From Analytics to Adaptive Learning
AN OVERVIEW OF K-12 BUSINESS MODELS & OPPORTUNITIES

Commissioned by Intel® Education UX Group

For Internal Training Only
Executive Summary

The emergence of “Big Data” and predictive analytics over the past few years has had a significant impact on many areas of daily life — from changes to the way baseball players are drafted to the way Wal-Mart sells Pop Tarts.1 In the finance field, “automated wealth managers” use algorithms to help customers manage their investment portfolios. Likewise, educators have been asking, “Could those same algorithms help students manage their learning?” As Knewton CEO Jose Ferreira put it, what could learners accomplish with the help of “a friendly mind-reading robot tutor in the sky?”2

Over the past few years, a number of factors, most prominently the adoption of software as a service (SaaS) tools for curriculum and testing, have coalesced to make the K-12 landscape ideal for learning analytics and adaptive learning systems.

The purpose of this paper is to:
• Review the landscape of education analytics and adaptive learning systems;
• Identify the key business models being employed; and,
• Determine opportunities and recommendations for Intel.

EDUCATION ANALYTICS KEY RESEARCH FINDINGS

1. Education reform in the U.S. is demanding evidence-based action

National standards and high stakes testing have put the impetus on educators to make data-driven decisions when it comes to curriculum, instruction, and remediation. The promise of learning analytics is that it can help clearly define these results, and, in many cases, can help identify next steps to improve outcomes - the “predictive” aspect of predictive analytics.

2. The funding is there.

Coming out of the last recession, in the U.S. the federal government tied school funding to reforms. The Race to the Top (RttT) Fund and Statewide Longitudinal Data Systems (SLDS) Grant Program rewarded K-12 institutions for bringing analytics into their decision-making process. Further, led by foundations like the Bill and Melinda Gates Foundation, philanthropic money has decided that learning analytics and adaptive learning systems are part of the solution to improving educational outcomes. The expansion of funding hasn't been limited to just the United States; organizations and events in Europe and throughout much of the world have focused on learning analytics in K-12.3 Lastly, evidenced by round after round of successful Series A Financing from companies highlighted in this report, the private sector is recognizing growth opportunities in learning analytics and adaptive learning and committing serious capital.

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2 https://www.youtube.com/watch?v=IjJDH_WeREQ
3 http://analytics.jiscinvolve.org/wp/
3. Schools are increasingly data-rich environments.

As technology becomes more ubiquitous across schools, more digital data has been captured based on student, teacher, and district level activity. Cloud computing has allowed individual school data to be aggregated with data across institutions and around the world, improving the potential utility of the data.

4. The technology has improved.

Not only has the amount of data exploded, so has the technology needed to store and process it all. Recent advances allow learning analytics to move from describing outcomes to providing meaningful insights into processes. Noting how analytics have helped improve other sectors, many see similar possibilities for education.

5. K-12 can learn from higher ed's experience.

Colleges and universities were the first to utilize learning management systems (“LMS”) and pilot some of the initial adaptive learning systems. While K-12 and higher-ed may be more different than alike, many companies are able to take existing systems developed for higher-ed and modify them for K-12.

BUSINESS MODEL FINDINGS

1. Business models vary, but the Freemium model is winning

A consistent struggle for most edtech companies is finding a balance between establishing a market presence and creating a consistent revenue stream. This seems to be a particularly evident pain point for companies delivering learning analytics and adaptive learning solutions. On the one hand, by offering their wares free of charge to educators, companies can quickly grow a base of teacher evangelists, happy to evangelize and “sell” the product to colleagues. On the other hand, an enterprise model establishes a consistent revenue stream, making the company more sustainable in the long term.

The freemium4 model has emerged as one possible solution. By offering a basic level of service at no cost to educators, companies can quickly grow their market share. In the long term, this established user base can “upsell” premium features to school- or district-level administrators. Edmodo is an excellent example of this model. It used its free level of service to attract over 51 million users and develop a presence in 93 of the top 100 largest US school districts.5 As a result, Edmodo is charging schools for premium services, including attractive analytics features for teachers and administrators.

Other companies have avoided directly charging educators by selling their products to other tech companies. Knewton, the adaptive learning platform provider, makes its money through partnerships with publishers and tech companies. This type of revenue model enabled Knewton to recently release their own adaptive learning system, Knewton Beta, entirely free to users, at least for the moment.

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4 https://en.wikipedia.org/wiki/Freemium
5 https://en.wikipedia.org/wiki/Edmodo
2. Partnerships and acquisitions are ubiquitous

The urgency to get into the game and not be left behind has created an atmosphere conducive to partnerships and acquisitions. As attractive as learning analytics and adaptive systems may be, most companies are not positioned to release a comprehensive solution without the help of others. LMSs, now frequently branded “Next Generation Learning Platforms”, are scrambling to be everything to everyone. D2L, maker of the Brightspace learning platform, developed a partnership with IBM to power its Analytics Insight Suite and bought the adaptive learning company, LeaP, all within the last two years. McGraw-Hill recently purchased ALEKS, an adaptive math program, and Area 9, an adaptive platform provider. IBM and Apple are partnering to bring an education app, the Student Achievement App, to market in the coming year.

3. Opportunities abound in emerging markets

Although education reform might be driving the adoption of analytics in the United States, companies are taking the trend worldwide. Examples such as the country of Uruguay adopting Schoology for their one-to-one initiative and McGraw-Hill’s recent interest in busuu, the world’s largest social network for language learning, demonstrate that companies see tremendous growth opportunities as the developing world comes online.

4. Personalized learning is big business

These days, there are not many education buzzwords trendier than personalized learning. Recognizing that a “one-size-fits-all” approach to teaching cannot reach all learners, educators have turned to technology as a powerful partner in adapting learning activities to individual student needs. Edtech companies have quickly jumped on board, providing products and services that claim to help inform decision-making across multiple school levels. Companies mine data in Student Information Systems to predict which students are at risk of dropping out and LMS dashboards give teachers a clear view of what learning looks like for each individual student to help teachers choose the best instructional approaches.

Adaptive learning systems promise to take personalization one step further by automating tasks traditionally reserved for teachers, from choosing content to providing just-in-time support. These systems are gradually transitioning from linear, rules-based systems to more complex, algorithm-based systems able to base decisions on more and more data events. The reality is that these systems commonly provide much more basic levels of adaptivity — assessing student progress, making content suggestions, and reporting progress to teachers. It’s hard to tell how quickly more comprehensive systems could be adopted into the mainstream. Does the recent release of systems like Knewton Beta indicate the future or just more hype?

One thing is certain; tech companies are excited about and committed to supporting personalized learning. At the start of September 2015, Facebook, partnering with a charter school organization, released its own personalized learning software. Summarizing the allure of personalization to tech companies, a Facebook press release reported that their software will “create a classroom experience that’s centered around students’ ambitions that takes advantage of all the technology and information accessible to a kid growing up today.”

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CONCLUSION

In the process of researching and writing the paper, we identified areas of opportunity in the learning analytics and adaptive learning systems industry. Each opportunity below is paired with at least one recommendation for Intel to consider.

Opportunities

A. Companies like Brightbytes have made a business by producing actionable insights from small amounts of targeted data. As the amount and diversity of data increases, similar opportunities could arise.

Recommendation(s):
1. Analyze opportunities for creating analytics engines/APIs that integrate with Google Classroom (or other LMS tools). For instance, Google’s class management system doesn’t incorporate learning analytics and given the high volume of Chrome OS devices sold with Intel inside this could be a key differentiator.

B. Opportunities for partnerships and acquisitions abound. Apple and IBM have partnered to produce a high profile education app, LMSs seek to quickly add features through acquisitions of other products or partnerships, and publishers actively partner with adaptive learning platforms to improve content.

Recommendation(s):
1. Expand the Intel-Microsoft relationship similar to what Apple and IBM are developing with their “Student Achievement App.” Microsoft is losing ground in an increasingly competitive education field. Intel could provide analytics support for products like School Information Sync, Class Dashboard, or within notebooks created by OneNote Class Notebook Creator.
2. Deepen relationships with publishers. Bring analytics and adaptive solutions from publishers into Intel Study rather than creating two separate silos of data (publisher and Intel Study). Some publishers, notably Houghton Mifflin Harcourt are increasingly open to having their content reside in another publisher’s LMS. Consider how to capitalize on OER content within Intel Study to add analytics components.
3. Partner with existing companies like Dreambox and bundle an integrated Intel Study and other adaptive systems in the sales of Intel purpose-built devices.

C. Adaptive math systems are much more common than language arts and other subjects. The market seems to be open to other subject area adaptive curricula. Adaptive learning apps include Content, Access, Application, Analytics, and Reporting features. By adding analytics and reporting, adaptive learning systems go beyond personalized learning and differentiate themselves from general consumer apps.

Recommendation(s):
1. Develop a curriculum (or model approach) for some other subject area (i.e., science, technology, maker, etc.) similar to Amazon’s TenMarks math curriculum.

D. Adaptive learning apps include Content, Access, Application, Analytics, and Reporting features. By adding analytics and reporting, adaptive learning systems go beyond personalized learning and differentiate themselves from general consumer apps.

Recommendation(s):
1. Fortify analytics and reporting features inside of Intel Study to ensure it is more than a basic eReader such as Kindle Reader.

E. Some companies like MasteryConnect have made their business by accomplishing a narrowly defined task well. The model here is that it is not about how comprehensive a product is but how well it accomplishes one or two specific tasks.

Recommendation(s):
1. Develop Intel Study to deliver high-value features. Ensure Intel Study includes:
• Standards alignment; or,
• Teacher, Student, and Parent dashboards with actionable data

F. Adaptive learning systems will soon be integrating affective data events.

Recommendation(s):
1. Develop Intel RealSense to capture unique data events from students during the process of learning. Examples include time-on-task and emotional response to content.
2. Include RealSense data in Intel Study and “sell” RealSense integration to other companies.

