as to type, ownership and governance arrangements.
- Largely decentralised, with public universities administered solely by the States.
- Public institutions are autonomous with respect to academic decision-making. Private institutions are fully autonomous.
- Accrediting organisations play an important role establishing minimum standards and rating institutions on various criteria.
- Long tradition of faith-related education (dating to the founding of Harvard in 1636 which was Puritan Congregationalist). Institutions offer distinctive environments for learning and student development and are some of the most well-known US colleges and universities.
- Majority of funding is from State grants (including research grants), tuition and fees.
- Growing concerns over the growing cost of higher education to students, particularly in a depressed job market where the benefits cannot be realised, to the extent that the sector is being labelled as *"a bubble in the classic sense"* with many degrees are *"overvalued."*[1]
- Rising cost of textbooks and important issue for students.
- Growing distance education market, partly in response to this challenges as campus-based programmes give way to those focused on students who study from home or workplace.

6.1 Technology

Many higher education institutions are motivated to stay on the cutting-edge of technology both to compete for students and to best serve their students' educational and job preparation needs. As a result, access to technology is almost universal and technology is used for virtually all campus functions, including administrative systems, teaching and learning, research and community services.

Budget cuts in recent years have impacted IT units and resources, but the signs are that the worst is over - 41.6% of colleges and universities experienced a budget cut in central IT services for 2010-2011, down from fully half (50%) last year.[2] In fact, higher education institutions continue to take on ambitious projects and expand their services for faculty and students. Many are shoring up wireless infrastructure, virtualising servers and desktops, digitising content, honing lecture capture capabilities, implementing virtual labs and classrooms, moving into app development and experimenting with mobile platforms.[3] In the past, most campus IT-related policy was developed within central IT organisations. This has increasingly evolved into a more shared model, where the responsibility for privacy, security, and other campus policies involves close collaboration between IT units and other campus units, often managed by Chief Information Security Officers, Chief Privacy Officers, or Chief Compliance Officers. In some cases this works well, and in others it promotes inefficiency and inconsistency.

There is a degree of tension between States' desires to run campus IT as part of State-wide economy-of-scale initiatives, and campus desires for greater autonomy and procurement authority. This is especially important during the present economic crisis as States seek areas where they can achieve greater efficiencies and reduce costs.

Table: Technology in US Higher Education Sector

Aspect	Main Points
Expenditure	■ Estimated ~$12.1 billion for colleges and universities.
Policy	■ No federal policy on educational technology aimed at higher education. ■ State-wide education technology policies are tied to Education Technology State Grants and may shape institutions policies.
Procurement	■ Some examples State-level procurement for education as a whole, from which higher education institutions may benefit. ■ Mostly, institution led, by CIOs or VPs for Technology.
Penetration	■ About 7 students per computer.[4]

1 *We're in a Bubble and it's not the Internet. It's Higher Education*, Apr 2011 http://techcrunch.com/2011/04/10/peter-thiel-were-in-a-bubble-and-its-not-the-internet-its-higher-education/
2 *Campus Technology 2010 Survey* http://campustechnology.com/Articles/2011/04/01/Moving-to-Mobile.aspx?Page=2
3 *2011 IT Agenda in Higher Education* http://campustechnology.com/Articles/2011/01/13/The-2011-IT-Agenda-in-Higher-Ed-3-Perspectives.aspx?admgarea=topic.mobilecomputing&Page=1
4 *15 Most Wired College Campuses, USA Today*, Feb 2011 http://www.usnews.com/education/best-colleges/articles/2011/02/09/15-most-wired-college-campuses

Distance Education

Notable in the US is a thriving distance education sector, with an astonishing number of online courses being offered across the country:

- 66% of higher education institutions offered college-level distance education courses (2006-07), with 12.36 million enrolments.[1]
- Highest enrolment figure in 2007 for the entire country was at the University of Phoenix Online Campus, which had 224,880 students.
- Number of higher education students taking some (but not all) classes online is expected to grow at 11% each year, from 12.36 million in 2010 to 21.13 million in 2015.[2] Even higher growth is expected among students taking classes exclusively online, with annual growth 23%, from 1.37 million in 2010 to 3.86 million in 2015. This will potentially equal the number of students taking classes exclusively on a physical campus, and overtake it by 2018.

