Personalizing Post-Secondary Education: An Overview of Adaptive Learning Solutions for Higher Education

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Ithaka S+R is a strategic consulting and research service provided by ITHAKA, a not-for-profit organization dedicated to helping the academic community use digital technologies to preserve the scholarly record and to advance research and teaching in sustainable ways. Ithaka S+R focuses on the transformation of scholarship and teaching in an online environment, with the goal of identifying the critical issues facing our community and acting as a catalyst for change. JSTOR, a research and learning platform, and Portico, a digital preservation service, are also part of ITHAKA.

Introduction

For the past decade, the conversation about technology's potential to transform higher education has grown louder and larger, encompassing more voices, opinions, and topics, and driving changes at a global scale. Participants in this discussion speculate about the possibilities for Massively Open Online Courses (MOOCs) to make quality education more broadly accessible to an international set of learners, deliberate over the value of leveraging business analytics to help students through degree programs, and debate the impact of technology-enabled learning on student outcomes and instructional efficacy. Though these conversations often contain nuanced interpretations and dissenting opinions, there exists little controversy over the fact that technology is transforming teaching, learning, advising, and credentialing.

In a landscape of open educational resources, learning analytics software, online course providers, and other innovations, one type of product that is receiving increasing attention and investment is adaptive learning solutions. Though diverse in the content they offer, the contexts to which they are suited, and the theories of teaching and learning from which they draw, adaptive learning providers are defined by their ability to respond to learner activity, and to adapt assessments, content, or questions to a learner's demonstrated level of mastery. Often called "personalized learning paths," questions and objectives are generated algorithmically depending on learner performance, driven by rules hard-coded into the adaptive platform, rules set by an instructor, or a mix of both. Many solutions draw from research and academic theories in human-computer interaction, machine learning, and cognitive science, such as Bloom's taxonomy, cognitive load theory, and knowledge space theory.[1] Each takes a different approach to creating the adaptive learning experience, varying in the type of data collected in a learner's profile, the frequency with which content adapts, the frequency of assessments, and other characteristics.[2]

In addition to using learners' data to determine the shape of their learning paths, adaptive learning solutions also provide data to instructors that allow them to track student progress, identify problem areas, and intervene on the class and student level.

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[1] For good overviews and definitions of adaptive learning, see Adam Newman, "Learning to Adapt: Understanding the Adaptive Learning Supplier Landscape," Tyton Partners (April 2013), http://tytonpartners.com/tyton-wp/wp-content/uploads/2015/01/Learning-to-Adapt_Case-for-Accelerating-AL-in-Higher-Ed.pdf and Michael Feldstein, "What Faculty Should Know About Adaptive Learning," e-literate (December 17, 2013), http://mfeldstein.com/faculty-know-adaptive-learning/.

[2] For classifications and descriptions of different types of adaptive systems, see Jim Thompson, "Types of Adaptive Learning," CogBooks White Paper, http://www.cogbooks.com/white-papers-adaptive.html.

Most platforms also provide students with a dashboard so that they can better understand their own progress and roadblocks. Additionally, most solutions incorporate aggregate student data into their development processes, using statistics regarding student usage of the platform to improve the product and refine relationships between learning objects and concepts.[3]

The Bill & Melinda Gates Foundation—as well as innovative institutions like Arizona State University—hypothesize that adaptive learning technology will provide the key to unlock the "iron triangle" of cost, access, and quality that many see as definitive of challenges in higher education.[4] Coined by John Immerwhar in 2008, this model posits that cost, access and quality sit in an "unbreakable reciprocal relationship, such that any change in one will inevitably impact the others." According to this logic, making a college or university more accessible or trying to increase the quality of instruction would necessarily drive up institutional costs. Inversely, reducing expenditures would inevitably make a school less accessible while threatening the quality of the education that a student could receive there. The Gates Foundation and innovative universities have identified the "personalized learning loop" that adaptive solutions curate as an especially promising avenue towards realizing increased access and student success while managing costs.[5]

In late 2014, the Gates Foundation announced seven finalists in its "Next Generation Courseware Challenge." Each finalist was funded to launch initiatives that use personalized or adaptive courseware to improve outcomes for low-income, post-secondary students. Four providers included in this report—CogBooks, Smart Sparrow, Acrobatiq and Cerego—were finalists in this competition, and each are currently in the process of launching networks of schools that use their platforms to develop and deliver adaptive general education courses.[6]

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[3] See Steve Kolowich, "The New Intelligence," Inside Higher Ed (January 25, 2013), available at https://www.insidehighered.com/news/2013/01/25/arizona-st-and-knewtons-grand-experiment-adaptive-learning.

[4] For more on Arizona State University's use of technology, see Kevin M. Guthrie, Christine Mulhern, and Martin A. Kurzweil, "In Pursuit of Excellence and Inclusion: Managing Change at Arizona State University," Ithaka S+R (January 2015), available at http://sr.ithaka.org/sites/default/files/reports/SR_Report_Managing_Change_ASU_012015.pdf.

[5] Keith Hampson, "The Gates Courseware Challenge," Acrobatiq Blog, http://acrobatiq.com/the-gates-courseware-challenge/.

[6] "Gates Foundation Announces Finalists for $20 Million in Digital Courseware Investments," Gates Foundation Press Releases and Statements (September 30, 2014), available at http://www.gatesfoundation.org/Media-Center/Press-Releases/2014/09/Gates-Foundation-Announces-Finalists-for-$20-Million-in-Digital-Courseware-Investments. Other winners, none of which are adaptive providers, are Lumen Learning, Rice University Open Stax, and Open Learning Initiative at Stanford University. Lumen Learning is an education management company that helps universities transition high-enrollment courses to open educational resources. Rice Open Stax provides free, open source text books for college courses, and Stanford OLI provides open and freely available online courses. Stanford OLI is similar to some of the

Perhaps because it is in its early stages and so fast-moving, it is difficult to get an accurate picture of the adaptive learning market. We began this research as part of an internal effort to understand the landscape of providers, the products they offered, and which institutions were using them. We soon realized that for an institution seeking an adaptive learning provider—or a researcher seeking to understand the market—there were few market reviews that could serve as an entry point. This report aims to fill that gap.[7]

Although not comprehensive, this report covers a wide range of providers, from the well-known products of large textbook publishers to emerging actors in the space. All are designed specifically for use in institutions of higher education for the purpose of course delivery and supplementation. The report does not include adaptive learning solutions for K-12 education, test-preparation, and life-long learning, or any solutions marketed directly to consumers. While we also reviewed a variety of multimedia, interactive academic solutions in our research for this report (for example, Carnegie Mellon and Stanford's Open Learning Initiatives), we have remained focused on solutions that respond automatically to learner performance and that tailor student learning paths to demonstrated levels of competency. Thirteen solutions are profiled in detail, with a focus on the providers, the high-level technical and pedagogical characteristics of their solutions, their business models, and their partnerships.

As more universities and instructors continue to incorporate adaptive learning solutions (a transformation we anticipate occurring at an accelerating pace), they will benefit from resources that compare providers on a variety of factors. It is our hope that, by compiling and organizing crucial product and organizational information in one place, this resource provides those interested in adopting or studying adaptive technologies with a place to start.

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solutions here, but rather than adapting automatically to student performance, it provides students and instructors with feedback through which they can manually adjust the course content or sequence. See http://oli.stanford.edu.