BUSINESS MODELS

<table>
<thead>
<tr>
<th>FREE</th>
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<tbody>
<tr>
<td>Free to educators, these companies have to seek revenue from other sources, including philanthropic, government, and/or private.</td>
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</table>

<table>
<thead>
<tr>
<th>SELL TO TECH COMPANIES</th>
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<tbody>
<tr>
<td>These companies charge other tech companies to integrate with their platform or service, allowing them to offer their product free of charge to schools and teachers.</td>
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</table>

<table>
<thead>
<tr>
<th>FREEMIUM</th>
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<tbody>
<tr>
<td>Freemium models use a tiered payment system offering a portion of its product free of charge, then charging for the use of premium features.</td>
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<tr>
<th>ENTERPRISE</th>
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<tr>
<td>Paid models charge annual subscription fees on a per student or per institution basis. Some offer short-term free trials or sandboxes to attract users.</td>
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<tr>
<th>PROS</th>
<th>CONS</th>
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<th>PROS</th>
<th>CONS</th>
<th>PROS</th>
<th>CONS</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Fosters positive branding in market</td>
<td>• No clear path to sustained revenue</td>
<td>• Consistent source of revenue without charging cash-strapped educators</td>
<td>• Tech companies might develop independent solutions</td>
<td>• Exposes educators to product while maintaining a path to revenue</td>
<td>• Challenging to convince educators of value of premium features</td>
<td>• Schools may have money to spend on analytics/adaptive learning solutions</td>
<td>• May not have educator “buy-in” to product</td>
</tr>
<tr>
<td>• Naturally creates educator evangelists for product</td>
<td>• Doubt about viability in the long term</td>
<td>• Difficult to transition to Freemium/Paid model</td>
<td>• No direct line to educators</td>
<td>• Creates larger market share numbers through single teacher implementations</td>
<td>• Educators not inclined to pay for features that were once free</td>
<td>• Larger marketing strategy needed to ‘sell’ product</td>
<td></td>
</tr>
<tr>
<td>• No barriers to entry</td>
<td>• • Consistent source of revenue without charging cash-strapped educators</td>
<td>• • Consistent source of revenue without charging cash-strapped educators</td>
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<td>• • Consistent source of revenue without charging cash-strapped educators</td>
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</tbody>
</table>

MODEL COMPANIES

| Learn Sprout, Khan Academy, CK-12, Knewton, ClassDojo | Learn Sprout, Knewton | Schoology, Edmodo, TenMarks, MasteryConnect, ClassCharts | Brightbytes (Clarity), D2L (Brightspace), Canvas, Dreambox Learning, Achieve3000, McGraw-Hill (ALEKS, LearnSmart), Pearson (myLab), HMH (Go Math!), Triumph Learning (Waggle) |
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  5. K-12 can learn from higher ed's experience.  

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Brightspace Learning Analytics  
Brightspace Adaptive Learning Solutions  
Canvas by Instructure  
 Schoology  
 Edmodo  
 Classroom Apps with Analytics  
 MasteryConnect  
 Behavior Analytics Apps  
 Student Achievement App  

Overview  
 Cognitive Tutor  
 ALEKS  
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 What’s Next in Adaptive Learning Systems: Opportunities for Growth  

ALEKS Implementation Purpose  
 ALEKS Implementation Strategy  
 What users have to say  
  - Scenario #1: Baywood Learning Center  
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Changing the Culture of Data Use in Delaware: How State Leaders Used Analytics to Create Education Policies That Matter  

Introduction

ORGANIZATIONAL OVERVIEW

The field of learning analytics is large and complex. Multitudes of companies are providing a wide variety of products and services to meet the needs of an array of educational institutions. In a 2012 policy brief on learning analytics in higher education, UNESCO's Institute for Information Technologies in Education (IITE) categorized the sector into three distinct levels: macro-, meso-, and micro-levels.

Analytics Levels

<table>
<thead>
<tr>
<th>MACRO-LEVEL</th>
<th>MESO-LEVEL</th>
<th>MICRO-LEVEL</th>
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<tbody>
<tr>
<td>District, state, or regional level</td>
<td>Classroom or school level</td>
<td>Student level</td>
</tr>
<tr>
<td>Services and products at this level help identify trends to inform decisions across multiple institutions.</td>
<td>These solutions, including both LMSs and a variety of stand-alone educational apps, provide teachers and site-level administrators with insights about what learning looks like across a school.</td>
<td>Adaptive learning systems that use data to tailor learner paths to the needs of the actual &quot;end-users&quot; in education</td>
</tr>
</tbody>
</table>

1 UNESCO IITE Policy Brief, Learning Analytics, November 2012
Note that while this structure can help organize learning analytics companies and products, it is not meant to be concrete. Products and services frequently blur the lines between levels. For example, an LMS can simultaneously inform superintendents with data on content mastery district-wide, help teachers create their instructional plan for the next day, and provide personalized content for individual learners.

Additionally, effective use of analytics in education relies on complete integration of systems and policy across all three levels. Historically, education systems have relied on macro-analysis to set policy from the highest levels. However, the recent proliferation of “smart” technology in the hands of students and teachers in the micro- and meso-levels has the potential to turn the system on its head. As the number of data events captured increases, so too does the complexity of the analytics needed to derive meaningful insights. Yet at the same time, this increased data creates a more balanced approach to setting policy by better informing decisions across all three levels.
Macro-Level: District-Level Learning Analytics

OVERVIEW

Education is rapidly transforming from a data-poor to a data-rich enterprise. Abundant data can provide evidence for making enterprise-wide decisions, but only when thoughtfully analyzed. At the district level, administrators must make timely decisions to improve the teaching and learning happening in schools and classrooms. By linking various types of data and applying sophisticated analytic techniques, district leaders can take actions that positively impact outcomes down to the student level.

Increasingly, new technologies capture extremely fine-grained data, providing opportunities for uncovering patterns and trends at the macro-level. Some school districts are exploring ways of aggregating and analyzing data from multiple sources, including administrative data, SISs, and events in learning management and digital learning systems. This “in-school” data can be combined with data from agencies outside school such as the juvenile justice system, the foster care system, or youth development programs to amass evidence for “early warning” systems. Using “predictive analytics,” districts can equip school leaders and teachers with timely support for targeted interventions that meet the needs of students identified as “at-risk.”

Companies are now recognizing that they can adapt business enterprise solutions to serve the education market. As a result of federal investments, more and more states have the necessary infrastructure in place at the district level to take advantage of these new products offered by private companies. In recent years, government grants have provided the engine for this improvement of data warehousing and analytics capabilities. The Statewide Longitudinal Data Systems (SLDS) Grant Program provides funding, services, and resources to help states manage education data, including individual student records. Between 2005 and 2012, 47 states, the District of Columbia, Puerto Rico, and the Virgin Islands have received at least one SLDS grant. 2 A related grant program, Race to the Top (RttT), assists states in making reforms, including “building data systems that measure student growth and success, and inform teachers and principals about how they can improve instruction.” Eighteen states and the District of Columbia received RttT grants totaling $4.1 billion. 3 For more information about how these funds have supported the use of analytics to influence and guide education reform at the state and district level, see the case study about Delaware’s partnership with Harvard’s Strategic Data Project included at the end of this report.

Many private companies offer to help states and districts collect, store, analyze, and visualize educational data. Other companies provide tools to developers creating software that integrates with the data systems used by schools and districts. Several examples of these tools appear in the section below.

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3 https://www.whitehouse.gov/sites/default/files/docs/settingthepacetreport_3-2414_b.pdf

BrightBytes
At a Glance

<table>
<thead>
<tr>
<th>COMPANY NAME</th>
<th>BrightBytes</th>
</tr>
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<tbody>
<tr>
<td>VALUE PRODUCT(S)</td>
<td>Clarity</td>
</tr>
<tr>
<td>PRICING MODEL</td>
<td>Annual subscription fee</td>
</tr>
<tr>
<td>NOTES OF INTEREST</td>
<td>Used by 1 in 5 US schools with a 98% renewal rate; uses pen and paper survey to gather data on technology use.</td>
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</table>

Founded in 2012, BrightBytes is a San Francisco-based company that builds online knowledge management platforms helping school administrators and leaders make better decisions. The flagship platform, Clarity, provides analysis of a school or district’s technology use and its impacts on learning outcomes. The data set comes from a 15-minute survey completed by students, teachers, and parents. Clarity makes specific recommendations from the data, based on input from BrightBytes’ team of educational researchers, school practitioners, and statisticians.
BrightBytes users pay for access to Clarity with an annual subscription fee determined by the number of students enrolled in a school or district. For the Northwest Service Cooperative in Minnesota, BrightBytes signed a contract offering Clarity for a “discounted annual fee” of $0.70/student. For districts wishing to upgrade to Clarity Pro (which includes parent surveys), they would have to pay an undisclosed additional per student fee, based on their student enrollment.4

According to their website, BrightBytes is working with 1 in 5 US schools, although this might not mean directly. In many cases, BrightBytes contracts with states or districts, rather than individual schools. In July 2015, BrightBytes announced a $33 million Series C financing. The capital will be used, in part, to continue globalization of its customer base.5

STUDENT INFORMATION SYSTEMS (SIS) LEARNING ANALYTICS

LearnSprout

At-a-glance

<table>
<thead>
<tr>
<th>COMPANY NAME</th>
<th>LearnSprout</th>
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<tbody>
<tr>
<td>VALUE PRODUCT(S)</td>
<td>LearnSprout Dashboard</td>
</tr>
<tr>
<td>PRICING MODEL</td>
<td>Free to schools and districts</td>
</tr>
<tr>
<td>NOTES OF INTEREST</td>
<td>Used by over 2,500 schools in 200 districts across 42 states; integrates with SIS systems</td>
</tr>
</tbody>
</table>

LearnSprout is a San Francisco-based company that helps schools and districts to visualize and analyze data collected in SISs. One tool developed by LearnSprout lets school administrators see which day of the year students are most likely to be absent. Another tool correlates grades and attendance behavior to help identify high school students at risk of dropping out.

LearnSprout provides its tools for free to schools and districts. The company earns its revenue from developer partners using the LearnSprout Connect API to integrate their software with a school or district's SIS. In 2014, Pearson partnered with LearnSprout to make LearnSprout Dashboard available in the Powerschool SIS. With this utility, Powerschool users can analyze and interpret student performance data for free.

4 [http://www.nw-service.k12.mn.us/cms/lib02/MN01000650/Centricity/Domain/25/Clarity%20Flyer%20and%20Order%20Form%20Fall%202013.pdf](http://www.nw-service.k12.mn.us/cms/lib02/MN01000650/Centricity/Domain/25/Clarity%20Flyer%20and%20Order%20Form%20Fall%202013.pdf)
Open Source SIS

Companies that provide open source information management systems also offer data analytics products. **OpenSIS** offers education analytics and business intelligence software called openIntel to school districts. The software can predict if schools are going to meet Adequate Yearly Progress (AYP) goals. In 2013, Foradian Technologies, a provider of enterprise software solutions for the education sector, released an API that allows users to run analytics on data collected in their open source school management software, **Fedena**. Fedena is being used in over 40,000 schools, including 15,000 government-run schools in India, as well as South America and Africa.

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7 [http://www.newindianexpress.com/magazine/article542565.ece](http://www.newindianexpress.com/magazine/article542565.ece)
Meso-Level: School and Classroom Focused Learning Analytics

OVERVIEW

Meso-level analytics focus on guiding decisions at the institution or building level. Learning analytics at this level can help provide a more transparent view of the successes and challenges in schools and classrooms. For teachers, they provide a window into what learning looks like in their rooms, helping them make choices about their next instructional steps for individual students or whole classes. In addition, analytics at this level can help communicate student performance in meaningful ways to important stakeholders like parents. For administrators, meso-level analytics can help them visualize trends, guide important decisions about where to allocate financial and human resources, and steer the direction of the entire school.

LMSs are one obvious example of learning analytics in the meso-level. LMSs generate countless data events each day with tremendous opportunities for analysis. In addition to the analytics in LMSs, the analytics involved in educational apps, such as ClassDojo and MasteryConnect, can not be ignored. As the number of teachers and students using educational apps increases, so too does the data these apps capture.

