Engineering Leadership Program
Coleman Fung Institute for Engineering Leadership

K-12 Education in 2020
Engineering Leadership Project

Revision Date: April 5th 2012

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Abstract

In this report, we start with the observation that U.S. K-12 education industry has not been able to fully meet the diverse needs of parents and students. It has been relatively slow in adopting advances in Internet technologies. The dominance of traditional “brick-and-mortar” public schools resulted in little choices for parents and students. We hypothesize that continued advances in technologies will eventually lead to choices in types of schools, course variety, time, location and pace of study. We expect these changes will go a long way in satisfying the diverse educational needs of students and parents. We investigate the current landscape of the K-12 education industry and analyze the technical, regulatory, and societal factors around the current landscape. We also look into the technical and business model innovations pursued by new technology-driven entrants into the K-12 online education industry and how the landscape may change in the future.
Introduction

Background and Observation

Over the past decades we have seen national or international chains and franchises supplant locally owned “brick-and-mortar” shops in many industries. Advent of Internet technologies pushed this trend further into the virtual world, with many services and goods distributed without relying on traditional physical retail locations.

K-12 education industry in the U.S. has largely lagged behind this trend, with the majority of schools being operated by local school districts. The necessity for face-to-face classroom experience combined with various regulatory and societal dynamics may have contributed to the continued dominance of the traditional brick-and-mortar model in the K-12 education system.

Today, news about the undesirable state of American public schools abound, with many reports on degrading academic standards, inconsistent quality of teaching, inadequate number of courses offered, and in some cases, concerns on the safety of students on campus. Public schools are not able to fully meet the needs of students and parents.

On the other hand, we have seen many recent advances in the application of Internet technologies for education. We observe that many universities are making their courses available online in addition to the traditional teaching methods. We also see excellent video instructions (VODs) are available at sites such as Khan Academy and also many online interactive tutoring services operating in this space.

Hypothesis

The above observations led to our hypothesis: Advancements in online technologies over time will enable more choices in K-12 education – schools, courses, teaching methods, pace, location – and help satisfy diverse learning needs.

In the following sections, we will present the existing education ecosystem and analyze how the new players equipped with online technologies are affecting the ecosystem. We will also analyze some of the regulatory and societal environmental aspects surrounding the public education system. We will then analyze how the industry dynamics will support our general hypothesis and attempt to make some more specific predictions in our concluding section.

Current State of K-12 Education in US

We start out this report with some observations and statistics about the current U.S. K-12 education landscape.
The K-12 education in the United States has been dominated by brick-and-mortar public schools for decades. As Figure 1 shows, 87% of students are enrolled in traditional public schools in 2009.

While “education quality” is not easily measurable, it is plausible to say that the current U.S. education system is not able to fully meet the diverse needs of parents and students, as evidenced by the proliferation of complaints about the quality of U.S. public schools. A quick Internet search generates an endless list of news articles and parents’ comments decrying the present state of U.S. K-12 education. Some quotes are listed below:

- "I moved from Georgia to Wisconsin a couple years before my oldest child would enter middle school (grades 7 and 8 in this area) in a highly acclaimed school district in a state with highly acclaimed public education. With all the acclaiming we do about schools around here, I was expecting my son’s educational experience to be outstanding. What I noticed right away was the complete lack of rigor. Very little homework, very little content in the curriculum, but lots of emphasis on self-esteem and getting along with peers and being good, cooperative citizens."

- "U.S. Education Slips in Rankings - Compared with their peers in Europe, Asia, and elsewhere, 15-year-olds in the United States are below average in applying math skills to real-life tasks."

- "One-size-fit-all - It is why I have been home schooling my son since he was old enough for nursery school. It is hard enough to raise children these days, but those “educators” in the State Board of Education (SBOE) ‘pie in the sky building’, far removed from actual education, continue to determine policy and curriculum for all children in public education. They don’t know what they are doing and they are doing it wrong. That’s as honest as I can be about it."

We observe that much of the unhappiness is related to the lack of alternatives provided by the current education landscape. While true, there are no strong incentives on the part of schools to take steps to meet the needs of students and parents.

To set the stage for the remainder of this report, we close this section with some additional data on the U.S. education industry.
The K-12 education industry is worth over $510B and is set to grow to $660B by 2020.