[7] A white paper prepared by advisory firm Tyton Partners is one example of a detailed and helpful review, and provides an in-depth profile on the business model and technical capabilities of eight providers, six of which are featured in this report, The Tyton Partners report also includes an appendix with more than 30 "additional suppliers to watch" in the higher education market (pared down from 70 that the company initially screened). Some of these additional providers already have adaptive capabilities; others may develop them in the future. See Adam Newman, "Learning to Adapt: Understanding the Adaptive Learning Supplier Landscape," Tyton Partners (April 2013), http://tytonpartners.com/tyton-wp/wp-content/uploads/2015/01/Learning-to-Adapt_Case-for-Accelerating-AL-in-Higher-Ed.pdf.

Scanning the Landscape: Differentiating Solutions

This report captures a variety of factors that are crucial when differentiating one solution from another. In addition to the business profile and typical customer type of each solution, these factors include the intended instructional use of an adaptive solution, its ability to host instructor-created or third party content, and whether it provides or integrates with a learning management system. Our study includes basic product information about each solution, especially factors that differentiate one solution from another.[8] However, this report does not dive deeply into the technological or pedagogical distinctions in adaptive solutions.

The specific ways in which adaptive solutions can be integrated into postsecondary instruction are diverse. Originally conceived as digital "tutors" that could provide personalized instruction at scale, most solutions now also have interactive and multimedia content delivery functionalities. Some providers, such as Adapt Courseware and CogBooks, even deliver entire courses without a face-to-face component. Other solutions are more commonly implemented in hybrid or blended learning environments, where a portion of class-time previously devoted to lecture or other face-to-face interactions is replaced with adaptive labs or assignments done on the software. As such, these solutions have the potential to dramatically alter the role of the instructor from a lecturer reaching an entire class at once to a coach or mentor providing students one-on-one guidance as they work through personalized class material at their own pace. Solutions designed for these contexts can also be used as supplements to—rather than replacements for—in-person instruction while keeping the traditional lecture format and instructional role intact. Instructors can use these products to identify different types of learners and assign additional challenge problems or extra credit work to high performing students while giving targeted "catch-up" assignments to those students who might be falling behind.[9]

Most of the solutions profiled in this report are flexible enough to be used in a variety of contexts, and use cases indicate that solutions can be adapted to the goals and parameters of course redesigns. It is our belief that as adaptive learning platforms begin to offer more instructor resources and course authoring tools (an emerging trend discussed below) they will become increasingly suited to blended contexts in which

[8] Carnegie Mellon and Stanford's Open Learning Initiative courses provide students and instructors with feedback, but do not adapt automatically. See http://oli.cmu.edu and http://oli.stanford.edu.

[9] For examples of implementations, see Newman, "Learning to Adapt: Understanding the Learning Supplier Landscape"; Michael Feldstein, "Efficacy, Adaptive Learning, and the Flipped Classroom," e-literate (April 2, 2014), http://mfeldstein.com/efficacy-adaptive-learning-flipped-classroom/.

online learning, practice, and assessment are used to enhance—rather than replace—instructor explanation, intervention, and support.[10]

One key element that distinguishes providers is the content model employed by these solutions. Many providers, especially those affiliated with textbook publishers, have closed-content models, meaning that course content, assessments, and learning objectives are hard-coded into the platform, with limited customization opportunities for the instructor. Smaller, start-up ventures tend to provide open-content models that allow for instructors to author their own content on the platform, set their own learning objectives and relationships, and configure their own course sequences. The authoring process varies from provider to provider; typically, the provider offers (for a fee) the support of instructional designers to help instructors adapt their content and syllabi to the adaptive format.

It is important, at this point, to make a terminological distinction. This report uses the word "platform" to describe the infrastructure that powers the delivery of adaptive content—wherever that content is from. Open-content solutions typically are "platforms" only. Closed-content solutions, such as those produced by textbook publishers, include the platforms and content. To complicate matters further, some closed-content solutions rely on platforms that are otherwise available as open-content solutions.

We emphasize this distinction because Knewton, which developed one of the most commonly used open-content platforms profiled in this report, has evolved from providing its solution directly to institutions to providing it exclusively to publishers for use in closed-content solutions. Several smaller platform providers have also begun to partner with content providers for multi-campus initiatives. For example, Cerego, a memory management adaptive platform, recently received funding from the Gates Foundation to create an introductory statistics course that uses content from Rice University's open-source textbook provider, Open Stax, and pulls multimedia content from BBC Worldwide, SETI Institute, and Fabien Cousteau's Ocean Learning Center.[11]

While it is important that readers understand the difference between platform and publisher, we also warn readers against drawing too crude a line between open and closed course authoring models. While the categorization here reflects real and important distinctions in the technical infrastructure of the solutions discussed, there

[10] Though technology enabled learning models are diverse, the National Center for Course Transformation's course redesign models offer helpful frameworks for thinking through various ways that technology can be used to transform classrooms. For descriptions of models, see Carol A. Twigg, "Improving Learning & Reducing Costs: Redesigning Large-Enrollment Courses," NCAT, (1999) http://thencat.org/Monographs/mono1.pdf.

[11] See also the partnership between Cerego and Cengage, described in our profile of Cerego.

exists some variation in the malleability of content within closed-content solutions. Most of these solutions provide course content, but allow instructors some control over defining learning objectives and mastery rules. Cengage Mindtap stands out as a solution that lies on the particularly flexible end of this spectrum. The solution also allows instructors to edit the default Cengage modules, delete content, and add their own lessons and media.

The remainder of the report profiles each of thirteen solutions in detail, along these dimensions and others. The tables below provide a brief, comparative summary for easy review.

Open Content

Resource	Date Founded	Country of Origin	Type	Content Model	Primary Client Type	Business Model	Intended Use (e.g. homework, hybrid class etc.)	LMS
Cerego http://cerego.com	2000	US	Adaptive courseware platform for memory management	Open	Publishers and other online providers; American universities	Subscription fees for institutions and corporations, freemium model for individual learners	Course supplement for MOOCs or face-to-face classes	Integrates with providers
CogBooks http://www.cogbooks.com	2007	Scotland	Adaptive courseware platform	Open	Corporate; breaking into higher ed market (see narrative)	Licensing agreements	Fully online courses, MOOCs	Integrates with providers
LoudCloud Systems http://www.loudcloudsystems.com	2010	US	Adaptive courseware platform	Open	American two and four year colleges and universities K-12	Licensing and subscription options available	Course supplement for blended learning	Hosts its own
RealizeIt http://www.cckf-it.com/	2007	Ireland	Adaptive courseware platform	Open	For-profit universities; K-12; corporate; some non-profit universities	Unknown	Course supplement for blended learning	Integrates with providers
Knewton http://www.knewton.com	2008	US	Adaptive courseware platform, partners with publishers for content	Open, but only shares its API with publishers/ content providers, not instructors	Publishers (international client base)	Financials of partnership unclear; Knewton provides publishers adaptive platform for content; publishers share student data with Knewton to improve platform	Depends on partnership	Depends on partnership
Smart Sparrow http://www.smartsparrow.com	2011	Australia	Adaptive courseware platform	Open	Australian universities, though breaking into American higher education market	Licensing agreements	Course supplements for blended learning	Integrates with providers