LEARNING MANAGEMENT SYSTEMS

LMSs have long been considered essential in the higher education sector, with approximately 95% of US higher education institutions adopting some system. Their prevalence in K-12 education, however, is still in its developmental stage. Instructure CEO Josh Coates describes the K-12 market as more like the “Wild West.” While there is substantial excitement towards the topic as technology devices become increasingly ubiquitous across K-12 districts, adopting an LMS can still be viewed as optional. LMS companies are starting to use analytics, and in some cases adaptive learning solutions, to portray LMSs as systems which K-12 stakeholders can no longer ignore.

We will not cover every LMS in this section. Instead, we have chosen to highlight LMSs that provide a comprehensive cross-section of the industry covering the following variables:

• Target Audience
  While all LMSs in the section serve the K-12 market, some are more geared towards higher education than others. Others were developed specifically to fit the needs of K-12 institutions.

• Business models
  LMS companies operate on a range of business plans. Some target district-wide adoptions and sell their services directly to decision makers at the administration level. Others use

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free access to basic levels of service to generate enthusiasm for their platform among teachers. In general, LMS companies tend to charge for premium features like analytics and adaptive learning tools. Fees are usually assessed per user and range from $3 to $10 annually depending on the size of the deal.

- **Learning analytics and adaptive learning solutions**
  LMSs offer a wide range of learning analytics and adaptive learning solutions. Some attempt to provide the services covered in the macro-level section of this paper while others focus on providing much more modest analytics useful to a classroom teacher or school-level administrator.

**Brightspace by D2L**

**At-a-glance**

<table>
<thead>
<tr>
<th>COMPANY NAME</th>
<th>D2L</th>
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<tbody>
<tr>
<td>VALUE PRODUCT(S)</td>
<td>Brightspace LMS</td>
</tr>
<tr>
<td>PRICING MODEL</td>
<td>Enterprise subscription (fee per user)</td>
</tr>
<tr>
<td>NOTES OF INTEREST</td>
<td>Integrates both analytics and adaptive learning into its platform; relies heavily on acquisitions and partnerships to build comprehensive platform</td>
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Founded in 1999, D2L was originally called Desire2Learn. The company changed names in 2014, renaming their LMS as Brightspace at the same time. According to D2L CEO John Baker, Brightspace is more than the average LMS featuring a content library and a grade repository. Similar to the trend of LMSs referring to themselves as Next Generation Learning platforms, he refers to Brightspace not as an LMS, but as an Integrated Learning Platform (ILP). According to Baker, it's poised to address “the biggest challenges there are for education — everything from improving retention rates to improving graduation rates to helping people accelerate their learning to really getting students engaged and inspired to driving adoption.”

Fusion, the latest version of Brightspace was just released at D2L's 2015 summer conference. It features improved features to help teachers and administrators analyze student progress as well as personalize student learning. It also includes a new analytics suite called Brightspace Insights, discussed below.

**Brightspace Learning Analytics**

At their recent conference, D2L unveiled the Brightspace Insights Analytics suite that includes the following features:

- **Student Success System (S3):** Predictive analytics identify trends in student behavior and help educators make timely interventions
- **Brightspace Data Platform:** The centralized platform aggregates additional data points, including transmissions from **IMS Caliper learning events** from sources like Microsoft OneNote and Kaltura Video Platform

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• Near-real-time updates: The analytics suite aggregates data hourly

In July 2014, D2L announced a partnership with IBM to help power their analytics suite. D2L now uses IBM’s Cognos business intelligence engine to provide information on “key learning outcomes, student engagement and enrollment metrics, and student grades data.” In addition, the platform uses IBM Cognos features to help with data visualizations provided to end-users in the Brightspace Learning Analytics Suite.

In 2013, D2L also purchased Degree Compass, a tool that uses predictive analytics to help college students graduate on schedule by choosing courses in which they will be successful. While currently targeting higher education, Degree Compass is included in the Brightspace bundle and this type of predictive analytics might be incorporated into K-12 systems more and more.

Brightspace Adaptive Learning Solutions

When D2L acquired Knowillage in September 2013, the company added an adaptive learning platform to their list of services. Knowillage's product, Learning Path (LeaP), now plays a central role in Brightspace and promises to personalize learning for individual students. Under D2L's direction, LeaP incorporates standards alignment through the Achievement Standards Network, also recently acquired by D2L. Teachers select learning objects, then LeaP scours the content library as well as open education resources to create learning pathways for individual students that are modified and updated based on student performance.

Business Model

Given their focus on learning analytics and adaptive learning at their recent conference, D2L clearly considers the two topics to be integral to Brightspace's success. To that end, D2L will go about purchasing companies or partnering with companies that can help them achieve their goal. Interestingly, two of their recent acquisitions were funded by philanthropic and/or government money. Degree Compass was built by Austin Peay State University and “played a central role in Tennesse’s successful Completion Innovation Challenge application, which received a $1,000,000 award from Complete College America and the Gates Foundation...” Additionally, the Achievement Standards Network, now operated by D2L, was funded in part by the National Science Foundation and the Gates Foundation.

D2L offers a free 30-day trial of Brightspace, but there is no free level of service. They are clearly marketing towards buyers at the district or state administration level to purchase their product and not individual teachers. The core level of service includes:

• Brightspace Learning Environment
• Brightspace ePortfolio
• Brightspace Learning Repository

• Brightspace Insights
• Brightspace LeaP
• Brightspace Degree Compass

Exact pricing is not available on the Web site. Additional “complementary” products, such as the Brightspace Binder and Brightspace Assignment Grader, extend the usefulness of Brightspace and are available as additional purchases.

Market Share

According to D2L, the company is working with more than 1,100 clients and 13 million learners worldwide. These numbers include K-12 schools, higher education, government, and enterprise sectors. D2L has been maintaining a stable 9% market share in the higher education sector and boasts a 98% client retention rate. D2L, a Canadian company, operates globally with offices in the United States, Canada, Europe, Australia, Brazil, and Singapore and offers online chat and support in Spanish and Brazilian Portuguese.

Recent large-scale K-12 deployments of Brightspace in the United States include:

• Bellevue School District,
• Oxnard Union High School,
• WHRO, (a consortium of 17 public school division in eastern Virginia),
• Upper Canada District School Board, and
• West Virginia Department of Education.

D2L does sell access to some of its analytics tools independent of the Brightspace platform. The adaptive learning platform, LeaP, integrates with different LMSs including Canvas and Blackboard. Degree Compass, the predictive analytics tool, is also available as a stand alone product to universities.

Canvas by Instructure

At-a-glance

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<tr>
<th>COMPANY NAME</th>
<th>Instructure</th>
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<tr>
<td>VALUE PRODUCT(S)</td>
<td>Canvas</td>
</tr>
<tr>
<td>PRICING MODEL</td>
<td>Enterprise subscription (fee per user)</td>
</tr>
<tr>
<td>NOTES OF INTEREST</td>
<td>Quickly gaining market share; analytics provided through Canvas Data</td>
</tr>
</tbody>
</table>

Launched by Instructure in 2011, Canvas is an LMS aimed at making teaching and learning easier for students and teachers. One of its most alluring qualities is its friendliness to the average teacher compared to other LMSs that might appear cumbersome or hard-to-learn. On the opposite side, some users have complained that Canvas is not as robust as some of the other, more established LMSs. The Canvas LMS includes many of the features that teachers have come to expect, including student and teacher dashboards, content editors and creators, assignment graders, integrated digital tools and apps, and collaboration and discussion features. Because Canvas is open source, tech savvy educators and IT staff can use the source code to build the specific features they need.
Analytics

Instructure has recently added a number of learning analytic tools to Canvas. Their Learning Mastery Gradebook allows teachers to monitor student progress by standards not grades. A number of different views and data visualizations make this information easily accessible to all stakeholders involved, including teachers, administrators, students, and parents.

In June 2015, Instructure announced the release of Canvas Data. Canvas Data is a cloud-based data optimization service delivered through Amazon Redshift, a fully managed data warehouse. According to Instructure, Canvas clients create more than 35 million education-related events each day. Canvas Data gives Canvas users the ability to access this online teaching and learning data in a “streamlined format optimized for queries and reports” making the analytics process more efficient.\(^\text{18}\)

Canvas also partners with Civitas Learning to provide predictive analytics and uses Intellify as the learning intelligence for its data service. Both Civitas and Intellify appear to predominantly service higher education. At this point, only a handful of higher education institutions have early access to Canvas Data. While this makes it seem like higher education is definitely the target audience for Canvas Data, it is available to K-12 institutions in their bundled purchase of Canvas.

Business Model

In an interview, CEO Josh Coates discussed creating growth with a balance of internal homegrown additions to the LMS alongside larger acquisitions. Acquisitions allow LMSs to quickly add the features users want, but they can lead to bloated, piecemeal systems. As opposed to D2L, Instructure has seemed more reticent to use acquisitions to build Canvas. Now that Instructure appears to be on the path to an IPO, rumors are starting to circulate about a possible large acquisition. Although it didn’t happen, rumors were circulating early this year that Instructure might purchase Pearson PowerSchool.\(^\text{19}\)

Canvas seems to operate on a similar business model to Brightspace, targeting district, educational service districts, or statewide adoptions. They offer a two-week free trial with sample content and classes for interested parties to use as a sandbox. After the trial, price is negotiated based on "size, training, support, and other localized factors."\(^\text{20}\) Canvas also advertises a simplified fee structure including a one-time implementation fee and an annual subscription fee based on the total number of users.

For an approximation of pricing, North Carolina negotiated a $3.74 per account price for all schools in North Carolina, based on 28,000 users. North Carolina is using Race to the Top (RttT) money in the 2015-16 school year to bring this cost down to $1 per user for schools in its districts. Instructure charges an initial fee of $12,000 per Canvas implementation in the state of North Carolina.\(^\text{21}\)


\(^{20}\) [https://www.dropbox.com/s/s6fm9qjb55lfcd/DEE-Android-Compete-Screencast-v2.m4v?dl=0](https://www.dropbox.com/s/s6fm9qjb55lfcd/DEE-Android-Compete-Screencast-v2.m4v?dl=0)

\(^{21}\) [http://www.nhcs.net/board/2015/June/AppendixO.pdf](http://www.nhcs.net/board/2015/June/AppendixO.pdf)
Although Canvas is geared toward top-down purchases, meaning purchases originating at a district or higher level, Instructure does reach out to individual teachers to build interest in their product. Canvas is free for teachers to set up accounts, create courses, and add students. This allows teachers to become familiar with the platform before a school- or district-wide adoption.