6.2 Mobile Education

In US higher education, the projected CAGR for Mobile Learning technologies (excluding traditional computing devices like laptops and netbooks) is 11.7% over five years, from a modest $96.87 million in 2009 to a still-modest $164.7 million in 2014.[3]

Some of the inhibitors for the growth in terms of market value include free content on iTunesU -at least 180 US universities have made their content available on iTunesU - and the development of free, home-grown Mobile Learning platforms at both individual schools and large education networks, such as Abilene Christian University, Boston University School of Management, Bridgepoint Education, Career Education Corp., and Walden University.

However, market value is not the only measure of penetration and all indications are that Mobile Education is an area of rapid innovation and take-up.

The general impression suggests a substantial move toward the adoption of mobile devices and applications among students and professors on campuses throughout the US. The expectation of access to a device, most typically a laptop, seems to be a given within higher education, but this year has seen many universities switching from laptops to tablets, especially iPads, or even offering both. Common practices include students using devices to view class material, listen to podcasts, and check schedules. Many professors use mobile devices to notify students of class updates, conduct quick quizzes or polls, and submit data while doing classroom field work.

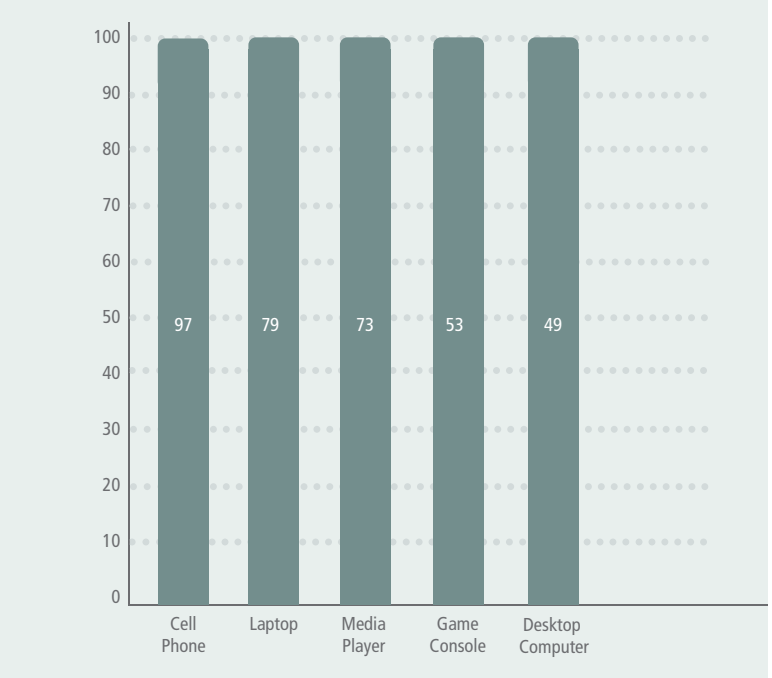
The main drivers of growth are e-Readers and mobile versions of LMSs - *"A major catalyst in this segment is the emergence of native platforms designed for the higher education market ...For example, the products from Inkling, Emantras, Irynsoft, Blackboard, Multiply IT, and StreaMe are being marketed heavily to the academic buyers, particularly the higher education buyers."*[4] In particular, Blackboard's Mobile Learning platform, Mobile Learn, is being seen as a significant product development and market catalyst.

Other universities have started to move away from running their own costly laptop programmes, as the proliferation of student-owned smart phones, tablets – especially iPads - and other mobile devices lessens this need. With their own multiple WiFi-enabled devices, students have less need for more equipment, especially one partly or entirely controlled by their institution.Some universities are instead focusing efforts and resources on expanding wireless bandwidth, shoring up network security and upgrading to 4G to support Mobile Learning.