Closed Content

Resource	Date Founded	Country of Origin	Type	Content Model	Primary Client Type	Business Model	Intended Use (e.g. homework, hybrid class etc.)	LMS
Acrobatiq http://www.acrobatiq.com	Open Learning Initiative founded in 2000; Acrobatiq launched July 2013	US	Adaptive courseware platform and content provider	Closed, but in the process of developing an authoring platform	American two and four year colleges and universities	Licensing agreements	Course supplement for blended learning	Integrates with Blackboard, Moodle, Canvas, Sakai, Desire 2 Learn, and others
Adapt Courseware http://adaptcourseware.com/	2010	US	Adaptive courseware	Closed with some configurability	American postsecondary	Licensing agreements	Fully online course delivery; course supplement for blended learning (secondary use)	Integrates with providers
Cengage MindTap http://www.cengage.com/mindtap/	2011	US	Adaptive courseware	Customizable but publisher based	American two and four year colleges and universities	Licensing agreements	Course supplement for blended learning or homework platform	Integrates with providers
Hawkes Learning Systems http://www.wileyplus.com/WileyCDA	1979 (textbooks) Transitioned to courseware in 1985	US	Adaptive courseware	Closed, publisher based	American two and four year colleges and universities (especially state schools)	Licensing agreements	Course supplement for blended learning or fully online	Hosts its own
McGraw Hill-Learn Smart Advantage http://learnsmartadvantage.com/products/learnsmart/	2007	US	Adaptive courseware	Closed, publisher based	American two and four year colleges and universities	Pricing based on subject and length of license	Course supplement for blended learning	Integrates with McGraw Hill's LMS, Learn Smart Connect
MyLab http://www.pearsonmylabandmastering.com/northamerica	Pearson Higher Ed founded in 1998	US	Adaptive courseware	Closed, publisher based	American two and four year colleges and universities	Licensing agreements	Course supplement for blended learning or fully online	Integrates with providers
Wiley Plus with Orion http://www.wiley.com/college/sc/oriondemo/index.html	2013	US	Adaptive courseware	Closed, publisher based	American postsecondary institutions	Licensing agreements	Course supplements for blended learning	Integrates with providers

Open-Content Platforms

Cerego

Website: http://cerego.com/

Type: Adaptive courseware platform for memory acquisition

Content Model: Open-content model

Year Founded: 2000

Headquarters/Location Founded: Millbrae, CA, USA

LMS Integration: Integrates with providers

Business Model: Cerego partners with institutions of higher education, corporations, and educators through subscriptions. It also makes existing content available to individual learners, and allows individual learners to upload their own content through a freemium model. Cerego also partners with publishers, including Cengage Learning. In 2014, it announced a partnership with Cengage's MindTap in which it will power one of MindTap's memory-management "MindApps."

Funding Information: Cerego has raised $28 million since it was founded, primarily through individual investors. This includes 3.4 million in 2009 from Japanese telecommunications giant NTT DoCoMo.[12]

About the Product: Cerego is an adaptive learning platform designed specifically for memory acquisition. As such, it tests a learner's ability to learn and retain information over a given period of time. The software is organized around objects (for example, a state, an historical figure, or a biological structure). A learner will be presented with that object and information about it (for example, a state's name and where it appears on the map), and will then be tested on this information until he or she demonstrates retention. As the platform is organized around objects with discrete attributes—rather than concepts that can be presented and tested in a variety of ways--Cerego has historically been used for memory based subjects such as geography, biology, history, and language acquisition. However, in September 2014, Cerego was selected as a finalist in the Gates

[12] Leena Rao, "Cerego Raises $3.4 million for Smart.fm, Launches Facebook Friend Quiz," TechCrunch (September 1, 2009), http://techcrunch.com/2009/09/10/cerego-raises-3-4-million-for-smart-fm-launches-facebook-friend-quiz/.

Foundation Next Generation Courseware Challenge and is using the grant money to develop an introductory statistics course that is the "first of its kind." For more, see below.

Partners: Historically, Cerego's main audience has been English-language learners in Japan, and it has partnered with both individuals and corporate customers. In 2012, it began to shift its focus to the U.S. education market and to individual learners in the U.S, and, most notably, partnered with edX to offer free courses from a variety of prestigious institutions to online learners. Additionally, it has partnered with Cengage Learning to power a memory-assessment component of its courseware.

In September 2014, Cerego was selected as a finalist in the Gates Foundation Next Generation Courseware Challenge and is using the grant money to develop an introductory statistics course called StatsPL. Other partners in the project include:

» OpenStax at Rice University, which will provide the text which guides the statistics course

» edX, which providers an open platform for hosting freely accessible courses

» NYU Create, which will help build simulations and games that will help students apply concepts from the course lessons

» BBC Worldwide, which will provide personalized and engaging videos on course content

» SETI Institute which will provide an applied learning environment that lets students "see the world of statistics through the eyes of an astronomer

» Fabien Cousteau's Ocean Learning Center, which will provide lessons that allow students to apply statistics to oceanography

» Columbia College and the City University of New York, which will act as pilot institutions for the course[13]

CogBooks

Website: http://www.cogbooks.com/

Type: Adaptive courseware platform

Content Model: Open

[13] "Introducing StatsPL: A Revolutionary New Course We're Developing with the Bill & Melinda Gates Foundation," Cerego Blog, (September 30, 2014), http://blog.cerego.com/post/98805710404/introducing-statspl-a-revolutionary-new-course.

Year Founded: 2007

Headquarters/Location Founded: Edinburgh, Scotland

LMS Integration: Integrates with providers

Business Model: For postsecondary institutions, Cogbooks charges annual licensing fees based on institutional size or on a per-user basis. In addition, it charges professional services and development fees for support during the implementation of its product.[14]

Funding Information: In October 2014, CogBooks secured $2.8 million in funding from DC Thompson Ventures and Nesta Impact Investments.[15] Like Acrobatiq, Cerego and Smart Sparrow, CogBooks was a finalist in the Gates Foundation's Next Generation Courseware Challenge to develop personalized courseware for low-income post-secondary students.[16]

About the Product: Cogbooks is a Scottish company that provides adaptive courseware to the corporate learning market and, more recently, to institutions of higher education. It markets itself as a micro-adaptive, intelligent, sequence driven learning system, meaning that at each "step" in the learning process, it responds to the learner's performance and "remaps" a learner's sequence accordingly (some providers do this on the unit level, rather than at the level of the individual question or activity). As students answer questions, the system develops an 18-parameter "learner profile," which informs an individual's learning path and the sorts of questions he or she is asked.

CogBooks has an open-authoring platform that allows instructors to create their own content or import content from open educational resources and third party systems. Additionally, instructors can decide the level of flexibility that a learner experiences within the platform. Learners can either move freely through content, or, if the instructor chooses, can be presented with a more structured and tailored sequence with mandatory activities. When configuring their first course on the platform, instructors are usually aided by instructional designers and subject matter experts (either CogBooks staff or contractors) in adapting their content for online delivery. Reporting and analytics allow

[14] "CogBooks" in Newman, "Learning to Adapt: Understanding the Learning Supplier Landscape," p. 27.

[15] Cogbooks gets 1.75 ($2.8) million education technology investment from DC Thompson Ventures and Nesta," CogBooks Blog (October 2014), http://blog.cogbooks.com/2014/10/02/cogbooks-gets-1-75-2-8-million-education-technology-investment-from-dc-thomson-ventures-and-nesta/.