<table>
<thead>
<tr>
<th>Average per-student expenditure</th>
<th>$9,233.5 ($7,925 to $10,542)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of Students enrolled</td>
<td>50M</td>
</tr>
<tr>
<td>Total market size</td>
<td>$462B</td>
</tr>
</tbody>
</table>

Table 1 Public K-12 Education Market Information

Technology in Education

Technology has played a leading role in the growth of the online and remote education market. In the 17th century it was the postal service that was used to send learning materials to the students. The TV played a similar role in the mid-20th century. The Internet has emerged as the new medium to deliver the interactive learning experience for the foreseeable future.

Advances in technologies such as Internet speeds, online collaboration tools and audio-visual areas have opened up new possibilities in how content and instruction is generated and delivered remotely. (For details, see the “Technology Statistics” section of the Appendix.)

Let us look at how technology enables new options and flexibility for learning:

**Teaching resource flexibility**
- The best subject matter experts can be used to generate content.
- Best teachers and their teaching methods can now reach beyond the local Geographies.

**Education content**
- Internet enables centralized content generation with a broad choices in distribution mechanisms
- Online Textbooks
- Online VODs
- Real-time remote instruction
- Customizable curriculum

**Choice for students**
- Students can choose from multiple teaching resources to best suite their needs.
- Students can have more choices of location, time, teachers and pace.

**Learning Pace**
- Students can learn at their own pace according to their ability and skills. Teachers can be made available easily for special needs students for personal education.
- This will enable students with different learning abilities to pace themselves better either slower or faster.
**Personalized progress tracking**
- Progress is maintained online enabling teachers to track class progress and facilitate easy access for parents and students to also track progress.

**Student /Teacher / Parent Interaction**
- Online tools can provide means to facilitate interactions among students, teachers and parents, to overcome any geographical or timing constraints.

**Emerging Ecosystem in K-12 Education**

In this section, we explore how new technology-driven players are entering into the K-12 education market.

Figure 4 shows a diagram depicting the ecosystem surrounding the traditional schools. In the traditional school model, all instruction and administration takes place within the school, with suppliers limited to such things as textbooks and school supplies. Students and parents can be considered as customers, with payments indirectly coming through governments in the case of public schools. School districts, state governments, accreditation agencies, and standardized test agencies are listed in the diagram as partners; they collectively set guidelines and help ensure the quality of the schools. Others schools could be considered as competitors – in the traditional school model, competition is usually limited to private schools, with tuitions that are prohibitive to many parents.

![Figure 3 Traditional Education Ecosystem (left)](image)

![Figure 4 Functional Elements in a School (right)](image)
In considering the entrance of technology-driven online players into the K-12 education industry, we first observed that a school could be broken down to multiple functional elements (Error! Reference source not found.). In traditional schools, the elements roughly map as follows:

- Curriculum/Content – textbooks, teacher-generated materials
- Instruction – teachers
- Enrollment and Progress Monitoring – teachers, school staff
- Other Admin Processes – principal, dean, other non-teaching staff, teachers
- Student/Parent/Teacher Community – physical location, club activities, school activities

Various online education players are introducing products and services that attack different parts of this deconstructed school ecosystem. Listing of these players and details of some companies are provided in the appendix. Below, we describe the various business models that are being pursued by these players:

**Private online schools** -- Examples include the Keystone School and the Apex Learning High School. A number of them are owned and operated by companies who also provide online curriculum or learning management systems. These schools cater primarily to the market of students who cannot attend their local schools for various reasons, including travel, international location, or disability. Stanford University Online High School is an example where the online technologies are utilized not necessarily just to overcome individual students’ situational challenges, but also to assemble a student body of especially gifted and talented students from various locations to provide an education experience that can’t be provided by local schools.

**Turnkey online education solution** -- K12 Inc., is a leading player with this business model. They provide a packaged solution of curriculum, learning management system, and other school administration processes and systems. School districts or state governments would provide funding, while operation of the school is handled by K12 Inc., as a turnkey solution provider. Teachers may be provided by the turnkey solution provider, or recruited by the school, with recruiting guidelines and training provided by the turnkey provider. Schools can be fully virtual or hybrid. K12 is even experimenting with a model where the turnkey education system is used in brick-and-mortar schools.