Market Share
Since appearing in the LMS landscape in 2011, Canvas has steadily gained market share in both higher education and K-12 sectors. Canvas recently overtook competitor Brightspace to hold over 12% of all higher education institutions. Numbers in the K-12 market are much less transparent, but in late July, Canvas announced several large K-12 adoptions including the following:

• WSPIC: Consortium of Washington State Educational Service Districts and school districts representing 730,000 students in over 1,500 schools

• Texas Region 11: Education service center serving 550,000 students across 77 districts in the Dallas-Fort Worth Area

• State of North Carolina: Contract to provide negotiated pricing statewide to all interested school districts

In September, Canvas announced the following news about K-12 adoptions in Indiana:

• More than 70 new Indiana K-12 institutions adopted Canvas in the last five months

• Indiana now has 80 school districts and institutions using the Canvas LMS

• Nearly 400,000 Indiana students and teachers are transitioning to Canvas

Schoology
At-a-glance

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<thead>
<tr>
<th>COMPANY NAME</th>
<th>Schoology</th>
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<tr>
<td>VALUE PRODUCT(S)</td>
<td>Schoology LMS</td>
</tr>
<tr>
<td>PRICING MODEL</td>
<td>Freemium; paid subscriptions for premium features and whole school integration</td>
</tr>
<tr>
<td>NOTES OF INTEREST</td>
<td>Popular K-12 LMS; engaging, intuitive dashboards for students and teachers</td>
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Like Canvas, Schoology is a LMS on the rise. It offers many of the traditional LMS features including dashboards, instructional and productivity tools, group workspaces, gradebooks, and mobile platforms. It also includes some built-in analytics features. What sets Schoology apart, however, is its focus on the K-12 market and its “from-the-ground-up” strategy for growth.

Analytics

Compared to some other LMSs covered, Schoology's analytics offerings may seem somewhat slim. It does not offer an in-house adaptive learning solution, and its analytics tools do not approach the macro-level of the Brightspace Analytics Insights Suite or Canvas Data. However, Schoology does include some analytics features that can be extremely helpful to individual teachers and school level administrators:

- Course analytics: Gauges student engagement through performance on assignments and participation in online coursework and discussions
- Assessment analytics: Tracks student performance on tests and quizzes question-by-question and curates a standard mastery gradebook
- Comprehensive or Individualized data: Displays both comprehensive results for an overall view of performance class- or system-wide as well as in-depth individual student reports
- Historical Student Data: Brings in student data from previous Schoology courses to provide an enlarged view of student activity
- Easy to understand: Simplifies data into readable, yet effective, dashboard views

While course analytics are available in the Basic Package (free for instructors), the more comprehensive analytics are only available in the Enterprise Package (fee per user).

At the enterprise level, Schoology works with individual schools to bring in the programs they need, including learning analytics and adaptive learning solutions. Schoology can integrate with any of IMS Global Learning’s approved applications, including adaptive learning platforms like D2L's LeaP or McGraw-Hill’s Adaptive Math Program, ALEKS.

Business Model

As apparent in the reviews on Graphite, Schoology is extremely popular among teachers. Schoology is very teacher-friendly by design. Its easy-to-use interface is quick for teachers to add to their toolkit. Schoology includes a social teacher network enabling teachers to connect across the globe. And, perhaps most importantly, Schoology is completely free for the individual teacher.

Schoology has capitalized on a “freemium model.” By attracting a mass of individual teachers to its LMS with its free Basic Package, Schoology has brought their product into the mainstream. The logical next step for many schools and districts is to institutionalize the LMS that teachers are already using and upgrade to Schoology's Enterprise Package. The Enterprise Package “gets the individual users the components they need — aggregated calendars, web hosting, SIS integration — to become a true professional learning community.”

Pricing for the Enterprise Package is negotiated on a per user basis. For the 2014-15 school year, the standard rate appeared to be $10 per user. Typically, the standard rate is discounted by 20 to 40 percent, based on student enrollment. Consistent with others in the industry, Schoology also charges a one-time setup fee of $1,500 and additional fees for professional development.

Market Share

As of late 2014, Schoology reported over 7.5 million users across 60,000 schools in almost 200 countries. Schoology serves both K-12 and higher education institutions, but the LMS was primarily developed for the K-12 market. This sets Schoology apart from the LMSs covered earlier that originally targeted only higher education.
Because it is available to teachers for free, individual teachers may choose to use Schoology even in the presence of another school- or district-adopted LMS. This vastly increases the total number of Schoology users, even though their number of district-wide adoptions might appear more limited.

Schoology has a number of large K-12 adoptions including the following examples:

• Delaware signed on with Schoology to power online and blended learning with 40,000 students in the 2015-16 school year and additional districts are planning on adopting the LMS in subsequent years.

• Uruguay selected Schoology as the LMS for their country’s 1:1 learning initiative.

SCHOOLOGY WINS IN URUGUAY

In 2007, Uruguay began its model laptop program, Plan Ceibal, to teach students foreign language and technology skills. Plan Ceibal first addressed the technical infrastructure by distributing 620,000 laptops, one for every student and teacher in public education, and providing Internet in all educational institutions. The next step, according to Miguel Brechner, President of Plan Ceibal, was “investing in tools for better pedagogy and better learning.”

Uruguay adopted Schoology in 2014, believing it would bridge the gap between pedagogy and technology. In addition, Uruguay cited two specific reasons for choosing Schoology:

• Schoology’s “intuitive, modern interface” is engaging for students and minimizes training time for staff.

• Its platform includes multiple languages: Spanish, English, and others.
Edmodo

At-a-glance

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<thead>
<tr>
<th>COMPANY NAME</th>
<th>Edmodo</th>
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<tbody>
<tr>
<td>VALUE PRODUCT(S)</td>
<td>Edmodo LMS and social network</td>
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<tr>
<td>PRICING MODEL</td>
<td>Freemium</td>
</tr>
<tr>
<td>NOTES OF INTEREST</td>
<td>Increasingly like an LMS; Snapshot tool analyzes achievement by standards</td>
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</table>

Edmodo refers to itself as a social network, not an LMS, providing students a place to safely interact in classroom discussions under close supervision of teachers and allowing parents to track their child's progress. Teachers can use Edmodo not only interact with students in their own classrooms, they also can connect and share resources with other educators around the world.

Edmodo has recently been building out their features to make their platform even more robust including Edmodo Sync, a single sign-on feature. In addition, it has been adding some learning analytics capabilities. These new features move Edmodo far beyond its original idea of a social network for students. As Edmodo has gradually added more and more features, for all intents and purposes, Edmodo is an LMS, one platform to manage student learning. Teachers can now curate content and manage assignments, while their students can access content, manage their online learning, and run apps.

Learning Analytics

Edmodo's analytics focus on giving teachers an in-depth look at student learning and administrators an overall view of what learning looks like across a school.

- Snapshots: Released in 2014, Snapshots assesses student mastery of Common Core State Standards through short, customizable quizzes. Data visualizations allow teachers to view performance by student or by class, making it easy to determine next instructional steps.

- Insights for Admins: Administrators can measure engagement with information on number of posts, assignments, and more to understand at-a-glance what is happening in classrooms across their schools.

Business Model

From its launch in 2008 until 2014, Edmodo was completely free. Like Schoology, Edmodo used a ground-up strategy to grow their business, giving away their platform to teachers. Now that so many teachers domestically and internationally are using the tool, Edmodo is starting to make a push into generating revenue from subscriptions.
Edmodo now operates on the “freemium” model. Its basic services remain free to individual teachers, but schools and districts can purchase premium features. Unlike some other LMSs that charge fees on a “per student” basis, Edmodo charges an annual fee per school to access the following features:

• Edmodo Premium: Includes additional features such as unlimited Snapshot with progress monitoring for standards-based assessment, Insights for Admin, and prioritized support ($2500 per school per year)

• Edmodo Sync: Integration into the district’s user directories for single sign on ($500 per school per year with volume discounts)

• Edmodo PD: In-person professional development ($2,500 for one day of training)  

Market Share

Like Schoology, Edmodo specifically targets K-12 institutions. Its founders, two former K-12 employees, built Edmodo upon their realization that LMSs created for higher education did not fit the requirements of the K-12 market. As of the winter of 2015, Edmodo had 47 million users and operated in over 300,000 schools worldwide and in 93 of the top 100 largest school districts in the United States. To get a sense of its growth rate, Edmodo had only 1 million users in 2010, before growing to 15 million users in 2012 and 35 million users in 2014.

CLASSROOM APPS WITH ANALYTICS

Analytics in the meso-level are not just limited to LMSs. A large number of educational apps also aim to enable educators to improve their instruction with real-time analytics on student achievement and behavior in their classrooms and schools.

With some exceptions, the companies that create these apps tend to start as small startups. They concentrate on building enthusiasm in the teacher community with free products that use analytics to help make the job of managing learning in the classroom easier. Instead of generating revenue from their users, these app companies seek private funding, at least initially. Once the user-base and demand for their product is established, the company might consider charging users for premium features. A great example of a company following this type of business plan is Salt Lake City-based MasteryConnect.

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28 http://gettingsmart.com/2015/02/edmodo-adds-premium-enterprise-features/
29 http://www.wired.com/2014/06/edmodo/
MasteryConnect

At-a-glance

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<tr>
<th>COMPANY NAME</th>
<th>Mastery Connect</th>
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<tbody>
<tr>
<td>VALUE PRODUCT(S)</td>
<td>Socrative, Student Mastery Reports</td>
</tr>
<tr>
<td>PRICING MODEL</td>
<td>Freemium</td>
</tr>
<tr>
<td>NOTES OF INTEREST</td>
<td>Helps teachers align student performance to standards</td>
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</table>

MasteryConnect's goal is to transform how teachers assess student learning. Instead of assigning traditional grades that do not provide specific information about what students know and are able to do, MasteryConnect aims to link student performance to specific standards, giving educators, students, and parents much more insightful, actionable data reporting.

MasteryConnect includes the following analytics features:

• Common Assessments: One of the original and most popular features of MasteryConnect lets teachers create and share assessments linked to Common Core State Standards. When an entire school or district adopts MasteryConnect, teachers can easily “compare and collaborate around data driven by common assessments.”

• Socrative Instant Response: This mobile and web-based instant response system aims to increase student engagement and give teachers real-time formative data on student understanding. MasteryConnect purchased the Massachusetts-based platform for $5 million dollars and stock in June of 2014.

• Student Mastery Reports: MasteryConnect released its own mastery reporting system in the summer of 2014 after a successful pilot program in a Missouri school district. According to a Business Wire press release, “The Mastery Report Card looks more like a Google Analytics dashboard than the traditional letter grade format, with circle graphs, bar charts and green, yellow, and red indicators to show exactly which standards the students have mastered and which ones they need help on.”

STANDARDS ATTRACT

One of MasteryConnect’s first products was a free mobile app listing Common Core States Standards. Since then, most of the company’s tools, including Common Assessments and Mastery Reports, have been firmly rooted in standards alignment. MasteryConnect, along with other LMSs prominently featuring standards alignment in their tools, clearly believes teachers and administrators view such features as essential in the US public education market.

MasteryConnect has been successful in rounding up private funding. Their initial Series A round of financing included $4.25 million dollars from a range of investors including the Michael and Susan Dell Foundation. In the fall of 2014, MasteryConnect raised a further $15.2 million dollars from private investors. Similar to how LMSs like Schoology and Edmodo first targeted teachers, MasteryConnect wants to use teachers to establish them in the market. According to CEO Cory Reid (a former CEO of Instructure), “Instead of a credit card payment, we want them [teachers] to become evangelizers. Roughly 33% of our sales have teachers involved.”