[16] "Gates Foundation Announces Finalists for $20 Million in Digital Courseware Initiatives," Bill and Melinda Gates Foundation (September 30, 2014), available at http://www.gatesfoundation.org/Media-Center/Press-Releases/2014/09/Gates-Foundation-Announces-Finalists-for-$20-Million-in-Digital-Courseware-Investments.

instructors to track student progress and preemptively identify issues at the student and class levels.

Unlike many of the other solutions listed in this report, which are meant to be used as course supplements in lab or homework settings, CogBooks' platform is designed for the delivery of an entire course and, at least in corporate contexts, has been used to host courses that are fully online.

Partners: All partners listed on CogBooks website are corporate partners, however, the company's 2014 receipt of Gates Foundation funding for the Next Generation Courseware Challenge indicates that it is moving into the American higher education market. Like Acrobatiq and Smart Sparrow, CogBooks' grant funded initiative, entitled "Project 100," will consist of partnerships with ASU, corporate content providers, assessment companies and other colleges and universities. It will focus on the improvement of student learning outcomes in social science and history courses. Major actors include:

» ASU, which will design the courses on CogBooks' open-content platform.[17]

» NBC Learn, the educational arm of NBC Universal News Group, which will provide access to its vast collection of original videos and archival news stories

It is unclear if these courses will be delivered fully-online or in blended-learning environments.

In addition to this initiative, a CogBooks announced in July of 2014 a partnership with the UK Exam Board to offer a personalized MOOC.[18]

[17] Whether ASU will use their experience in online and blended learning to act as a "guide" to other universities in designing courses (as seems to be the case in Smart Sparrow's InSpark Science Network), or whether they will be the sole course designers, remains unclear.

[18] See "New partnership between UK exam board OCR and adaptive learning platform CogBooks to personalize first school Computing MOOC," CogBooks blog, July 29, 2014, available at http://blog.cogbooks.com/2014/07/29/new-partnership-between-uk-exam-board-ocr-and-adaptive-learning-platform-cogbooks-to-personalise-first-school-computing-mooc/ and "June 5th 2012: CogBooks expands into US higher education sector," available at http://www.cogbooks.com/news.html.

Knewton

Website: http://www.knewton.com/

Type: Adaptive learning software platform, partners with publishers for content

Content Model: Open, but only shares its API with publishers/content providers, not instructors

Year Founded: 2008

Headquarters/Location Founded: New York, NY, USA

LMS Integration: Depends on partnership

Business Model: Financials depend on partnership; Knewton provides publishers the adaptive platform for content; publishers share student data with Knewton to improve platform

Funding Information: Knewton has received five rounds of funding from a variety of venture capital firms, individual investors, and from Pearson Education. In total, Knewton has received $105 million in funding since 2008.[19]

About the Product: Knewton markets itself as "heavy duty infrastructure for the adaptive world." It provides the underlying infrastructure for Mylab, Cengage, Wiley, Gutenberg technologies and others content providers (Knewton provides APIs for its applications, and these partners provide content). Its products, like other adaptive learning software, provide personalized courses of study based on student performance as well as learning analytics.

Partners: While most of Knewton's partnerships are with publishers and other content developers (national and international), it notably partnered with Arizona State University in August 2011 to redesign developmental math courses through an initiative

[19] "Knewton," on CrunchBase, https://www.crunchbase.com/organization/knewton.

called the Math Readiness Program.[20] Courses were offered in online and hybrid formats, and content was based on Common Core Standards for Mathematics. ASU agreed to pay Knewton $100 for every student registered for a Knewton-powered course, and the university passed this fee onto students instead of charging them for a traditional textbook.

The university started out with 5,000 first year students in developmental math courses powered by Knewton. Some courses used Pearson-provided content on Knewton's platform. One of ASU's remedial math courses, MAT110, worked with Knewton's subject matter experts to adapt existing course content to an adaptive learning context, breaking down the existing syllabus into 52 distinct concepts to be mastered.[21]

Since the initial ASU partnership in 2011, Knewton has shifted its business model to primarily act as a platform provider in partnerships with content developers. As it has moved forward with its partnership with ASU and developed the university's Adaptive General Education program, all of the content has been provided by Pearson, with which Knewton has been partnering on select MyLab products since 2011. In this "ecosystem," Knewton provides ASU's instructors with data about their students' learning, maintains a "school official" at ASU, and provides ASU administrators with aggregate student data across the curriculum. Pearson also has a school official at ASU, and has unrestricted access to student learning data to improve its product. While Knewton provides the technical infrastructure to power Pearson MyLab's adaptive capabilities, Pearson shares data with Knewton and tags content to improve the adaptive features of Knewton's system. This allows Knewton to understand which content is related to which concepts, allowing them to track which concepts might be related to each other in student's learning experiences.

Knewton's partnership with Pearson began in October 2011. The ASU partnership preceded this.[22]

[20] "Knewton Technology Helped More Arizona State University Students Succeed," Knewton Case Study, http://www.knewton.com/assets-v2/downloads/asu-case-study.pdf; Luci Scott, "ASU pilot program aims to boost freshman math success," (January, 6, 2011), http://www.azcentral.com/community/tempe/articles/20110106asu-online-math-pilot-program.html.

[21] Steve Kolowich, "The New Intelligence," Inside Higher Ed (January 25, 2013) https://www.insidehighered.com/news/2013/01/25/arizona-st-and-knewtons-grand-experiment-adaptive-learning.

[22] Ibid.

Other partners include:

- Santillana
- Wizard
- Sesame Workshop
- Elsevier
- Glydendal Undervisning
- Sanoma
- Malmberg
- Sebit
- Adaptive Curriculum
- Microsoft
- Cengage Learning
- Gutenberg Technology
- Lelivrescolaire
- Cambridge University Press
- Macmillan Education
- Triumph Learning
- Houghton Mifflin Harcourt
- Wiley
- Pearson[23]

LoudCloud Systems

Website: http://www.loudcloudsystems.com/

Type: Adaptive courseware platform

Content Model: Open

Year Founded: 2010

Headquarters/Location Founded: Dallas, TX, USA

LMS Integration: Hosts its own

Business Model: LoudCloud offers both subscription and licensing options, with the price of the latter determined by the number of users. It charges additional fees for custom development, integrations, and professional services.

As the Tyton Partners report explains, LoudCloud's "product" consists of disaggregated modules. Institutions can purchase a full suite of modules, or can choose individual modules to integrate into their existing learning platform. These modules include an

[23] "Partners," Knewton, http://www.knewton.com/partners/.

adaptive e-reader/learning platform, a learning management system, analytics dashboards, and a course authoring tool for professors.[24]

LoudCloud markets itself to university leaders and administrators, and, as discussed in our description of the product, the platform includes features that make it particularly suitable to institutional implementations.

Funding Information: LoudCloud was founded in 2010 and has raised $11 million over two rounds of funding in 2010 and 2012.[25]

About the Product: LoudCloud Systems provides "customizable teaching and learning solutions built for collaboration and recommendation." Its signature product, "Fastrak" offers "competency based learning" models that allow students to progress at their own pace, collaborative authoring systems, and advanced databases that track and measure student progress. As discussed in "Business Model," LoudCloud also offers each of the integrated services in FastTrack as a distinct module, depending on an institution's needs.