**Curriculum and Content** - Companies such as K12 and Compass Learning provide online curriculum for various subjects and levels. Traditional schools may purchase these to enhance their course offering (e.g. AP courses), or students may purchase these to make up for dropped units or to take advanced courses beyond what’s offered by their local school.

**Learning Management System** - This refers to an integrated system to track enrollments, deliver contents, or track progress. It is often packaged together with curriculum and content, but can be provided standalone to work with online curriculum provided by another company. Companies such as Blackboard provide LMS to schools that provide any online courses as part of their offering.

Table 2 provides some details on the different kinds of schools that are being enabled by online education technologies.
Table 2 Traditional and Online Schools

<table>
<thead>
<tr>
<th>School type</th>
<th>Funding</th>
<th>Curriculum</th>
<th>Instruction</th>
<th>Pace</th>
<th>Current Student</th>
<th>Current Players</th>
</tr>
</thead>
<tbody>
<tr>
<td>Traditional Public School</td>
<td>Primarily public</td>
<td>Fixed w/ some choice at higher grades</td>
<td>Live Teacher F2F and interactive</td>
<td>School directed</td>
<td>87%</td>
<td>Neighborhood public school</td>
</tr>
<tr>
<td>Traditional Private School</td>
<td>Parent funded</td>
<td>Fixed w/ some choice at higher grades</td>
<td>Live Teacher F2F and interactive</td>
<td>School directed</td>
<td>10%</td>
<td>Local</td>
</tr>
<tr>
<td>Charter Public School</td>
<td>Mostly public</td>
<td>Possible choices</td>
<td>Live Teacher F2F and interactive</td>
<td>School directed</td>
<td>3%</td>
<td>Religious, purpose-built and special-needs</td>
</tr>
<tr>
<td>Online virtual school</td>
<td>Parent (private)</td>
<td>Lots of Choice</td>
<td>Live Online Teacher and VOD</td>
<td>Self and school directed</td>
<td>&lt; 1%</td>
<td>K12.com Connections Academy Stanford OHS</td>
</tr>
<tr>
<td>Hybrid or Blended School</td>
<td>Customizable based on need</td>
<td>Lots of Choice</td>
<td>Hybrid Physical and Virtual Teacher</td>
<td>Self and school directed</td>
<td>New model</td>
<td></td>
</tr>
</tbody>
</table>

Political, Societal, and Regulatory Factors

Charter Schools

A charter school is a "publicly funded school that is typically governed by a group or organization under a legislative contract or charter with the state." Charter schools exist to provide a community-driven approach to education as opposed to one legislated by a central bureaucracy.

Public funding for education is predominantly directed towards traditional public schools, which represent about 90% of the student population. The traditional public schools have highly regulated curricula with more standardization and very limited opportunities for student or parent choice on class options. Unfortunately, the public education system has very little motive or incentive to deviate from the current approach. Education reform initiatives have largely been viewed as Band-Aids and not adequate for the scope of the problem.

The Federal Elementary and Secondary Education Act and the extension, No Child Left Behind Act, enables charter schools to seek public funding for each enrolled student. In addition, California provides grants up to $575,000 for the implementation of a charter school to help defray the initial startup cost. The growth of charter schools (see Figure 5 Charter School Enrollment) highlights the
popularity of these institutions amongst policy makers and parents as a key lever in driving education reform. Parents have had limited choices for their children’s education. The choices were to pay for a private school or move to a highly regarded school district, both expensive options. In addition, a movement at the local level through charter schools is an excellent means of influencing the education system.

Social Interactions

Parents and students want the social interaction that traditional schools provide, as they believe it is important in the students’ growth. One fear that has been voiced consistently is that online schools will limit these face-to-face interactions. The online schools have addressed this by supplementing the programs with social activities. For example, Stanford implements self-selected ‘student clubs’ and a ‘summer session’ that provides opportunities for students to meet in person.

Anti Discrimination Legislations

The Americans with Disabilities Act (ADA) and the Individuals with Disabilities Act (IDEA) were introduced to ensure that US residents with disabilities were not discriminated. Charter schools could seek additional federal funding or incentives as the lower cost of online-based schools combined with the technology innovations allows more children with disabilities to participate in the new classroom setting. The reconciliation of ADA and IDEA may enable online charter school growth.