MasteryConnect still operates on the “freemium” model that includes the following account levels:

• Free: Verified educators can access basic features, such as the Socrative Instant Response system, and share common assessments.

• Single Teacher: For $159 dollars per school year, individual teachers can access additional features like grading tools, data tools and reporting, and curriculum maps

• School/District: For $7 per student/year, districts can integrate MasteryConnect’s assessment and data solutions across the district and create Student Mastery Reports that include school and district reports. Additional fees are charged for online and on-site professional development.

Behavior Analytics Apps

Helping improve the way teachers monitor student progress and design instruction is not the only way apps are using analytics in the classroom; a number of apps also aim to make teachers’ lives easier by tracking and analyzing student behavior.

• ClassDojo

According to ClassDojo, it is used in half of all U.S. schools and is the most popular classroom management app in the country. ClassDojo allows teachers to quickly collect data about student behavior and pass that information along to students and their families. Currently, the app does not do much with the data besides incentivize positive behavior. In fact, after some bad press from the New York Times,32 ClassDojo made it clear that, starting in January 2015, it would be deleting profile data after one year unless saved by a parent or student.

At this point, ClassDojo is completely free to educators. Similar to other educational app business models, ClassDojo intends to keep its app free to teachers forever, but eventually “plans to make money through premium features . . . schools and parents can pay for.”33

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33 [https://www.classdojo.com/nyt/](https://www.classdojo.com/nyt/)
• **ClassCharts**

Like ClassDojo, ClassCharts, a web-based app created by the UK company Edukey, helps teachers track and incentivize student behavior. However, ClassCharts goes one step further. It attempts to use data collected by the teacher to identify how different students interact and make predictions about which students work well together. In this way, the app helps teachers form groups and create seating charts. Beyond that, ClassCharts aggregates all of this data into in-depth reports on behavior at the classroom- or school-level. ClassCharts has a free version for teachers, however, its business model centers more on selling a whole school version that integrates with schools' SISs.

### Student Achievement App

Just this summer, Apple and IBM announced a collaboration on a new learning app called the Student Achievement App. The project is the latest development in the partnership between Apple and IBM in IBM’s MobileFirst for iOS program. So far, the two companies have worked together to create over 100 native iOS apps for enterprise use. The new partnership has brought IBM's big data and analytics to Apple's many iPhone and iPad users in the banking, retail, insurance, and telecommunications sectors. The Student Achievement App represents Apple and IBM's first push into the education market with their partnership. According to appleinsider, "It is not yet known whether Apple or IBM will take the lead in software development, but with MobileFirst deployments IBM does the heavy lifting with help from Apple."³⁴

At this point, there is not much information about the exact features and functionality of the Student Achievement App. Apple and IBM have approached four school districts across the United States to test and help develop the app. The first versions are supposed to be released later this fall, with the app planning to go live sometime in 2016.

### EDUCATION ANALYTICS WITH IBM

While not many specifics are known about the Student Achievement App, a 2014 IBM white paper clarifies IBM's view on analytics in education and could indicate possible features of the app. IBM cites three required components for any system personalizing education:

1. **Smart instructional content:** Students need digital content that matches complexity, readability, and subject matter requirements. (The recent addition of collaboration and feedback tools to iTunes U could mean that Apple will be responsible for providing this component.)

2. **Longitudinal student data:** Data sources need to expand beyond traditional SIS inputs (attendance, grades, demographics) to integrate data about social and work-related activity.

3. **Human engagement:** Students and teachers need to engage with the data to personalize learning paths. (An intuitive, user-friendly iPad app could provide such a platform.)
Depiction of IBM's vision of the role of analytics in personalizing learning pathways.

While it remains to be seen how “transformative” the Student Achievement App will turn out to be, it represents a push by two major technology companies into the education market. Similar to Intel trying to create a brand with Intel Study, Apple and IBM are pushing to establish a clear identity in the classroom. Apple, long a major player in education, likely wants to release an innovative project to reassert iPads as the device of choice in an increasingly competitive field. IBM seems to want to establish itself as a major provider of learning analytics with the Student Achievement App, especially when considered alongside the appearance of IBM Cognos business intelligence in D2L's analytics suite.
Three Components of Adaptive Learning Systems

- **CONTENT MODEL**: Adaptive learning systems need substantial content tied to standards and learning objectives to use with learners.

- **LEARNER MODEL**: Adaptive learning systems need to gather info about the learners themselves from simple (what students know) to complex (how students best learn).

- **INSTRUCTIONAL MODEL**: Adaptive learning systems need to make decisions about next instructional steps, and get the right content to the right learner at the right time.

**OVERVIEW**

The primary beneficiaries of learning analytics at the micro level are the learners themselves. As technology use increases in the classroom, more data is captured about student activities throughout the learning process. This information can be used to create individualized learning pathways for students. Systems that attempt to automate this process are called adaptive learning systems and have the potential to drastically change how we educate students.

The US Department of Education Office of Educational Technology defines adaptive learning as follows:

*Digital learning systems are considered adaptive when they can dynamically change to better suit the learning in response to information collected during the course of learning rather than on the basis of preexisting information such as a learner's gender, age, or achievement test score. Adaptive learning systems use information gained as the learner works with them to vary such features as the way a concept is represented, its difficulty, the sequencing of problems or tasks, and the nature of hints and feedback provided.*

Generally, adaptive learning systems are made up of three core components: a content model, a learner model, and an instructional model.

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Micro-level: Adaptive Learning Solutions for Students

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Adaptive learning systems are still in their infancy. Building on the success of a handful of innovators, a number of adaptive learning systems are starting to be used in K-12 institutions around the globe. Much like LMSs in the K-12 market, however exciting the prospects of using an adaptive learning system to personalize learning may be, it is not yet viewed as essential.

Adaptive Learning’s Move From Early Adopters Into The Mainstream

In a 2013 report, Eduventures placed adaptive learning on Geoff Moore’s Crossing the Chasm graphic (see image). Eduventures expects to see three pieces of evidence in the coming years indicating adaptive learning is transitioning more into the mainstream market:

1. Additional companies touting adaptive learning solutions
2. Additional adaptive learning programs and products appearing in the market
3. Additional evidence, both anecdotal and research-based, highlighting student success with adaptive learning

Examining the trajectories of two of the first adaptive learning systems, Cognitive Tutor and ALEKS, can help establish a sense of the industry as well as a common business path. The two programs have many features in common including, they both:

- Originated in research universities with public money;
- Target math concepts and skills;
- Are intended as supplementary instructional tools; and
- Were eventually purchased by major players in the education industry.

Cognitive Tutor
At-a-glance

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<tr>
<th>COMPANY NAME</th>
<th>Cognitive Tutor</th>
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<tr>
<td>VALUE PRODUCT(S)</td>
<td>High school math tutor</td>
</tr>
<tr>
<td>PRICING MODEL</td>
<td>Charges annual subscription fees per student</td>
</tr>
<tr>
<td>NOTES OF INTEREST</td>
<td>Adapts to student performance with on-demand hints and feedback; owned by Apollo Education Group</td>
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</tbody>
</table>

Carnegie Learning’s Cognitive Tutor, focused on high school math instruction, was originally developed by cognitive scientists at Carnegie Mellon University. The system uses pretests to assess what students know and what they need to learn, then continuously adapts to their performance as they move through content. Instead of simply notifying students of correct and incorrect responses, Cognitive Tutor provides on-demand hints and just-in-time feedback to help correct students at their point of misunderstanding.

As of 2011, Cognitive Tutor had been used by over 600,000 students in grades 6-12. Around this time, Carnegie Learning and its Cognitive Tutor program were acquired by Apollo Education Group, owner of University of Phoenix, for $75 million. The decision to acquire the adaptive learning system was largely seen as a move by Apollo Education Group to increase graduation rates at the online-based University of Phoenix.

Interestingly, in spring 2015, University of Phoenix announced that it was phasing out Cognitive Tutor and transitioning back to Pearson’s myMathLab, another adaptive math system that the company had previously blamed for poor student retention. Considering that University of Phoenix will be spending approximately $85 per student annually to use Pearson’s system, the move seems to spell out an ominous future for Cognitive Tutor.

ALEKS
At-a-glance

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<tr>
<th>COMPANY NAME</th>
<th>ALEKS</th>
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<tr>
<td>VALUE PRODUCT(S)</td>
<td>Adaptive math and science courses</td>
</tr>
<tr>
<td>PRICING MODEL</td>
<td>Charges annual subscription fees per student</td>
</tr>
<tr>
<td>NOTES OF INTEREST</td>
<td>Uses numeric fields, as opposed to multiple choice answers to interpret student understanding; owned by McGraw-Hill</td>
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</table>

Assessment and Learning Knowledge Spaces (ALEKS) was one of the first Internet-based tutoring programs. Originally developed at UC Irvine and New York University with support from a National Science Foundation grant, ALEKS uses artificial intelligence to “gauge students’ proficiency in a subject using a small number of
questions and...quickly and continuously determine what students know and can do.”

Instead of using multiple choice questions, ALEKS asks students to fill in numeric fields, better equipping it to accurately identify points of misunderstanding. Although it was first developed for math instruction, ALEKS now supports learning in science including AP courses for chemistry and physics.

ALEKS first partnered with McGraw-Hill to help with distribution of their product. In the summer of 2013, McGraw-Hill purchased ALEKS for an undisclosed amount and added it to its list of adaptive learning programs.

McGraw-Hill charges a tiered rate per individual user for the general K-12 ALEKS program:

- One Month: $20 per student
- Five Months: $27.50 per student
- Twelve Months: $45 per student

McGraw-Hill charges extra fees for specialty ALEKS courses such as AP physics. School districts can contact the publisher for school-based pricing.

According to its website, ALEKS has been used by millions of students and in thousands of schools throughout the world. Because it originated in a research university, ALEKS is supported by extensive research highlighting its efficacy, especially in enrichment, remediation, or homeschool situations. For further insight on ALEKS from a teacher’s perspective, refer to the case study at the end of this report.

**INDEPENDENT ADAPTIVE LEARNING SOLUTIONS**

The climate seems right for independent companies to create adaptive learning systems. In recent years, the educational reform movement in the United States has focused the conversation on content mastery through Common Core State Standards, Race to the Top, and high stakes testing. Teachers, schools, and districts have to ensure all students are making gains, not just the students in the middle. With this goal in mind, adaptive learning systems promising truly personalized learning paths sound enticing. Further, the newest national assessments, both SBAC and PARCC, are online tests. Districts need to ensure they have the technology to administer these tests, and more technology in schools means a larger market for adaptive learning systems. Finally, adaptive learning isn't entirely new. Current and future adaptive learning system developers can build on the technology of the innovators in the industry, such as ALEKS and Cognitive Tutor.