Apart from the modular "ecosystem" that its products comprise, LoudCloud stands out from other products because it contains features that make it particularly suitable for institutional implementation. Its authoring system, which allows faculty to create content, mastery rules, and learning objectives, also allows users to share competencies across departments and programs. Additionally, its LMS and its reporting features offer views for administrators, faculty, and students, and its analytics module offers aggregated reports to "present a simple, consolidated performance dashboard of program, instructor, and student performance."[26]

Partners: LoudCloud System's website does not provide a list of partners, though a scan of recent news articles and press releases indicates that the University of Florida and Grand Canyon University use its products.[27] LoudCloud also partners with K-12 institutions.

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[24] "LoudCloud" in Newman, "Learning to Adapt: Understanding the Learning Supplier Landscape," p.38.

[25] Ibid.

[26] See "LoudSight," LoudCloud's website, http://loudcloudsystems.com/?page_id=604.

[27] See "LoudCloud Announces New Partnership with University of Florida, Lastinger Center," LoudCloud (September 18, 2014), http://loudcloudsystems.com/?p=1117; LoudCloud Systems Introduced First Fully Adaptive and Configurable Learning Management Systems for Higher Education and K12," PR Newswire (February 9, 2012), http://www.prweb.com/releases/LoudCloudSystems/LearningManagement/prweb9180054.htm.

Realizeit (by CCKF)

Website: http://www.cckf-it.com/

Type: Adaptive courseware platform

Content Model: Open

Year Founded: 2007

Headquarters/Location Founded: Dublin, Ireland

LMS Integration: Integrates with providers

Business Model: RealizeIt partners with K-12 and higher education institutions, and can be implemented by course or on a more systemic level. Additionally, it provides software for businesses for continuing education. No information on the financial details of these partnerships was available.

Funding Information: CCKF has raised €11 million in funding since 2007. In November of 2014, CCKF closed €5 million in funding to expand into the United States higher education market.[28]

About the Product: RealizeIt provides students with a customized learning experience and educators with analytics on students' performance. The system starts each course by determining each learner's current state of knowledge through an assessment. Then, the system uses an algorithm to determine the lessons that a learner needs to review (and, for the sake of the efficiency, which components of a course a learner does not need to review), and generates a personalized learning map. At each step in the course, the system adjusts the learning map in real time to adapt to the learner's demonstrated level of competency in a topic, skill, or concept.

Like other adaptive platforms, RealizeIt gathers data on a learner's performance to build a "learner profile" that informs the map, while providing instructors with insight on student performance and the effectiveness of the curriculum. As the system gathers and records data for each learner, it similarly creates profiles for each piece of learning content, question, resource and concept in the curriculum, and how each relates to one

[28] "Irish start-up CCKF uses algorithms to drive future of classroom," Silicon Republic, (August 13, 2013), http://www.siliconrepublic.com/start-ups/item/33784-irish-start-up-cckf-uses-al.

another. It uses this information to create a set of predictive analytics for each learner based on how they have performed on related sets of concepts and questions.

RealizeIT is "content agnostic," meaning it can be adapted to any content (the "ecosystem" is currently in use with 16 different subject areas). CCKF has also developed an automated process to migrate legacy material (including textbooks) and can host and deliver full courses that incorporate a variety of media types. Instructors can set objectives for learners, create specific tests and assessments as part of the learning process, and use analytics to vary the content delivered to different types of learners.

Partners:

- Western University of Health Sciences[29]
- University of Texas System's Total Educational Experience.[30]
- University of Central Florida
- Indiana University
- Bay Path University
- American Intercontinental University
- Apierian
- Sanford Brown
- Colorado Technical University
- The Career Education Corporation[31]

One Silicon Republic Article reports that, as of August 2013, students in more than 11,000 course areas had used the platform.[32]

[29] "Teaching Head and Neck Anatomy in a Blended Learning Environment," Western University, http://teachtech.westernu.edu/head-neck-anatomy-blended-learning/.

[30] Paul Fain, "Competency, Texas Style," Inside Higher Ed (November 16, 2014), https://www.insidehighered.com/news/2014/11/06/competency-based-health-profession-credentials-university-texas-system. For more on Total Educational Experience, see https://utx.edu/initiatives/tex/.

[31] The Career Education Corporation manages for-profit schools including Colorado Technical University and American Intercontinental University. The company has invested in CCKF as part of an effort to transform learning in many of its schools. See Paul Fain, "New Player in Adaptive Learning," Inside Higher Ed (July 29, 2013), https://www.insidehighered.com/news/2013/07/29/career-education-corp-expands-major-adaptive-learning-experiment.

[32] "Irish start-up CCKF uses algorithms to drive future of classroom," Silicon Republic, (August 13, 2013), http://www.siliconrepublic.com/start-ups/item/33784-irish-start-up-cckf-uses-al.

Smart Sparrow

Website: http://www.smartsparrow.com/

Type: Adaptive courseware platform

Content Model: Open

Year Founded: 2011

Headquarters/Location Founded: Sydney, Australia

LMS Integration: Integrates with providers

Business Model: Smart Sparrow offers a variety of tiered licensing agreements with and charges additional fees for professional services, including curriculum development, pedagogical consultation, content development, student support, integrations and software development. The solution is priced per academic license, and depends upon the number of authors and the number of students who will be using the product. Group licenses are also available for academic departments, as are enterprise licenses for more institutional implementations.

Prices are as follows:

» $39/mo for tutorials and individual teachers

» $119/mo for small and medium sized classes

» $199/mo for lectures and courses

Custom prices are available for larger class sizes and campus-wide institutions.

Smart Sparrow has also worked with institutions to develop specific resources or full courseware. For example, in August 2012, Smart Sparrow received a $3.3 million (Australian) grant from Australia's National Broadband Network Enabled Educations and Skills Service Program to develop courseware for a national biomedical education initiative that was delivered through several Australian medical schools.[33]

Funding Information: In 2011, Smart Sparrow secured a round of institutional funding from Australia venture firm OneVentures and Uniseed. Smart Sparrow has also

[33] "Smart Sparrow," in Newman, "Learning to Adapt: Understanding the Learning Supplier Landscape," p.54.

received grants to fund specific initiatives (see reference to the biomedical education initiative above), and is a finalist in the Gates Foundation's Next Generation Courseware Challenge (see "Partners" section).

About the Product: Smart Sparrow is the product of the Adaptive Learning Research Group and the University of New South Wales, based on research conducted by Dr. Dror Ben Naim for his dissertation in the UNSW School of Computer Science and Engineering. More so than most other providers, Smart Sparrow empowers instructors to author their own content, and boasts an "intuitive authoring tool" with drag and drop functionality, built-in templates, collaborative tools, and easy rule-setting procedures for creating up adaptive learning paths. Additionally, Smart Sparrow's platform includes "Knowledge Analytics" that provides instructors insight into how students interact with content so that instructors can optimize their courses based on evidence.

For students, the product provides instant adaptive feedback based on their performance, and develops learning pathways depending on mastery levels and rules that the instructor has set.