Analysis and Conclusions

We have seen that the new technology driven entrants into the K-12 education industry are causing a new ecosystem to formulate, with the different functional pieces of a school being broken out, and various players developing products in content, content distribution, learning management systems, and social community tools. They are pursuing a variety of business models, including a variety of non-traditional private schools, the turnkey managed schools, or the sales of online course curricula of various types.

Market size for online education as a proportion of the overall K-12 education industry is still minuscule, but is large enough to fund these innovation cycles. Public companies such as K12 Inc., and Blackboard are reporting profitable financial results and growing. In addition, as seen with Khan Academy and Moodle, the “funding” provided in the form of expertise and manpower of open-source community is also contributing to the growth and maturity of online education systems.

The fact that a dominant part of our education spending comes from public funding is a major impediment to fast adoption of advanced online technologies. There are no strong market forces at play to compel the traditional schools to aggressively adopt technology-driven innovations. However, we are seeing recent growth of public charter schools, which provide an avenue for public funds to be spent on alternatives to traditional schools. Advent of online technologies lowered the hurdle of starting a new school, as evidenced by the turnkey managed school solutions.
Face-to-Face interaction among students and teachers remains an essential component of education. This is addressed through increased sophistication in online communication technologies, as well as different types of blended or hybrid schools that mix online course distribution and instructions with activities and Face-to-Face interactions.

Overall, we predict a gradual but steady increase in the adoption of non-traditional schools, online curriculum, learning management systems, and other technology-driven educational services and products. Innovation in application of online technologies to education is taking place, and factors that have kept public schools to operate in the traditional “locally owned” “brick-and-mortar” model are gradually removed.

We also expect that boundaries between traditional schools and online virtual schools will blur over time, as public charter schools and online virtual schools expand their presence by venturing into various hybrid or blended models, provide alternatives to traditional schools, and motivate traditional schools to adopt more online curriculum and content. We also expect more students to attend multiple schools of different types depending on their needs, as is the case with part time students at the Stanford Online High School who also attend their local schools.

In closing, we have listed our predicted “winners” and “losers” in the K-12 education industry, in Figure 6 Winners and Losers in K-12 Education in 2020.

Figure 6 Winners and Losers in K-12 Education in 2020
Appendix

Education Statistics

Online Education Statistics

Source: Fast Facts about Online Learning (INACOL)

- 40 states have state virtual schools or state-led initiatives.
- 30 states, as well as Washington, DC, have statewide full-time online schools.
- There were an estimated 1,816,400 enrollments in distance-education courses in K-12 school districts in 2009 – 2010, almost all of which were online courses. 74% of these enrollments were in high schools.
- This estimate does not include students enrolled in most full-time online schools which were approximately 200,000 students in 2009-2010 and 250,000 students in 2010 – 2011
- These figures represent phenomenal growth as a decade ago, it was estimated there were 40,000-50,000 enrollments in K-12 online education.
- The current U.S. average per pupil expenditures for a fully- online model is $6,400 and for a blended-learning model is $8,900. Traditional school models have an average per pupil expenditure of $10,000.

Source: K12 Inc., 2011 Annual Report:
(Original sources iNACOL, NCES)

- Online: 4M students participated in formal online program, growing by 46% (2010)
Charter School Trends

Charter School Trends

Charter School Enrollment Trends
Company Information

**Business Model Summary**
- Provides turnkey management services to virtual and hybrid public schools (75% of revenue)
  - Presence in 29 states
- Operates online private virtual schools
  - K12 International Academy, The Keystone School, George Washington University Online High School
- Sells individual courses and associated services to schools
- Sells curriculum or individual courses to end-consumers (home schooling, summer-school course work)
- Owns curriculum (collection of teaching content and tools) under several brands (K12, A+, Aventa, powerSpeak, etc.)
- Owns proprietary Learning Management, Student Information Systems

**Ecosystem Info**
- Customers:
  - Public school districts, end-consumers.
- Competitors:
  - Turnkey Management -- Advanced Academics (DeVry), Connections Academy, White Hat Management, etc.
  - Online curriculum -- Apex Learning, Archipelago Learning, Compass Learning, etc.
  - Online private schools -- Laurel Springs School, etc.
  - Public virtual schools not utilizing turnkey management systems
- Partners:
  - Public school districts, Blackboard (LMS partnership)
- Suppliers:
  - Some third party online platform products
- Other:
  - Accreditation Agencies (to accredit their online private schools)
  - Third party test services (College board, etc.)