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40 https://www.edsurge.com/aleks
Levels of Adaptivity and Personalization

Adaptivity is a buzzword with a wide variation in meanings. This graphic describes different levels of adaptivity observed in this paper. While it is true that more adaptive learning programs can better adapt to the specific needs of individual students, levels of adaptivity are not indelibly linked to levels of personalization.

Given the favorable climate, an increasing number of independent start-ups have begun offering adaptive learning systems. The following companies are by no means comprehensive, but they are intended to give an overview of the different types of systems, business models, and pricing in the industry.

### Dreambox Learning

**At-a-glance**

<table>
<thead>
<tr>
<th>COMPANY NAME</th>
<th>Dreambox Learning</th>
</tr>
</thead>
<tbody>
<tr>
<td>VALUE PRODUCT(S)</td>
<td>K-8 adaptive math system</td>
</tr>
<tr>
<td>PRICING MODEL</td>
<td>Charges annual subscription fees per student</td>
</tr>
<tr>
<td>NOTES OF INTEREST</td>
<td>Adapts level of content to student abilities; provides choice of activities to students for engagement</td>
</tr>
</tbody>
</table>

Dreambox Learning is an adaptive learning program targeting K-8 math concepts and skills. Designed to be a supplemental instructional resource, Dreambox's platform is meant to adapt to individual learners, providing both enrichment and remediation.

- **Adaptivity**
  Dreambox's solution offers more adaptive learning capabilities and functionality than other existing programs. Its patented Intelligent Adaptive Learning technology collects more than 50,000 data points every hour that a student uses it. Dreambox uses this data to "adjust the lesson and level of difficulty, scaffolding, sequencing, number of hints, and pacing, as appropriate." The system also promotes personalization of learning paths by giving students choices about what type of learning activity they engage in.

---

• Business Model
    Dreambox operates on a pay-for-service model, selling to district-level decision-makers. Some large-scale deployments include the Rocketship Education charter organization and Los Angeles Unified School District.

• Pricing
    As of 2013, Dreambox appeared to charge annual subscriptions on a per user ($25/user) and per site ($7,000/site) basis.44 Dreambox offers discounts based on the size of the deal. On top of annual fees, Dreambox charges fees for teacher professional development.

Khan Academy
At-a-glance

<table>
<thead>
<tr>
<th>COMPANY NAME</th>
<th>Khan Academy</th>
</tr>
</thead>
<tbody>
<tr>
<td>VALUE PRODUCT(S)</td>
<td>Video content library with skill tracking platform</td>
</tr>
<tr>
<td>PRICING MODEL</td>
<td>Free for students, teachers, and school “forever”</td>
</tr>
<tr>
<td>NOTES OF INTEREST</td>
<td>Heavily supported by philanthropies connected to school reform movement</td>
</tr>
</tbody>
</table>

Khan Academy’s mission is “to provide a free, world-class education for anyone, anywhere.”45 Initially only providing simple math tutorials, Khan Academy now has classes in science, computer programming, history, art, and economics. Khan Academy uses student and teacher dashboards to track and manage content mastery across multiple disciplines. It is also working closely with schools to scale from servicing individual users to servicing entire classrooms and schools. Further,

• Adaptivity
    At this point, Khan Academy is only minimally adaptive. Students can check in on understanding after watching tutorials, and the Khan Academy engine recommends next activities. However, its adaptivity features do not extend beyond basic branching.

• Business Model
    Khan Academy's non-profit status makes it relatively unique in the industry. Khan Academy is growing rapidly. As of February 2014, Khan Academy had about “10 million unique user per month, . . . up from about 144,000 per month in early 2010.”46 Khan Academy's mission extends beyond the United States. Only 65% of its users are American.

    To fund all of this growth, Khan Academy has been effective in seeking philanthropic money, most notably from the Gates Foundation, which has not only poured more than 10 million dollars into the company but has also been a vocal advocate for Khan Academy.47 Khan Academy supplements these large funding sources by seeking small donations from their users on their website and through emails.

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44 Dreambox Price Quote. We were unable to find pricing on their site, but did locate this sales order.
45 https://www.khanacademy.org/about
47 Inside Philanthropy
Khan Academy also grows its solutions through the contributions of volunteers. For example, the effort to translate Khan Academy content into a variety of global languages is entirely volunteer-based.48

• Pricing
Khan Academy is completely free for students, coaches, and teachers.

Achieve3000

At-a-glance

<table>
<thead>
<tr>
<th>COMPANY NAME</th>
<th>Achieve3000</th>
</tr>
</thead>
<tbody>
<tr>
<td>VALUE PRODUCT(S)</td>
<td>Adaptive literacy program</td>
</tr>
<tr>
<td>PRICING MODEL</td>
<td>Charges annual subscription fees per student</td>
</tr>
<tr>
<td>NOTES OF INTEREST</td>
<td>Uses Lexile levels to match content with students; improves reading comprehension</td>
</tr>
</tbody>
</table>

Achieve3000’s website showcases research finding that it improves students’ reading levels beyond expected gains and keeps students on track for college and career. The company claims increased gains the more time students spend in its system. Achieve3000 fits a number of implementation models, including intervention, rotations through school labs, and flipped classroom. While Achieve3000 claims to be the “core of your instructional roadmap,”49 it notably leaves out whole class integrations from its list of implementations.

• Adaptivity
Achieve3000 uses a diagnostic test to determine student Lexile levels, a standardized system for matching students with texts. It then assigns appropriate texts to readers and evaluates reading comprehension. Based on ongoing assessment, it continually increases text rigor to coincide with students’ reading level gains.

• Business Model
Achieve3000 sells to district and school-level administrators hoping to improve year-end test scores in English/Language Arts. Evidenced by case studies on their website, Achieve3000 has been widely used in the US K-12 education sector, including Chicago Public Schools and by the New York Department of Education.

• Pricing
Subscriptions to Achieve3000 are sold annually on a per-student license basis. A 2010 price sheet indicated that, at that time, a license was approximately $50 per student. As the number of licenses purchased increases, the price per student decreases. For example, a school that purchased more than 1,176 was charged approximately $30 per student.50

48 http://international.khanacademy.org/
49 https://www.achieve3000.com/how-it-works
TenMarks

**At-a-glance**

<table>
<thead>
<tr>
<th>COMPANY NAME</th>
<th>Tenmarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>VALUE PRODUCT(S)</td>
<td>Online Math Software</td>
</tr>
<tr>
<td>PRICING MODEL</td>
<td>Freemium; $20 annual fee per student for premium features</td>
</tr>
<tr>
<td>NOTES OF INTEREST</td>
<td>Represents a push by Amazon into education; premium level includes real-time interventions called “Amplifiers”</td>
</tr>
</tbody>
</table>

Similar to the Khan Academy, TenMarks is meant to supplement traditional classroom math instruction. Content is organized in concept “albums” focused on different Common Core domains. Students watch short videos to learn new content and then demonstrate mastery in short quizzes.

- **Adaptivity**
  
The system is only minimally adaptive. It uses an analytics engine to identify which students are struggling and then recommends content and activities for remediation.

- **Business Model**
  
  What sets TenMarks apart from its peers is its path for growing its business. Started as an independent company in 2008 by two parents in Boston, MA, TenMarks took the fast track to growth. In 2013, Amazon acquired it for an undisclosed amount. According to VentureBeat Media, Amazon bought TenMarks to extend its digital content into education and make the Kindle tablet more attractive to schools.51

- **Pricing**
  
  TenMarks operates on the freemium model. A basic level of service giving teachers, parents and students limited access to content and features is entirely free. Its paid level of service, costing $20 per student annually, grants access to all content across grade levels, as well as features such as remediation and enrichment recommendations and real-time interventions.

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While most of the learning analytics solutions at the micro-level involve adaptive learning systems, there are other types of analytics at the learner level that do not fit this mold. One example is LinkedIn’s new efforts in the education market. Using linkedin.com/edu, LinkedIn is providing data about its 364 million users directly to students. Using a variety of search criteria, students can use the data to help make decisions about what college to attend, what major to choose, and the best career paths to follow. By opening up their system to any user above the age of 13, LinkedIn is increasing its user base and establishing itself as the premier network for professionals even before its users graduate from high school.

SOLUTIONS FROM MAJOR PUBLISHERS

In the world of large education publishing companies, the question seems to be not whether you have an adaptive learning program, but how many of these programs you have in your line of products. Increasingly, even basic digital textbooks include interactivity and some minor level of adaptivity. Most major publishers now also include an adaptive web-based learning system in their list of products.
Consider the three core elements of adaptive learning systems: a content, learner, and instructional model. These major publishers have always had the content model. Creating sequenced, standards-based learning content is their forte. As the market for adaptive learning systems grows, adding adaptivity to this content is the natural next step. Generally, the major publishers have used third-party platforms to power their programs. One platform provider, Knewton, will be covered later in this section.

2013 was an important year for some of these acquisitions and partnerships. Following are some of the highlights affecting the K-12 market:

- McGraw-Hill acquired ALEKS
- McGraw-Hill purchased a 20% stake in Area 9, a company it had previously partnered with.
- Kaplan acquired the adaptive test-prep company, Grockit
- D2L purchased its adaptive learning system, LeaP (discussed in section 2)
- Cambridge University Press, Houghton Mifflin Harcourt, and Triumph Learning partnered with Knewton to bring adaptivity to their systems.53

**McGraw-Hill**

As mentioned earlier, ALEKS, one of the first adaptive learning programs, is now part of the McGraw-Hill family. For McGraw-Hill, this is not their only adaptive product.

- **LearnSmart**

  LearnSmart was originally developed for higher education but now is compatible with textbooks across the disciplines for students in grades 6-12. LearnSmart helps craft personalized paths for students as they move through textbooks by asking students to answer questions, then mark their level of confidence in the answers. In this way, it determines which concepts have not been fully understood and adjusts content accordingly. LearnSmart also attempts to help with retention by revisiting concepts that may not be fully understood.

  LearnSmart was used by 3 million total users since its launch in 2009 and grew by 45% from 2012 to 2013 alone.54 According to McGraw-Hill, its over 700 million answered questions make LearnSmart's adaptivity more refined and reliable. Students can access LearnSmart via the website or mobile app for $9.99 per student per year (in addition to the cost of purchasing compatible textbooks).55

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McGraw-Hill developed LearnSmart in partnership with Area 9, a Denmark based adaptive learning company. In 2013, McGraw-Hill acquired a 20% stake in Area 9, then purchased the remaining 80% in 2014. Speaking about the purchase, McGraw-Hill CEO Buzz Waterhouse said, “Area9 has been instrumental to our success in becoming the leader in adaptive learning. This acquisition will allow us to accelerate our development of integrated teaching and learning experiences that help generate results for students and instructors – and which we see as a central element in the future of education in the U.S. and across the world.”

- **busuu**

One such future move with Area 9’s technology may involve the social network-style language learning system, busuu. McGraw-Hill just invested $6.7 million dollars in the company, giving it a minority stake. According to TechCrunch, “McGraw-Hill Education has adaptive learning technology which could prove useful to busuu’s products.” McGraw-Hill is likely interested in using busuu to access the global language instruction market, “which total $60 billion annually and is growing rapidly as the developing world comes online.”