1 U.S. Department of Education, National Center for Education Statistics (2008). Distance Education at Degree-Granting Postsecondary Institutions: 2006–07 http://nces.ed.gov/fastfacts/display.asp?id=80
2 *The US Market for Self-paced eLearning Products and Services: 2010-2015 Forecast and Analysis*, Ambient Insight Research http://www.ambientinsight.com/Reports/eLearning.aspx
3 *The US Market for Mobile Learning Products and Services: 2009-2014 Forecast and Analysis*, Ambient Insight Research http://www.ambientinsight.com/Resources/Documents/AmbientInsight_2008-2013_US_MobileLearning_Forecast_ExecutiveOverview.pdf
4 Idem

An area of particular interest in the US is the use of and support of campus mobile apps, which increasingly serve as *"the new campus portal buttons on a smartphone screen replace the bookmarks on an internet browser or the hot links on a campus portal."*[1] Most are tied to the institutions LMS, although their features often extend beyond this. Going forward, 70% of CIOs and senior IT leaders see *"mobile [LMS] apps are an important part of our campus plan to enhance instructional resources and campus services."*[2] Still, the move to mobile apps on campus remains in the early stages: just 13% activated mobile LMS apps by Fall 2010, although another 10% expect to do so soon and nearly a quarter are reviewing this. e-Books is another area where there is good reason to be optimistic. 86% of CIOs and senior IT leaders agree that *"e-Book content will be an important source for instrumental resources in five years,"* up from 73% in 2009.[4] Additionally, more than 78% agree that *"e-Book readers [hardware] will be important platforms for instructional content in five years."* According to Green, *"e-Books remain a much wished for, ever-arriving technology in higher education. The platform options, market opportunities and enabling technologies continue to improve."*

Activating Mobile LMS Apps, Fall 2010[3]



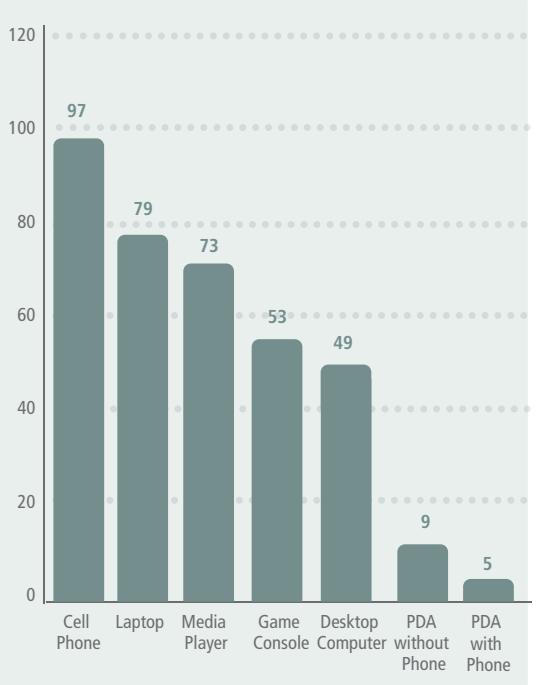
The potential of cloud computing seems to be recognised, but so far, this is an area of confusion. In a recent survey, IT leaders and staff from a representative 61% of institutions called for a national cloud for higher education created by the federal government. Nonetheless, this seems to be widely seen as a key area to develop going forward.

1 Kenneth C. Green, founding director of The Campus Computing Project
2 Campus Technology 2010 Survey http://campustechnology.com/Articles/2011/04/01/Moving-to-Mobile.aspx?Page=2
3 Idem
4 *Campus Technology 2008* http://campustechnology.com/articles/2008/01/snapshot-personal-electronic-devices-owned-by-students.aspx

6.3 Ownership of Mobile Devices

According to a 2008 study conducted by Cisco, 97% of US college students own a mobile phone and 79% own a mobile computer. More recently the focus has been on smartphone ownership, with Texas University concluding that at least half of their students owned smartphones.

Technology Ownership Amongst US Higher Education Students[1]



Importantly, Apple has a firm foothold in the higher education market, though student ownership of Apple devices amongst nearly 50% of students - with estimates as high as 70% - with buying intentions indicating the trend will continue.

1 *Campus Technology 2008* http://campustechnology.com/articles/2008/01/snapshot-personal-electronic-devices-owned-by-students.asp

6.4 Case Studies

Connected, Abilene Christian University

Abilene Christian University's project "Connected" has been considered best practice for mobile technology integration into higher education. The programme has attracted considerable attention in the media but impact has not been evaluated in a systematic and rigorous way.