**Financials and Market Info**
- 98890 students (managed schools, online curriculum, private schools)
- $522M revenue, $12M net income (2011)
  - 75% from managed schools
  - (chart from Google)

**Other Notes**
- Non-virtual schools:
  - Recently acquired International School of Berne (traditional school),
  - Running some Brick and Mortar Classroom Pilots in many states
- Recent Acquisitions:
  - Kaplan Virtual Education assets, International School of Berne, The American Education Corp, KC Distance Learning (Aventa, Keystone)
<table>
<thead>
<tr>
<th>Program Component</th>
<th>K12 Inc.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Curriculum / Content</td>
<td>• 600 courses, 66,000 hours of instructional content, 700,000 media modules</td>
</tr>
<tr>
<td></td>
<td>• Brands: K12, Aventa, A+, Virtual Sage, Insight</td>
</tr>
<tr>
<td>Interactive Instruction</td>
<td>• Own teachers or teachers hired by public virtual school partners.</td>
</tr>
<tr>
<td></td>
<td>• Fully online, or hybrid (some f2f)</td>
</tr>
<tr>
<td></td>
<td>• Hiring evaluation program, training program</td>
</tr>
<tr>
<td>Curriculum Management (management of enrollment, progress, assessment. Ul for online course offering)</td>
<td>• Online School (OLS) – proprietary Learning Management System</td>
</tr>
<tr>
<td></td>
<td>• Student Administration Management System (SAMS) – proprietary Student Information System (transcripts, order processing, demographics tracking, etc)</td>
</tr>
<tr>
<td></td>
<td>• Third-party systems (Blackboard, ANGEL, eCollege, Moodle)</td>
</tr>
<tr>
<td>Student / Teacher / Parent Community</td>
<td>• thebigthinK12 – online community for students, teachers, parents, staff</td>
</tr>
<tr>
<td></td>
<td>• Parents Lounge – online parent community</td>
</tr>
<tr>
<td></td>
<td>• Assign homeroom teacher, guidance counselor and/or adviser</td>
</tr>
<tr>
<td>Accreditation (for degrees, schools, systems)</td>
<td>• Accredited by AdvancED, (NCA, SACS, NWAC)</td>
</tr>
<tr>
<td></td>
<td>• Partner public schools run by regional school districts</td>
</tr>
<tr>
<td></td>
<td>• College Board approval (Aventa’s AP programs)</td>
</tr>
</tbody>
</table>

**Business Model Summary**

- Provides a wide-range of enterprise oriented software for the entire education eco-system.
- Software licensed on an annual basis for a renewing revenue source.
- Complete range of products is key strength. Most through acquisitions.
- Professional services for start-to-end installation and training
- Acquired by Providence Equity Partners and becomes a private company again.

**Ecosystem Info**

- Customers:
  - Colleges and universities, and schools
  - Textbook publishers
  - Student-focused merchants
  - Corporate and government
- Competition:
- Suppliers:
  - None
- Partners/Alliances:
  - All major content providers (incl McGraw-Hill)
- Salesforce
- Acquisitions:
  - 2008: The NTI Group
  - 2009: ANGEL Learning Inc.
  - 2010: Self-T-Net Inc, Illuminate, Wimba, Presidium

**Financials and Market Info**

- 1998 (26 licenses) - 2010 (12,700 licenses)
- $447M revenue, $165M net income.
  - 50% - post-secondary
  - 15% - K-12
  - 17% - international
  - 18% - corporate and govt.
Pearson Publishing, Inc.