Partners: Though Smart Sparrow has much more of a presence at Australian Universities, it is beginning to expand into the U.S. market. Partner universities listed on its website include:

» Arizona State University

» University of New South Wales

» Central Queensland University

» University of Newcastle

» Monash University[34]

Like Knewton, Smart Sparrow enjoys a strong partnership with Arizona State University. In April of 2014, the company announced a partnership with ASU online in which they would launch a course called "HabWorlds Beyond," that would teach students about space exploration and climate science. The course was developed by ASU and Smart Sparrow over the course of three years, and, beginning in Fall 2014, was made available to any institution via the Smart Sparrow platform.[35]

[34] See "Case Studies," Smart Sparrow, https://www.smartsparrow.com/case-studies/.

[35] "Smart Sparrow and Arizona State University to Launch HabWorlds Beyond," MarketWired (April 22, 2014) http://www.marketwired.com/press-release/smart-sparrow-and-arizona-state-university-to-launch-habworlds-beyond-1901610.htm.

Building on this model, Smart Sparrow and ASU announced on January 16, 2015 that it would partner with twenty-four universities and colleges to create the "InSpark Science Network," designed to improve outcomes in science courses with high failure rates. Smart Sparrow, funded by a $4.5 million grant from the Gates Foundation's Next Generation Courseware Challenge, would provide faculty with tools to develop and share general education science courses, and to deliver these courses to their students in adaptive, blended learning formats.

InSpark includes multiple academic, non-profit, and corporate organizations. Founding partners in the InSpark Science Network initiative include:

» ASU, where Profess Ariel Anbar, director of the Center for Education through Exploration, will guide faculty in the network in developing "smart courses that teach basic science concepts through the exploration of intriguing questions," (the details of the uniformity of these courses from school to school, and ASU's role in authoring them, remain unclear)

» Achieving the Dream, which will work to ensure that faculty and community colleges can access the network

» The University of Texas at Arlington, where George Siemens, Executive Director of UT-Arlington's Learning Innovation and Networked Knowledge lab will lead a research effort to test the efficacy of the initiatives

» e*mersion, a science animation company[36]

This initiative marks a significant increase in Smart Sparrow's presence amongst American institutions.

[36] "Network of Science Educators Will Tap Emerging Technologies to Tackle College Completion Challenge," MarketWired (January 16, 2015), http://www.marketwired.com/press-release/network-science-educators-will-tap-emerging-technologies-tackle-college-completion-challenge-1983608.htm.

Closed-Content Platforms

Acrobatiq

Website: http://www.acrobatiq.com

Type: Adaptive courseware platform and content provider

Content Model: Closed, but in the process of developing an authoring platform (see "About" section.) Currently, instructors can customize the order of content and assessments, and can add in media, but cannot create their own courses.

Year Founded: The Carnegie Mellon Open Learning Initiative, Acrobatiq's predecessor, was founded in 2001. Acrobatiq was launched in July 2013.

Headquarters/Location Founded: Carnegie Mellon University, Pittsburgh, PA USA

LMS Integration: Integrates with providers

Business Model: Licensing agreements, cost based on agreement

Funding Information: Acrobatiq is backed by Carnegie Mellon University, and built on the work of the Open Learning Initiative. OLI has received more than $20 million in grant funding since it was founded in 2001, and was initially funded by the William and Flora Hewlett foundation. In late 2014, Acrobatiq was named a finalist in the Gates Foundation's "Next Generation Courseware Challenge," and is splitting $20 million in funding to pursue initiatives to enhance its courseware to improve outcomes for low-income students.

About the Product: Based on research conducted through Carnegie Mellon University's Open Learning Initiative and backed by CMU., Acrobatiq offers customizable, adaptive courseware for college courses. The courseware combines instruction, simulations, assessments and goal directed activities ("Adaptivities") with hints and feedback for students, and can be used in conjunction with or as a replacement for a textbook for undergraduate courses. Each unit begins by summarizing the big picture and the organization of the material in the course and how it fits together. Students must take self-assessments before moving on to new material. Practice questions are customized and personalized for individuals based on their levels of mastery—those with lower estimated mastery receive more practice problems than those with high estimated mastery.

A “Learning Dashboard” provides real-time student data to professors that they can use to determine where students need additional assistance and how to focus in-class time. Additionally, the Learning Dashboard can be customized by adding, moving, or deleting data cards.

Though Acrobatiq does not currently support an open-content authoring platform, the platform does offer some opportunities for customization. Instructors can change the course name, and delete, add or reorder the modules and units. They can also choose whether the quizzes are graded or timed, how assessments are given, and incorporate their own videos and media.

Acrobatiq can be implemented systematically or on a course by course basis. Acrobatiq provides courseware for the following subjects:

- Educational Research Methods
- Information Technology Fundamentals
- Anatomy and Physiology
- Survey of World History
- Statistical Reasoning
- Probability and Statistics
- Introduction to Biology
- Introduction to Psychology
- Nursing Informatics

Though Acrobatiq’s content platform is not currently open to authoring from instructors, it is in the process of making this a possibility. In October 2014, Acrobatiq was named a finalist for a $20 million grant as part of the Gates Foundation’s Next Generation Courseware Challenge, launched to support learning initiatives designed to help disadvantaged college students with general education classes. Acrobatiq will receive a portion of the prize along with 7 other finalists.[37] It will use the money to “accelerate the development of a new authoring platform that allows individual educators to create their own courses based on [its] research-backed instructional methodology.” Additionally, Acrobatiq will use the funding to enhance its current offerings, develop new courseware, enhance the Learning Dashboard for instructors, create a new Learning Dashboard for students and test new pricing models. The initiative would consist of partnerships between Acrobatiq, StraighterLine (an online course provider), Western Governors University, ASU, the University System of Georgia, ACE and others.[38]

[37] Keith Button, “These 7 ed tech solutions will split $20M from the Gates Foundation,” Education Dive (October 17, 2014), http://www.educationdive.com/news/these-7-ed-tech-solutions-will-split-20m-from-the-gates-foundation/320527/.

[38] Keith Hampson, “The Gates Courseware Challenge,” Acrobatiq Blog (January 6, 2015), http://acrobatiq.com/the-gates-courseware-challenge/.

Partners:

- Western Governors University
- New Mexico State
- UNC-Chapel Hill
- University of Pittsburgh
- Carnegie Mellon University
- NYU
- University of Kansas
- University of Colorado Boulder
- Eastern Illinois University
- University of Georgia
- University of Maryland, Baltimore County
- Laureate International Universities
- Binghamton University
- University of Texas at El Paso
- Queens University
- University of Illinois at Chicago
- Point Loma Nazarene University
- Marist College
- Morrisville State College
- University of Texas at Dallas
- Seattle University
- Southern Christian University
- University of Vermont
- Alfred University
- Cuyamaca College
- Andrews University
- Le Moyne College
- Grays Harbor College
- Mountain View College
- Northwester Michigan College
- Rollins College
- Santa Fe College
- Santa Ana College[39]

As part of the Next Generation Courseware Challenge, Acrobatiq currently (as of February 2015) has a call for institutional partners posted on its website to "pilot enhanced adaptive courseware and to provide implementation feedback" for terms beginning in the summer and fall of 2015. Partner institutions will be able to use the software, and receive training, support, evaluation services, and reports at no charge.

[39] All information from Acrobatiq's website, http://acrobatiq.com/.