**Pearson**

Pearson’s primary adaptive learning product is called MyLab and Mastering. Pearson started partnering with adaptive learning platform provider, Knewton, in 2011 to bring adaptivity to some of its math, economics, reading, and writing content. The partnership continued in 2013, as the two companies worked together to transform content in many of the sciences. MyLab and Mastering uses analytics to “detect patterns of student success and failure” to help students better understand concepts. MyLab and Mastering courses integrate with a variety of LMSs, including Moodle, Brightspace, Blackboard, and Canvas.

Pearson also acquired start-up Learning Catalytics in 2013. Learning Catalytics is a response polling system that not only gives teachers data about student understanding but also attempts to strategically group students based on what they know and don’t know.

It should be noted that while Pearson, with its MyLab and Mastering product, addresses nearly all subjects across the disciplines and reaches more than 11 million students each year, it primarily targets higher education courses. MyLab and Mastering technology has only been applied to a handful of high school AP and math courses. Pearson has yet to make a significant push into adaptive learning systems in the K-12 space.
Others

Other large publishers have developed solutions claiming to be adaptive learning systems (both in partnership with Knewton):

- **Houghton Mifflin Harcourt** (HMH)
  HMH supports its elementary and middle school math curriculum, Go Math!, with an adaptive assessment tool. Built with Knewton technology, the tool analyzes student answers to determine “strengths, weaknesses, preferences, and gaps.” It gives students personalized feedback and recommends next assignments. It also provides teachers with real-time analytics on student “needs, challenges, and learning styles” and recommends next instructional steps.61

- **Triumph Learning**
  Triumph Learning has developed a new learning tool, called Waggle, through a partnership with Knewton. Waggle is marketed as a “personalized practice tool” to go along with their all-inclusive math and English/Language Arts (ELA) curriculum in grades 2-8. The program assesses what students get wrong, how and why they get it wrong, how much help they need, and how they fared in previous attempts to make sure students are learning at the point of struggle, “moving up and forward but never back.”62 Waggle, released in the fall of 2014, advertises pricing starting at just under $10 per student per year. Its focus on math and ELA as well as grades 2-8 indicate that it is targeting the SBAC and PARCC test prep market.

OPEN EDUCATIONAL RESOURCES

Open Educational Resources have the potential to be a major disruptor in education. The market that historically used to be controlled by publishing companies selling subscriptions is increasingly flooded with free, customizable content. Organizations like CK-12 have begun curating OER content in meaningful ways for students and teachers. Funded in large part with private or philanthropic money, CK-12 is adding interactive elements to texts. CK-12’s flexbooks give teachers the ability to combine existing standards-aligned text, videos, and quizzes with their own content. While these do not yet include adaptive learning technology, that might be the next step. Another of CK-12 newer products, Braingenie, brands itself as an adaptive system for students to practice math and science questions in a gamified environment.

62 [https://www.youtube.com/watch?v=knY-1BUw4](https://www.youtube.com/watch?v=knY-1BUw4)
Knewton

At-a-glance

<table>
<thead>
<tr>
<th>COMPANY NAME</th>
<th>Knewton</th>
</tr>
</thead>
<tbody>
<tr>
<td>VALUE PRODUCT(S)</td>
<td>Platform powering other companies adaptive learning systems</td>
</tr>
<tr>
<td>PRICING MODEL</td>
<td>Revenue from licensing platform to developers</td>
</tr>
<tr>
<td>NOTES OF INTEREST</td>
<td>Knewton Beta (released August 2015) allows educators to develop their own adaptive content for free</td>
</tr>
</tbody>
</table>

Knewton operates as a service provider, giving educational publishers the adaptive infrastructure to allow them to offer personalized learning materials. Knewton’s partnerships span most of the major education publishers in the U.S., including Houghton Mifflin Harcourt, MacMillan Education, Triumph Learning, and Cambridge University Press, among others.

In developing their adaptive learning platform, Knewton has set out to create the world’s most valuable repository of data on how people learn. Larger volumes of student data gives Knewton more to analyze, and improves the automated coaching provided to each student. According to GSV Capital, an investor in Knewton:

“Knewton’s goal is to be the ‘API for Education’—millions of pieces of digital educational content will run through the Knewton engine to create the Knewton Knowledge Graph. This Graph will further identify billions of connections among learners, learning styles, content and instructional methods to personalize a learning pathway in almost any subject for any user. Additionally, Knewton aims to be the “LinkedIn of Learning”—every user on the Knewton Knowledge Graph should have a Learning Portfolio that tells the user how he or she learns best using the data created from the first day of using Knewton-powered content.”63

Knewton looks to serve the global education market, not just K-12 schools in the United States. In March of 2014, Knewton announced a partnership with Microsoft. Microsoft’s global reach extends to Ministries of Education around the world. According to Knewton’s business development director Sara Ittelson, “by introducing Knewton technology to Ministries of Education around the world, Microsoft can streamline nationwide deployments of adaptive learning materials, helping more students access a more personalized learning experience.”64

63 http://gsicap.com/investment-portfolio/knewton/
64 http://www.knewton.com/blog/knerds/knewton-partners-microsoft/
Also in March of 2014, Knewton partnered with Sebit, a multinational education technology company headquartered in Turkey and owned by Türk Telekom. “Many of Sebit’s existing products have been chosen by Ministers of Education in a number of countries as nationwide solutions,” said Jose Ferreira, founder and CEO of Knewton. “We are impressed with Sebit’s ambitions for digital education products and honored to help them realize their vision. We’re looking forward to working together to deliver more personalized and engaging educational content to students around the globe.”

Pricing

Knewton makes its revenue from licensing its technology to businesses and developers. From Ferreira:

“Knewton’s goal is to be like [Amazon Web Services] for education. We’ve created a shared data infrastructure platform that makes it fast and easy for anyone to build extremely powerful adaptive learning applications with Knewton. As our platform gets stronger over time, with more features and more data, every product built using our platform automatically gets stronger too.”

The Amazon Web Services (AWS) pricing model may offer a glimpse of what Knewton has in store for the future. AWS customers pay for computing time, data storage, and data transfer out. Conceivably, in the future, content providers and cloud-based software developers would pay to use the Knewton platform following a similar type of model.

KNEWTON AND HP - ADVANCED ANALYTICS ON PAPER ASSIGNMENTS

In April 2015, Knewton announced a deal with Hewlett-Packard to build a service that provides advanced analytics on paper assignments through a smartphone app. The service then generates and delivers on-demand personalized work by networked printers. HP’s customer educators assign print materials tagged by HP Link technology (like a QR code). Once the work is completed, the teacher or student can scan it with the HP smartphone app and feed results into Knewton’s system. From there, Knewton’s database recommends an individualized worksheet or textbook chapter as the next step for a student.

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66  https://www.knewton.com/resources/blog/ceo-jose-ferreira/the-coming-world-of-adaptive-learning/
67  http://aws.amazon.com/pricing/
The smart classroom: Double down on data driven

One possible glimpse into the future of education comes in the form of a new for-profit school organization, the AltSchool, founded by a former head of personalization at Google. The AltSchool uses two primary strategies to personalize learning. First, pedagogically, it relies on small class sizes of around 12 students per teacher that are not constricted by traditional grade level age requirements. Second, each classroom is hard-wired with video cameras collecting terabytes of data for analysis. The data can help teachers be in more than one place at once by helping them see and hear things they normally would not. What's more, the data is sent to AltSchool's headquarters to be mined for insights into what is happening in the classroom, analyzing variables ranging from how space is utilized to what students and teachers are doing at all times. Not only can this data help classrooms in the AltSchool Network, founder Max Ventilla hopes that other educational organizations will pay to access AltSchool's data. Starting with a single campus in San Francisco, the organization is opening additional schools this year in Brooklyn and Palo Alto and plans to eventually open schools across the country even in rural areas. But with tuition ranging between $20,000 and $28,000, it's unclear if this approach will scale to the larger education market.69

WHAT'S NEXT IN ADAPTIVE LEARNING SYSTEMS:
OPPORTUNITIES FOR GROWTH

Although adaptive learning systems have seen tremendous growth in the past few years, important challenges still remain:

• **Teaching more than math:** At this point, most adaptive learning systems only target math instruction or other concrete topics. It is much more challenging to create systems for language-dependent learning like writing and reading where there is no right or wrong answer.

• **Moving from supplemental to core:** Adaptive learning systems are still largely meant to be supplemental learning resources. Teachers may use them occasionally for independent study, but so far at least, they are not viewed as core instructional tools. As a result, it's easy to view them as non-essential.

• **Being actually adaptive:** Many of these companies say their products are adaptive, but beyond providing some basic interactivity and monitoring student progress through their content, most do not approach the level of actually being an intelligent tutoring system capable of replacing in-person tutoring.

Adaptive learning is a trending topic in education, receiving substantial financial support from government, philanthropic, and private sources. Given this support, adaptive learning technology products will continue to improve their levels of adaptivity and effectiveness. One exciting area for ongoing development is the ability of schools and teachers to use platforms such as Knewton Beta to author their own adaptive content. Smart Sparrow and CogBooks are already starting to offer this type of service in the higher education market.

In the coming years, adaptive learning systems will also likely be able to gather and interpret new data sources, increasing systems’ validity across subject areas. For example, AutoTutor, developed at the University of Memphis, uses a conversational system to interact with students and is able to understand student-written responses and questions. While AutoTutor is not yet a viable product, adaptive learning systems may be heading in this direction.

Utilizing new hardware and software, adaptive learning systems will also start to gather “affective” data from students, seeking to interpret students’ emotional response to the learning activities. One possible example of this includes using device cameras to gauge understanding and emotions through facial expressions. Wearables may also record data from learners as they work through lessons and assessments.

Finally, many adaptive learning systems are improving their ability to draw meaningful conclusions from the data that they gather. As these systems aggregate more and more students, they will be able to make more insights about students, such as levels of engagement and frustration.

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Case Study: Lessons from ALEKS Users

Sifting through product websites, news releases, and whitepapers, it can be hard to discern what adaptive learning systems look like in the classroom. How are they used? Why are they chosen? How are they viewed? ALEKS, one of the longest running adaptive learning systems, encourages educators to fill out an online survey and shares the results on its web site. The 937 completed surveys provide a window into how its system (and, potentially, other adaptive learning systems) are being used in schools.

ALEKS IMPLEMENTATION PURPOSE

Educators primarily view ALEKS as a supplemental tool. The top five purposes cited by educators for using ALEKS were enrichment, supplement, at-risk students, test prep, and intervention.

ALEKS by Implementation Purpose
ALEKS IMPLEMENTATION STRATEGY

Users also gave feedback on how they implemented ALEKS in schools. **Adaptive learning systems seem best suited for one-to-one implementations with one device for each student.** However ideal that situation might be, the ALEKS data demonstrates that most schools still have not attained that level of technology integration. The majority of schools use ALEKS in computer labs. While one-to-one programs may be on the rise, the on-the-ground realities dictate that ALEKS and other adaptive learning systems must also cater to schools with computer labs, a handful of classroom computers, and laptop carts. Interestingly, over 30% of users also responded that students use ALEKS at home, further indicating that ALEKS is being used for homework or extra practice, not as the core instructional tool.