New Players in Online Education Ecosystem

<table>
<thead>
<tr>
<th>Curriculum / Content</th>
<th>Managed (Turnkey) Schools</th>
<th>Learning Management System</th>
<th>Online Private Schools</th>
<th>Others</th>
</tr>
</thead>
<tbody>
<tr>
<td>K12</td>
<td>K12</td>
<td>Blackboard (by Blackboard Inc -- founded 1997, 1700+ employees, More info [here])</td>
<td>The Keystone School (by K12)</td>
<td>Accreditation Organizations</td>
</tr>
<tr>
<td>Aventa Learning (KCDL, acquired by K12 in 2011) - AP courses</td>
<td>Advanced Academics (DeVry)</td>
<td>Pearson LearningStudio (by Pearson eCollege)</td>
<td>Apex Learning High School</td>
<td>State Governments and school districts</td>
</tr>
<tr>
<td>A+ (American Education Corp. acquired by K12)</td>
<td>Connections Academy</td>
<td>Moodle (Open Source)</td>
<td>Laurel Spring School</td>
<td></td>
</tr>
<tr>
<td>Virtual Sage (Sagemont Virtual -&gt; Kaplan -&gt; K12)</td>
<td>White Hat Management</td>
<td>Desire2Learn (&quot;founded in 1999&quot; - not much more info)</td>
<td>Stanford University Online High School</td>
<td></td>
</tr>
<tr>
<td>Insight (Insight -&gt; Apollo Group -&gt; Kaplan -&gt; K12) - targeting &quot;at risk&quot; students</td>
<td>Education Elements</td>
<td>ANGEL Learning (acquired by Blackboard in May 2009)</td>
<td>George Washington University Online High School</td>
<td></td>
</tr>
<tr>
<td>Middlebury Interactive Languages - Middlebury and K12 joint venture</td>
<td></td>
<td>OLS (Online School) (K12's proprietary LMS system).</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Khan Academy</td>
<td></td>
<td>Anywhere (American Education Corp, acquired by K12)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Traditional Textbook Companies</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Apex Learning</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Compass Learning</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Archipelago Learning</td>
<td></td>
<td></td>
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<td></td>
</tr>
</tbody>
</table>
Technology Statistics

### Tablet Shipments Worldwide, by Vendor, 2011

<table>
<thead>
<tr>
<th>Vendor</th>
<th>2011</th>
<th>% share</th>
</tr>
</thead>
<tbody>
<tr>
<td>Apple</td>
<td>40.5</td>
<td>62%</td>
</tr>
<tr>
<td>Samsung</td>
<td>6.1</td>
<td>9%</td>
</tr>
<tr>
<td>Amazon</td>
<td>3.9</td>
<td>6%</td>
</tr>
<tr>
<td>Barnes &amp; Noble</td>
<td>2.2</td>
<td>3%</td>
</tr>
<tr>
<td>Other</td>
<td>9.4</td>
<td>14%</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>65.2</strong></td>
<td><strong>100%</strong></td>
</tr>
</tbody>
</table>

Note: numbers may not add up to 100% due to rounding.
Source: IHS Suppil as cited in press release, Feb 16, 2012

### US iPad Users and Penetration, 2010-2014

<table>
<thead>
<tr>
<th>Year</th>
<th>iPad users (millions)</th>
<th>% change</th>
<th>% of total population</th>
<th>% of internet users</th>
<th>% of tablet users</th>
</tr>
</thead>
<tbody>
<tr>
<td>2010</td>
<td>11.5</td>
<td>-</td>
<td>143.9%</td>
<td>49.8%</td>
<td>28.5%</td>
</tr>
<tr>
<td>2011</td>
<td>28.0</td>
<td></td>
<td>94.9%</td>
<td>32.6%</td>
<td>24.2%</td>
</tr>
<tr>
<td>2012</td>
<td>41.9</td>
<td></td>
<td>83.6%</td>
<td>19.3%</td>
<td>16.9%</td>
</tr>
<tr>
<td>2013</td>
<td>53.9</td>
<td></td>
<td>76.4%</td>
<td>12.7%</td>
<td>19.8%</td>
</tr>
<tr>
<td>2014</td>
<td>60.8</td>
<td></td>
<td>71.2%</td>
<td>24.2%</td>
<td>68.0%</td>
</tr>
</tbody>
</table>

Note: individuals of any age who use an iPad at least once per month
Source: eMarketer, Nov 2011

### Worldwide Tablet PC Pixel Density Forecast

- 100 to 149 ppi
- 150 to 199 ppi
- 200 to 249 ppi
- 250 to 300 ppi

### International Bandwidth by Region - 2010

Source: ITU Measuring the Information Society 2011

### Broadband Penetration by Household - Q3 2011 - Top 30 Countries

Source: Data/Topic 2012
References

We have referred to a number of web sites and documents to compile this study. Below is a non-exhaustive list of web sites we referred to, organized by category.