Case Study – Connected , Abilene Christian University	
Aim	Make information accessible in new contexts and situations by promoting mobile learning.
Scale	4,000 undergraduate students, faculty and staff.
Description	■ Application of technology varies significantly, but is generally used to create course blogs, have podcasts of their lessons, etc. ■ Examples of integration of technology within classrooms include: – use iPhones for surveys and feedback, with students giving their opinions or answering questions with immediate display of results. – students created an app for iPads. ■ Promoting development of new apps to meet different class needs. The Statistics app, for example, features lessons, simulations, calculators, quizzes, flashcards, graphic organisers, a glossary and a list of formulas and symbols.
Partners	Abilene Christian University, AT&T, GetYa Learn On, Apple.
Funding/Business Model	■ Majority of students previously owned their mobile devices. ■ For those that didn't, 1,969 devices were distributed to students, 240 devices to faculty (95.6%) and 201 devices to staff members. Today, 100% of the student body has a mobile phone. ■ Funded by the university's fees. ■ AT&T donated US$ 1.87 million to expand research on the programme.
Technologies	iPhones, iPads, iPods Touch.
Impact on Learning	■ Students report improvements in attention, involvement, interest, active learning, contact with professors and the overall class experience. ■ 92% of faculty reported feeling comfortable using the device for a required course activity. 83% of faculty reported using the device in class regularly.
Lessons Learned	Wide variety of uses and applications across the university makes it difficult to evaluate in a systematic and rigorous way. All reported impact is merely anecdotal to date.
Sustainability	The programme seems sustainable in the longer term because private companies have increased their donations to the university, in part because of the impressive media attention that it has attracted.

iStanford Mobile Campus App

iStanford was one of the first mobile campus apps, launched in 2008.

Case Study – iStanford Mobile Campus App	
Aim	Original idea of two Stanford staff – started out as an experiment with aim of putting Stanford 'in the palm of your hand'.
Scale	64,000 people--44,000 more than attend or work at Stanford--have downloaded the app.
Description	■ Can download from Apples App store. ■ Features include: – Search courses & enrol in classes. – View grades & study list. – Search public directory information. – Search campus map, bus routes, bus locations. – View athletics schedules, scores, & news. – Browse campus events. – Watch Stanford uTV. – Read campus news.
Partners	Developed by staff and students at Stanford University. Students part of internal software development team, TerriblyClever Design.
Funding/Business Model	Developed internally.
Technologies	Native app for iOS (iPhone / iPad), Android, and Blackberry.
Impact on Learning	■ Did not directly impact learning.
Lessons Learned	■ New idea, so unburdened by institutional requirements and could focus on what students wanted Remained a relatively simple spec. ■ No need to purchase devices. ■ Initial roll out carefully choreographed.
Sustainability	■ Offered a commercial version of MobileEdu (based on iStanford) which was sold to a other schools, including Duke (DukeMobile), Washington, Texas A&M, University of San Diego, Medical College of Georgia, UCSD. ■ Plans to make app operate as mobile ID card capable of financial transactions and giving access and privilege control. ■ TerriblyClever Design bought by Balckboard in 2009.

Ohio State University

Case Study– Ohio State University	
Aim	Enable students to listen to podcasts of lectures in their own time.
Scale	Medical students at Ohio State University.
Description	■ PDA program for students in place since 2000, but devices were unreliable, lacked functionality and had limited educational potential. ■ At the same time, the medical school was podcasting lectures, but students could only view them on a PC. ■ Also saw opportunity to embrace data, curriculum materials, a broad set of built-in features, and medical apps that detail everything from human anatomy to pharmaceutical information used in clinical care. ■ Students with different levels of medical training and technical savvy tested the device for several months.
Partners	Student initiated, with support of Vice Dean for Education at the College of Medicine.
Technologies	iPod Touch.
Funding	Existing PDA programme meant that funding to provide every student with an iPod Touch or iPhone was already incorporated into tuition and fees.
Impact on Learning	Significantly affected the way students experience lectures and the way professors design their class sessions: ■ Ability to watch lectures before going to class, using them as pre-readings, allows students to pace their learning — reviewing information for clarity or speeding past content they already know. ■ Liberates professors from lecturing, enabling more interactive, collaborative sessions. ■ Students gain a deeper understanding and are more engaged. ■ In the hospital, residents can do more real-time teaching. ■ Patient care is improved by use of reference material and medical apps.
Lessons Learned	■ Bureaucratic obstacles to transition from one mobile platform to another. ■ Former PDA program demanded a significant amount of IT support.
Outcome	■ Fully implemented - iPod Touch and iPhone are now the exclusive portable devices for the medical school, carried by every student. ■ Because iPod touch and iPhone require minimal support, IT time has been repurposed to optimise the medical school's lecture podcast programme. ■ University is currently redesigning its curriculum to further personalise each student's education using iPod touch and iPhone.