Adapt Courseware

Website: http://adaptcourseware.com/

Type: Adaptive courseware

Content Model: Closed, with some configurability to combine or edit exiting content with instructor or third-party content

Year Founded: 2010

Headquarters/Location Founded: Las Vegas, NV, USA

LMS Integration: Integrates with providers

Business Model: Licensing agreements with universities

About the Product: Adapt Courseware provides adaptive learning tools that test for leaner mastery of each topic within a course and provide instructors analytics and data about student achievement. Designed for the delivery of an entire course (though it has been implemented in blended learning environments as well), the platform offers students three ways to receive information: they can watch videos of lectures or demonstrations, read lecture notes, or practice relevant activities in an interactive manner. When students engage in practice activities, their performance on one problem will determine the content and questions to which they are subsequently directed. At its most basic level, practice questions are "stacked" in order of difficulty, and an algorithm determines to which level of questions the student should be directed, depending on whether he or she responded correctly to previous ones. Instructors can customize questions and the order in which they are stacked.

The platform provides analytics to both students and instructors. Students can track their progress on a given unit through a "mastery bar," while instructors have access to more detailed data on individual student progress and class-level problem areas.

Finally, the courseware includes social learning components. These are useful for remote learners in fully online courses, but could also serve as valuable tools in more proximate or blended settings. Students create a profile on the social learning platform, and can engage in discussions with other students, ask questions to the instructor, search for students with similar interests or who live nearby, and can even arrange study sessions with other learners. The social learning platform includes screen sharing, messaging

tools, and webcam support, and allows for the creation of groups based on a variety of factors, including a student's progress in a course.

Adapt Courseware currently makes products for business, composition, mathematics, and social studies courses. According to Tyton Advisors, the company has secured funding for a 22-course general education roadmap which would include a full suite of courses to fulfill the requirements for an associate's degree in business.[40]

Partners: Adapt Courseware advertises its courses to the postsecondary market, but does not provide a list of partner institutions on its website. It does reference two notable partnerships that deserve mention here.

» In October 2013, Adapt Courseware was awarded one of fourteen grants offered by the Bill and Melinda Gates foundation as part of its Adaptive Learning Market Acceleration Program. Adapt is using the grant money to fund a two-year study, in partnership with North Carolina State, to test student learning outcomes in adaptive learning sections of Introduction to Psychology courses against outcomes in sections that do not use adaptive courseware. [41]

» Adapt Courseware is a Pearson eCollege Technology partner, meaning that its solutions have been incorporated into Pearson's Learning Studio and integrate easily with Pearson platforms.[42]

Cengage MindTap

Website: http://www.cengage.com/mindtap/

Type: Adaptive courseware

Content Model: Publisher based, with many opportunities for customization (instructors can rearrange content, delete content, or add their own content/assignments)

[40] "Our Product," Adapt Courseware, http://adaptcourseware.com/whyadapt/ourproduct/; "Adapt Courseware" in Newman, "Learning to Adapt: Understanding the Learning Supplier Landscape, p. 16.

[41] See Kristi Emerson, "NC State University Partners with Adapt Courseware to Secure Adaptive Learning Grant," Adapt Courseware News (October 2013), http://adaptcourseware.com/ncstategatesgrant/

[42] See "Partners and Grants," Adapt Courseware, http://adaptcourseware.com/company/partners/.

Year Founded: Cengage Learning was founded in 2007. Mindtap was launched in March 2011 but only emerged as truly "adaptive" when it partnered with Knewton in February 2015.[43]

Headquarters/Location Founded: New York, NY, USA

LMS Integration: Integrates with providers

Business Model: Licensing fees, with pricing options based on the course and a customizable suite of apps for interactive assignments, quizzing, and assessment. Cengage Mindtap is sold to specific instructors (rather than institutions) on a course-by-course basis.

Funding Information: Cengage was created through the restructuring of International Thomas Publishing in 2007. From this initial buyout, as well as acquisitions of other publishing and training companies, Cengage acquired $5.8 million in debt. On July 2, 2013, Cengage filed for Chapter 11 Bankruptcy. The company emerged from Chapter 11 on March 31, 2014, eliminating $4 billion of debt and securing and additional $1.75 billion in exit funding.[44]

About the Product: Mindtap was initially offered as a customizable, multimedia e-textbook with opportunities for instructors to incorporate their own materials with Cengage's curriculum and content. The original product allowed instructors to track student progress and students to interact with course content from a variety of devices. It offered products for a variety of college courses, from business to anthropology to mathematics. With the February 2015 announcement of a partnership with Knewton's adaptive learning engine, Mindtap's product will come to look much more like the other platforms included in this report (pilot projects will begin in select business and sociology courses). Expected to launch in fall 2015, the platforms will now offer personalized learning pathways to students based on their performance and predictive analytics tools to instructors based on student data.[45]

Partners: Cengage partners include more than 750 four-year and two-year institutions in the United States.

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[43] "Cengage Learning Launches Knewton Adaptive Learning Technology within MindTap for Management and Sociology Students," PR News Wire (February 18, 2015), http://www.prnewswire.com/news-releases/cengage-learning-launches-knewton-adaptive-learning-technology-within-mindtap-for-management-and-sociology-students-300037621.html.

[44] Carl Straumsheim, "Cengage Surfaces," Inside Higher Ed (April 2, 2014), https://www.insidehighered.com/news/2014/04/02/cengage-learning-emerges-bankruptcy-focus-digital-growth.

[45] Joshua Bolkan, "Cengage Partners with Knewton on Personalized Learning," Campus Technology (February 2015), http://campustechnology.com/articles/2015/02/18/cengage-partners-with-knewton-on-personalized-learning.aspx.

Hawkes Learning Systems

Website: http://www.hawkeslearning.com/

Type: Adaptive courseware

Content Model: Closed, publisher-based

Year Founded: 1979 (textbooks); transitioned to courseware in 1985

Headquarters/Location Founded: Mount Pleasant, NC, USA

LMS Integration: Hosts its own

Business Model: Licensing agreements, cost based on agreement

About the Product: Hawkes Learning Systems' "mastery based homework and testing system provides error-specific feedback for students and a complete course management system for instructors." Their products also include supplemental textbooks, online gradebooks (a course management system), test generators and lesson editors. Case studies on Hawkes' site indicate that the software can be used for a variety of course structures, including:

» Supplement to Lecture/Hybrid (mix of lecture and lab time, sometimes structured group activities are included)

» Computer Assisted (aids students through instruction and practice of the material before they move onto graded homework assignments.)

» Modular-Emporium (lab time replaces lecture time, students progress through material at different rates)

» Online, self-paced[46]

Like Pearson's MyLab, Hawkes is used in National Center for Academic Transformation-funded course redesigns.[47]

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[46] See "Case Studies," Hawkes Learning Systems, http://www.hawkeslearning.com/Instructors/TestimonialsAndCaseStudies.htm.

[47] See "Six Models for Course Redesign," as well as the entire National Center for Academic Transformation website, http://www.thencat.org/PlanRes/R2R_ModCrsRed.htm.