Learning Management Systems

- Blackboard Inc
- Pearson LearningStudio
- Moodle
- Desire2Learn

Curriculum / Content

- K12 – brands such as Aventa, A+, Virtual Sage, Insight
- Khan Academy
- Compass Learning
- Apex Learning
- Archipelago Learning
- http://www.pearsoned.com/ - Pearson education

Accreditation Agencies

- Middle States Association of Colleges and Schools
- New England Association of Schools and Colleges
- North Central Association of Colleges and Schools (now part of AdvancED)
- Northwest Accreditation Commission (now part of AdvancED)
- Western Association of Schools and Colleges
- Southern Association of Colleges and Schools (now part of AdvancED)

Integrated (Turnkey) school solution

- K12 - “vertical model” - provides all pieces. Also runs own private schools.
  - 2011 Annual Report
- Education Elements - just raised $6M series A. “Hybrid learning management system” + consulting services to put the rest of the school together around it.
- Connections Academy (owned by Pearson)

Online Schools - public
• Pennsylvania virtual charter school
• Bluesky Online (Minnesota)

Online Schools - private

• Stanford University Online High School
• National Connections Academy
• Allied National High School
• Penn Foster High School
• Keystone National High School
• Christa McAuliffe Academy Online
• George Washington University Online High School

After-School Programs

• Kumon -- after-school math and reading program
• Russian School of Mathematics -- after-school mathematics program
• Sylvan Learning Center -- math, reading, writing, test-prep tutoring. Online tutoring, too
  (but business seems to focus mainly on face-to-face)
• tutor.com -- online tutoring help. Prequalified tutors. Tutoring on-demand.
• growingstars.com --
• examville.com --
• Stanford Education Program for Gifted Youth
• Johns Hopkins Center for Talented Youth Online

Others

• SnappSchool -- weekly email sent to parents, with refreshers on what their kids are learning
  in school, so that parents can help their kids with their schoolwork.
• http://www.greatschools.org/ -- various data on schools throughout the nation, and more.

Student communities and social interactions

Online schools are putting in lots of effort to plug this noticeable shortcoming of online education.
Let’s look into what’s being done, and how that’s working out...

• http://www.pavcsk12.org/student/socialization/
• http://www.connectionsacademy.com/our-program/school-community.aspx
• Stanford university online high school student clubs
• Stanford University Online High School Summer Session

News Articles

• SC Senate takes up bill that could increase public charter schools statewide
• Lawmakers loosen admissions for online charter schools as state's largest such
  school graduates biggest class
• Electronic Education: Flipping the Classroom | The Economist (on Khan Academy use in a classroom in a school in Los Altos)

Education Market Information

• National Center for Education Statistics
  ○ Digest of Education Statistics Table 100

• International Association for K-12 Online Learning
  ○ Fast Facts about Online Learning

• National Home Education Research Institute


Technology Research

  o http://www.websiteoptimization.com/bw/2012/ - broadband statistics and information
  o http://tctechcrunch2011.files.wordpress.com/2012/01/pixels-tablets1.png - tablet resolution
  o Some of the tables are from articles being published on a email distribution list
National rankings consistently place UC Berkeley’s undergraduate and graduate programs among the world’s best. Berkeley is home to top scholars in every discipline, accomplished writers and musicians, star athletes, and stellar scientists—all drawn to this public university by its rich opportunities for groundbreaking research, innovative thinking and creativity, and service to society.

The Coleman Fung Institute for Engineering Leadership, launched in January 2010, prepares engineers and scientists—from students to seasoned professionals—with the multidisciplinary skills to lead enterprises of all scales, in industry, government and the nonprofit sector.

Headquartered in UC Berkeley’s College of Engineering and building on the foundation laid by the College’s Center for Entrepreneurship & Technology, the Fung Institute combines leadership coursework in technology innovation and management with intensive study in an area of industry specialization. This integrated knowledge cultivates leaders who can make insightful decisions with the confidence that comes from a synthesized understanding of technological, marketplace and operational implications.

The Center for Entrepreneurship & Technology (CET) is an academic center and industry partnership within UC Berkeley’s College of Engineering. Its mission is to equip engineers and scientists with the skills to lead, innovate, and commercialize technology in the global economy. Through teaching, programs, network building and research interlaced with strong industry participation, the Center teaches entrepreneurship as it relates to individual venture creation and to innovation within existing entities.