7 Market for Mobile Education

The US Mobile Education market (K-12 and higher education only) was estimated at $168 million in 2009, with a 12.8% CAGR implying a 2011 value of $213.8 million[1] and projected to reach $308 million by 2014. The figures exclude many key elements of the full Mobile Education ecosystem, but are modest nonetheless.

Mobile Education projects are generally small and focused, certainly in the first instance, though once proven, they might extend to meet other educational needs. Many use fairly basic features of devices, such as voice memos, text messaging or taking pictures, and apply them the classroom or broader learning settings. Accessing resources, especially podcasts, and uses for administration, collaboration and communication are also commonplace. The overwhelming majority of initiatives target older students, in senior high schools or universities, with the CTE segment seeming to be relatively overlooked.

Particularly interesting is the Digital Curriculum project in Virginia, although small and in the early stages. It is currently one of the few examples of a State-led initiative, it has the support of Pearson and it is delivered via iPads, which seems to be the Mobile Education device of the moment. Most importantly, it goes back to the bones of the curriculum and reshapes teaching and learning around delivery via mobile devices, supported entirely by digital resources. Although not evidenced so far, it also has the potential to follow the mobile model through to the assessment stage, especially with the close involvement of Pearson, a leader in the assessment field.

7.1 Mobile Education Ecosystem

There is a little centrally driven educational technology policy. The National Education Technology Plan 2010 is a step in the right direction but provides few concrete steps and little funding. Public interest and investment in these issues is so low that private organisations (combinations of non-profit and well established corporations generally) are stepping in to drive change. For example, Pearson, along with Virginia Secretary of Education Gerard Robinson, and Apple, has created the new Digital Learning Council, established to accelerate personalised learning through the use of technology in America's schools.

Almost all activity is driven at an institution level. There are few examples of anything led at a school district or State level – the State of Virginia Digital Curriculum pilot, and the Connecticut iTunes U cites are examples – but this is clearly an area of potential as States and school districts have the funding and autonomy, as well as the desire to reduce spending. Moreover, when they do operate at a State level, there is potential for all education segments, including the seemingly overlooked CTE segment, to benefit.

The commercial Mobile Education market in the US is very fluid and innovative, with many large international players, most notably Pearson and Apple, and leading LMS providers taking centre stage. Blackboard is a key player, with Mobile Learn, a mobile LMS, and Mobile Central, which is software for creating mobile campus apps. Linking with an LMS, especially a mobile LMS, seems to be emerging as a key success factor.

1 *Ambient Insight Comprehensive Report: the US market for mobile learning products and services: 2009-2014 Forecast and Analysis*, Ambient Insight 2010 http://www.ambientinsight.com/Resources/Documents/Ambient-Insight-2009-2014-US-Mobile-Learning-Market-Executive-Overview.pdf

The main educational publishers are collaborating on distribution channels, such as Course Smart, and making a growing number of alliances with smaller innovators, such as Inkling and GetYaLearn, to help them transition to delivery of e-Textbooks on mobile devices. Device manufacturers, mainly of e-Readers, are targeting the education sector, so far with limited success - Kno, which launched a tablet for students earlier this year, has quickly withdrawn the product and is switching to a Textbook app. And a whole host of companies also offering device and network security are springing up.