Partners: No full list is available, but case studies on Hawkes' website include:

- Alcorn State University
- Ancilla College
- Arkansas State University
- Austin Peay State University
- Central Michigan University
- Culver Academy
- Fort Scott Community College
- Greenville Technical College
- Kaua'I Community College
- Kirkwood Community College
- Mississippi Valley State University
- Morehead State University
- Navarro College
- Southwestern Michigan College
- Spoon River College
- Springfield College
- Texas State Technical College
- University of Mississippi
- University of Nevada-Las Vegas
- University of New Mexico-Gallup
- University of North Carolina-Charlotte
- University of Wisconsin-Sheboygan[48]

McGraw Hill-Learn Smart Advantage

Website: http://learnsmartadvantage.com/products/learnsmart/

Type: Adaptive courseware

Content Model: Closed, publisher-based

Year Founded: 2009

Headquarters/Location Founded: New York, NY, USA

LMS Integration: Integrates with McGraw Hill's LMS, Learn Smart Connect

Business Model: LearnSmart can be purchased as a standalone product, or as an add-on to McGraw Hill's digital homework management platform, Connect. As a standalone product, pricing depends on the subject and whether the product will be used for one or

[48] All information from Hawkes' website, http://www.hawkeslearning.com/.

two semesters. As an integration, fees for LearnSmart are included in the price that an instructor or institution pays for Connect.[49]

Funding Information: LearnSmart has been funded by McGraw-Hill through an exclusive development relationship with Area9 (the technological infrastructure that powers LearnSmart).[50]

About the Product: LearnSmart Advantage is adaptive learning technology that includes LearnSmart (a course supplement), SmartBook (an adaptive e-reader), LearnSmart Achieve (for "long-term memory"), LearnSmart Prep (course prep) and Learn Smart Labs (for science). Like other adaptive learning software, LearnSmart advantage products offer personalized learning paths for students based on their performance and analytics for students and instructors. They are designed as course supplements to be used for homework or in lab sessions. Content is based on McGraw-Hill's material, and cannot be added to by instructors.

Partners: No full list is available, but partners include:

- Amarillo
- California State University Dominguez Hills
- Hinds Community College
- New Mexico State University
- State College of Florida
- Triton College
- University of Colorado Denver
- Valencia College
- Bunker Hill Community College
- College of Charleston
- Lone Star College Cyfair
- Northwest Vista College
- Tennessee Tech University
- University of Cincinnati
- University of South Carolina[51]

[49] "LearnSmart" in Newman, "Learning to Adapt: Understanding the Learning Supplier Landscape," p.42

[50] Ibid.

[51] All partners listed in LearnSmart's case studies, available at http://learnsmartadvantage.com/instructors/case-studies/.

Pearson MyLab

Website: http://www.pearsonmylabandmastering.com/

Type: Adaptive courseware

Content Model: Closed, publisher-based

Year Founded: Pearson Higher Education founded in 1998; unclear if MyLab launched with it or later, though 2006 annual reports cite its usage.[52]

Headquarters/Location Founded: Upper Saddle River, NJ, USA

LMS Integration: Integrates with providers

Business Model: Licensing agreements

» Cost to Student: Online course, etextbook and a printed textbook cost around $200 for students, and the course itself costs $85.50 for most courses.[53]

» Cost to University: Based on agreement

About the Product: MyLab offers textbook-based, multi-media, adaptive learning tools for college courses that enable instructors to deliver all or a portion of their courses online. The course materials offer exercises directly correlated to Pearson textbooks that instructors can assign for homework, quizzes, or tests. These exercises are presented with sample problems and interactive guided solutions, and regenerate algorithmically to create a learning path determined by a learners' demonstration of mastery. Learning paths consist of units that include a pre-test, videos and slides on the content, practice problems and a post-test. MyLab's online grade book automatically tracks all student results and gives the instructor control over how to calculate final grades.[54]

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[52] Pearson's archived press releases only go back to 2010; Annual Reports go back to 2006.

[53] See "FAQ", Pearson MyMathLab, http://www.pearsonmylabandmastering.com/northamerica/mymathlab/educators/faqs/index.html.

[54] "MyLab & Mastering: Features," Pearson MyLab, http://www.pearsonmylabandmastering.com/northamerica/educators/features/feature.php?f=1.

MyMathLab's products are built around Pearson's textbooks, with some room for customization at the course level. The platform has been embraced by the National Center for Academic Transformation as an integral tool in math course redesign.[55]

Partners: Though no comprehensive list has been made public, the Pearson website includes many case studies that provide a sense of MyLab's clientele.[56] Their partners include two-year and four-year colleges, and their products are used in both hybrid and fully-online undergraduate classrooms.

MyLab, like other Pearson products, has a strong international presence, and has implementations at universities in the Middle East, Australia, and beyond. In 2013, more than 1.3 million international students registered for MyLab solutions (not exclusively for math), and increase of 17% from 2012. In North America, student registrations grew 9% to almost 11 million.[57]

Wiley Plus with Orion

Website: http://www.wiley.com/college/sc/oriondemo/index.html

Type: Adaptive courseware

Content Model: Closed, publisher-based

Year Founded: 2013

Headquarters/Location Founded: Hoboken, NJ, USA

LMS Integration: Integrates with providers

Business Model: Licensing agreements, cost based on agreement

About the Product: WileyPlus with Orion emerged in 2013 as the product of a partnership between WileyPlus (Wiley's online textbook provider) and SnapWiz, an adaptive learning technology engine. The product integrates Snapwiz's technology with

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[55] See National Center for Academic Transformation, http://thencat.org/.

[56] See "Results," Pearson MyLab & Mastering, http://www.pearsonmylabandmastering.com/northamerica/educators/results/results-library.php.

[57] Pearson, "Annual Report and Accounts 2013," https://www.pearson.com/content/dam/corporate/global/pearson-dot-com/files/annual-reports/ar2013/2013--annual-report-accounts.pdf.

Wiley Plus content, giving students personalized learning pathways based on their demonstrated levels of proficiency, and instructors analytical tools to track student progress.[58] For each chapter, the solution determines a learner's initial level of mastery by administering a chapter-level diagnostic test. Based on the results of this diagnostic, learners can go back and study WileyPlus material before embarking on activities or continue onto personalized practice questions at the chapter or learning objective level. As learners practice, the system adapts continuously, determining subsequent questions and activities depending on how learners answer questions, on their indicated levels of confidence, on how long it takes them to answer each question, and on how much time has elapsed since they've answered a similar question. Students can track their progress on a "Personal Proficiency Dashboard," which allows them to see which questions they've completed correctly, their mastery of particular topics, and their performance relative to the rest of the class.

Instructors also have access to real-time proficiency reports so that they can see where reinforcement is needed on the class and student level. These reports include class dashboards that provide summaries of usage, a "Class Metacognitive Analysis" that displays each student's level of topic proficiency, and a report on the most challenging activities for the class. Instructors can also use the tool to facilitate collaboration between students, and can use proficiency reports to group together students with similar needs.

WileyPlus with Orion currently offers courseware for a broad range of WileyPlus titles, including those for accounting, anatomy, natural sciences, finance, mathematics, and Spanish.

Partners: WileyPlus with Orion partners with two-year and four-year institutions in the United States. No list is publicly available.[59]

[58] For more on this partnership, see "Wiley and Snapwiz to bring Adaptive Learning Technology to WileyPlus," *Book Business Magazine* (May 9, 2013), http://www.bookbusinessmag.com/article/wiley-snapwiz-bring-adaptive-learning-technology-wileyplus/.

[59] All information from the WileyPlus with Orion website, http://www.wiley.com/college/sc/oriondemo/index.html.