**ALEKS by Implementation Strategy**

![Diagram showing implementation strategies](chart.png)

**WHAT USERS HAVE TO SAY**

The ALEKS surveys provide anecdotal data useful in understanding adaptive learning through the eyes of educators. The responses showcase a number of recurring themes including the following:

- Educators **commonly connect ALEKS to student performance on benchmarking** assessments like NWEA’s Measures of Academic Progress (MAP).

- Educators frequently use ALEKS **to reach students that are not being reached** through standard modes of instruction, both remedial and gifted.
• Teachers reiterated the importance of having a teacher present to answer questions and help students set and adhere to goals. Many also recommended designing hands-on, authentic math experiences to complement learning in ALEKS.

The following three scenarios represent a cross-section of ALEKS in the educational landscape across grade levels, types of schools, and implementation purposes.

Scenario #1: Baywood Learning Center

<table>
<thead>
<tr>
<th>EDUCATOR</th>
<th>Grace Neufeld, Director</th>
</tr>
</thead>
<tbody>
<tr>
<td>LOCATION</td>
<td>Oakland Unified School District, Oakland, CA</td>
</tr>
<tr>
<td>GRADE(S)</td>
<td>K - 12</td>
</tr>
<tr>
<td>PURPOSE</td>
<td>Enrichment/Gifted and Talented, Special Education, At-Risk Students</td>
</tr>
<tr>
<td>ALEKS PORTION OF CURRICULUM</td>
<td>60%</td>
</tr>
<tr>
<td>TIME SPENT IN ALEKS</td>
<td>1-7.5 hours per week</td>
</tr>
</tbody>
</table>

Baywood Learning Center is an alternative school for gifted children. Our learners have a very high cognitive ability; therefore, their age has little to do with their academic grade level. These gifted children have a high need for autonomy. ALEKS is great for gifted students because they have some control over what to work on and can advance at an appropriate pace. This satisfies both their need for autonomy and their need for advancement. At one point, we had a six-year-old student who needed college level math. With ALEKS, we were able to let him work at his own level and his own pace. Most of our students love ALEKS because they can accomplish so much more than with a textbook.

We have a morning period every day in which students may work on academic targets in Math and Language Arts that they designed with our staff and their parents. Every day each student works on their independent ALEKS program for a set agreed amount of time. If student goals are not met, the student may opt to continue progress at home. (i.e. “homework”). The Math and Language Arts time is usually five days per week from 15 minutes to 1.5 hours depending on student needs.

ALEKS is great for gifted students because they have some control over what to work on and can advance at an appropriate pace. This satisfies both their need for autonomy and their need for advancement. At one point, we had a six-year-old student who needed college level math. With ALEKS, we were able to let him work at his own level and his own pace. Most of our students love ALEKS because they can accomplish so much more than with a textbook.

It’s helpful to have the teacher’s help along with ALEKS, so a teacher should be present and available at all times during math lab time. If a student gets stuck on a problem, they can get support from their teacher.
Scenario #2: Horizon School

<table>
<thead>
<tr>
<th>EDUCATOR</th>
<th>Troy Seyfert, Teacher</th>
</tr>
</thead>
<tbody>
<tr>
<td>LOCATION</td>
<td>Pewaukee School District, Pewaukee, WI</td>
</tr>
<tr>
<td>GRADE(S)</td>
<td>4 - 6</td>
</tr>
<tr>
<td>PURPOSE</td>
<td>Core Curriculum</td>
</tr>
<tr>
<td>ALEKS PORTION OF CURRICULUM</td>
<td>100%</td>
</tr>
<tr>
<td>TIME SPENT IN ALEKS</td>
<td>5 hours per week</td>
</tr>
</tbody>
</table>

This is our first year using ALEKS with our Pre-Algebra students at the sixth grade level. Overall, my experience has been positive. I really enjoy being able to create Individualized Learning Plans (ILPs) for all of my students. Also, ALEKS has been continually updated to meet the needs of the students and teachers. We found that in a traditional classroom certain students can become bored with the slower pace that the curriculum generally dictates.

In the beginning of the year we have the students focus on Whole Numbers and Integers, Rational Numbers, and Proportion, Percent, Data, and Probability. After those are completed, students can then begin to focus on topics of interest.

Generally the students log into ALEKS right away. This gives them a jump start before we interrupt with other tasks. We conference with the students once every seven school days using a form we created. The students update their own forms from school and home. Additionally, we have teaching seminars four days a week. These are conducted using data from ALEKS to see the concepts that are of highest need. Also, we build in a “math chat” where students are free to walk around the room and assist each other. We also use the quiz feature about once a week, and once every quarter we have all students participate in a week long project that relates to real world math applications.

We set goals depending on their pace and level of understanding. But the long term goal of each student, at the very least, is to complete the Pre-Algebra course by the end of the year. During our conferences with students, we examine their ILPs and look at the past week’s goal.

We have seen tremendous growth for the majority of our students who are using ALEKS. As a district, we use Measure of Academic Progress (MAPs) as one of our standardized benchmarks. Students’ scores have been a positive indicator that ALEKS is helping them progress through the math curriculum at a comfortable, yet challenging pace. The majority of students have given positive feedback about their experience with ALEKS. They really enjoy working at their own pace, first and foremost. Also, they appreciate the fact that they can work at home without hauling a textbook back and forth.
Scenario #3: Peeskill Middle School

<table>
<thead>
<tr>
<th>EDUCATOR</th>
<th>Chris Kness, Special Education Teacher</th>
</tr>
</thead>
<tbody>
<tr>
<td>LOCATION</td>
<td>Peekskill City School District, Peekskill, NY</td>
</tr>
<tr>
<td>GRADE(S)</td>
<td>6 - 8</td>
</tr>
<tr>
<td>PURPOSE</td>
<td>Special Education</td>
</tr>
<tr>
<td>ALEKS PORTION OF CURRICULUM</td>
<td>25%</td>
</tr>
<tr>
<td>TIME SPENT IN ALEKS</td>
<td>5 hours per week</td>
</tr>
</tbody>
</table>

ALEKS has been extremely beneficial for the students in my self contained special education class. The students have a variety of disabilities including learning disabilities, emotional issues, neurological disorders, autism, physical and medical handicaps, and other various syndromes. The ALEKS program is excellent because it allows the students to work independently and receive instant, direct feedback on their progress and tasks. Students can work at their own pace and if they get tired or lose focus they can stop and pick up later at that exact point. Each student can work at their own instructional and functioning level in order to meet their individual needs.

I let half of the class work on ALEKS while I give individual attention to the other half working on another skill set. Then, another period we switch and do the same thing. It allows me to focus my attention on individuals and small groups while ALEKS is being used. [Students] are encouraged to use ALEKS as much as they can, hopefully every night.

I have seen very good progress in my students with respect to their individual needs and functioning levels. The students are able to work independently and then we discuss their progress as well as their strengths and weaknesses. I have seen students improve in areas that they have demonstrated a weakness for an extended period of time; ALEKS allows them to focus on those skill sets which need improvement. The students really enjoy ALEKS and like to meet with me to discuss their progress and also their weak areas. They take ownership over their own learning as independent thinkers. The students can self monitor themselves and receive direct feedback from ALEKS. Many of the students have low self esteem and a poor self image due to years of academic frustration and failures. The fact that they can get direct feedback from ALEKS is very beneficial for them. It allows them to self adjust and work on skills they need to improve upon without it being advertised in class. The direct feedback and instant assistance gives them a new found independence and learning is great for them!
Case Study: Strategic Data Project (SDP)

Changing the Culture of Data Use in Delaware: How State Leaders Used Analytics to Create Education Policies That Matter

In 2010, the state of Delaware won $119 million in Race To The Top (RTTT) funding to support a variety of education reforms. Part of this funding went towards expanding and improving the capabilities of the longitudinal data system that captured information about students and teachers throughout the state. In partnership with the Harvard's Strategic Data Project (SDP), the Delaware Department of Education (DDOE) launched two diagnostics developed by researchers at Harvard's Center for Education Policy Research (CEPR). As SDP Fellow Donna Mitchell emphasized, the diagnostics would achieve what the partnership was meant to do: "create demand for more data."

Many different stakeholders saw value in the DDOE's ability to conduct rapid, focused analytics. The head of the DDOE's Teacher and Leader Effectiveness Unit (TLEU) often sought additional data to reinforce his public remarks on education topics and inform his policy making. DDOE leaders used diagnostic analyses to highlight problems and press district leaders to respond with appropriate plans. On April 18, 2013, SDP Research Director Lindsay Page presented the findings from one of the two diagnostics in a historic building near the DDOE. Board members of the State Board of Education, Delaware Governor Jack Markell, and an array of state leaders attended the presentation. One week later, Delaware State Senator David Sokola (D-Newark) introduced a bill to amend Title 14 of the Delaware code relating to educator licensure, certification, and preparation programs. The governor of Delaware signed the bill into law less than two months later (June 2013). Reflecting on the SDP partnership and its outcomes, Delaware's Secretary of Education Mark Murphy had this to say:

"What we saw is that in a period of several months, you can go from having very little information to having really good information and taking it public. Then you can create a situation where you have both support and pressure: support to make changes in policy, combined with pressure on schools, districts, and legislative leaders to make better human capital decisions. That is remarkable."

Summary of Key Findings From the SDP Human Capital Diagnostic for Delaware, Presented to the State Board of Education, April 18, 2013

RECRUITMENT

- More than one quarter of Delaware's teachers (28%) have five or fewer years of teaching experience.
- Fewer than one in 12 teachers are new hires each year.
- High-poverty schools have larger shares of new hires (5%) than low-poverty schools (3%).
• Teacher characteristics (race, gender, years of teaching experience) differ markedly between high- and low-poverty schools.

• Teachers are less likely to be minority than their students.

PLACEMENT
• The least academically prepared students (elementary and middle school) are more likely to be placed with the most inexperienced teachers.

• This is also true when we look at student placement within schools.

DEVELOPMENT
• Teacher impact on student achievement increases the most in the first few years of teaching.

• There is little difference in impact on student achievement between teachers with and without master's degrees.

EVALUATION
• Teacher impact on student achievement varies widely across the state.

• On average, a math teacher’s impact on student achievement is predictive of future impact — but there is movement between impact groups.

• In 2011–12, among teachers participating in Delaware’s new teacher evaluation system, more than two in five teachers were rated “Exceeds Expectations.”

RETENTION/TURNOVER
• More than 15% of teachers do not continue teaching in the same school the following year.

• A large share of newly hired teachers (> 36%) leave teaching in Delaware within four years.

• Charter schools tend to have higher turnover than traditional schools.

• High-poverty schools have higher rates of teacher turnover.

• Retention trajectories are similar for newly hired teachers graduating from different programs.\(^\text{72}\)