The development of mobile campus apps highlights how consumer-led initiatives have quickly been picked up by commercial providers and become more and more mainstream. The first app, iStanford, was developed by a student-led start-up in 2008, which was subsequently bought by Blackboard in 2009. Many more universities have gone on to develop them in-house, sometimes involving students. At the same time, LMS providers, like Blackboard, Desire2Learn, Datatel, Sunguard Higher Education, are selling software for institutions to create mobile apps that link with their platforms and new vendors are also emerging, such as Jenzabar, oMbiel.

7.2 Market Potential

In the broader mobile learning market (as opposed to the more narrowly focused formal education market described in this report), the US is the top consumer in the world,[1] with the market for Mobile Learning products and services reaching $632.2 million in 2009 and demand forecast to grow at a CAGR 18.3%, reaching $1.4 billion by 2014. Boom areas are driven by consumers, purchasing edugames, especially brain trainers, and device embedded learning products for young children, and healthcare buyers, purchasing handheld decision support and mobile continuing medical education by healthcare students and clinicians.

Formal education (preK-12 and higher) is one of the consumer segments of Mobile Learning (others are consumers themselves, corporates, government, non-profits and associations, and healthcare) and represents about a quarter of this expenditure, so $168m in 2009 with less aggressive, but still impressive growth rates of CAGR 13%.

These market values seem relatively conservative. In part, they are modest because they exclude much of the expenditure related to delivering e-Education, notably the cost of devices (they refer only to knowledge transfer activities, content, tools and applications accessed on mobile devices). They also exclude infrastructure investments and costs, such as increased bandwidth or development of virtual servers, and the cost of network tariffs and traffic.

1 *Ambient Insight Comprehensive Report: the US market for mobile learning products and services: 2009-2014 Forecast and Analysis,* Ambient Insight 2010 http://www.ambientinsight.com/Resources/Documents/Ambient-Insight-2009-2014-US-Mobile-Learning-Market-Executive-Overview.pdf

There are in fact many reasons to think that Mobile Education has greater potential across US education than these market value figures indicate, including:

- Solid IT infrastructure in schools, colleges and universities, covering key areas of administrative support, teaching and learning, research (for universities) and community support. Budgets are in place, and although they have been under pressure, they have largely been maintained.
- National Broadband Plan will help improve network coverage and bandwidth, although institutions also need to make investments here.
- Institutional autonomy over most technology plans and procurement, supported by State level polices and larger scale central purchasing.
- Mobile Education pilots and initiatives seem less likely to peter out and more likely to become embedded as institution funding is more long-term.
- High levels of demand from users, especially in college and higher education settings, where ownership of devices is ubiquitous and potential uses are constantly evolving.
- Increasing realisation that students can use their own devices and institutions need to focus on enabling this by tackling issues of protocol, security and bandwidth.
- Thriving commercial sector, which though global in outlook, sees the US as the natural springboard for developments as well as a key source of revenue. Many companies are developing new products and services or supporting institution-level pilots and initiatives (Pearson and Virginia State, AT&T and ACU etc.).
- Higher education steals all the limelight in the US, and to a lesser extent, schools. Against this backdrop, CTE and adult education appear underserved. Yet there is lots of evidence that Mobile Education can have a positive impact in these segments and there are high levels of mobile device penetration, suggesting there is an opportunity here.
- Pressures on access to education and concerns over costs driving different delivery models which might be well-served by Mobile Education, notably, distance education.
- Significant home schooling market, with mobile devices mostly available in the home.

Table: Mobile Education Segments in Relation to Mobile Learning Markets, 2009-2014,[1] $m

Segment	2009	2011 (e)	2014 (e)	CAGR
PreK-12	70.90	93.9	143.3	15.1%
Higher Education	96.87	120.9	164.7	11.7%
Total Education	167.77	213.8	308.00	12.9%
Other Buying Segments	464.43	671.0	1,156.8	20.0%
Total Mobile Learning	632.2	884.8	1,464.8	18.3%
Formal Education as % of Total	26.5%	24.2%	22%	

1 *Ambient Insight Comprehensive Report: the US market for mobile learning products and services: 2009-2014 Forecast and Analysis,* Ambient Insight 2010 http://www.ambientinsight.com/Resources/Documents/Ambient-Insight-2009-2014-US-Mobile-Learning-Market-Executive-Overview.pdf

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