BRAVE NEW WORLD OF EDUCATION:

Personalized Adaptive Learning Tools
Promises One-on-One Tutoring for All Students

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Introduction – Three 21st Century Students

1. **Joe** -- a college freshman at a state university is up late studying for his Intro to Psychology exam. He pushes the books on his desk aside and takes out his tablet. Resisting the temptation to click on a game, he navigates to a virtual tutor, a personalized algorithm-enabled assessment and study program that tests him on what he has just read. He does okay – but not perfect. The program notes he’s still unsure about one or two key concepts covered in the course reading this week. “Good enough to pass the exam,” he thinks. But before he closes out of the program, Joe’s virtual tutor suggests he take another look at the relevant passages of the ebook covering those concepts. The specific material appears on his screen, and Joe is able to read just those sections where he needs to pay closer attention. When he goes back to take the assessment again, he aces it. Studying seems to take a lot less time than it did in high school, Joe thinks, despite college work being much more challenging. Maybe there’s time for a quick game after all.

2. **Gabe** -- Gabe, a seventh grade middle school student, is in summer school. He likes playing computer games and using the computer. Consequently, he likes learning on his own using the computer much more than he does in a full classroom environment. Luckily, Gabe’s school uses an adaptive learning program that develops a personalized learning plan based on how each student learns best. In Gabe’s case, the system recognizes that Gabe does better in a virtual learning set-up and it assigns him to learn this way more frequently. When Gabe and his friend, Colin, discuss what they learned in their previous classes at lunch, they realize they are both working towards the same skills but in a manner that is more enjoyable for each one of them. Gabe’s phone vibrates at the same time as Colin’s with an incoming message. They both get text messages telling them which classroom and teacher they should report to right after lunch, and both head off for more individualized learning.
3. **Jenn** -- is a college freshman about to take a placement exam that will determine the math course she will need to take in her first semester. No paper-and-pencil exam at her college. Instead, Jenn takes a 45-minute online assessment that determines her mathematical knowledge by asking roughly 30 questions. Each subsequent question is based on the Jenn’s response to all the previous questions; each set of assessment questions is unique. When Jenn completes the assessment, a precise report of her mathematical knowledge is generated. Based on that information, Jenn is placed in the appropriate math course aligned with her abilities. Since the college has accurate placement information for Jenn, it’s a win-win situation for her and the college. She’s placed in a course that matches her skill level, and the college has some level of certainty that Jenn will succeed in the course and not have to re-take it or consider dropping out of school as a result of failing the course.

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These scenarios may sound as if they are taking place in the classroom of the near future, but in fact, this kind of learning is going on right now – in the United States and in many other countries. Adaptive learning programs like LearnSmart, ALEKS and, most recently, Power of U are here, **now**, and they are already making a significant difference for thousands of students.

And we’ve only just begun.

What these and other adaptive learning programs in development promise is a long-term, cost-effective way of providing each and every student – from kindergarten all the way up and through graduate school and beyond – with a “smart” program designed to adapt to a student’s individual strengths and weaknesses and provide customized, precisely targeted, and evidence-based educational content. As the program “learns” where the student is in his or her development, it responds with an evolving stream of up-to-date lessons and materials that are always extending a students' knowledge frontier – just one step ahead of where the student currently is in his or her journey toward mastery of any given subject.

Some have compared adaptive learning to the GPS technology many people now have in their cars. These navigation tools always know a car’s exact location and speed, as well as current traffic

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**How One College Instructor Incorporates Adaptive Learning Tools into Her Coursework**

Professor Kathleen (Kitty) O’Donnell is a CPA and assistant professor of Accounting in the Department of Business Administration at Onondaga Community College in Syracuse, New York. Onondaga is part of the State University of New York (SUNY) system with nearly 13,000 full- and part-time students working toward two-year degrees in 28 separate academic disciplines.

We spoke with Professor O’Donnell to get the perspective of an instructor who is actually employing adaptive learning tools in her classroom now. In her Accounting classes, she uses LearnSmart with *McGraw-Hill Connect*®, a web-based assignment and assessment platform.

**What is it that encouraged you to begin using these new tools in the first place?**

“We’ve had ‘smart classrooms’ for a while now. What we’ve been waiting for are smart technologies to take full advantage of those smart classrooms. That’s what programs like Connect and LearnSmart offer.”

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conditions. Information is updated continually to constantly adapt and offer the optimal route for getting drivers where they want to go as efficiently as possible. Others have likened adaptive learning to “smart” search engines or social media tracking tools and advertising. These interactive programs, which have become ubiquitous in many consumer-based industries, are powered by sophisticated algorithms; they have the ability to assess a consumer’s individual preferences and respond with ads for products of particular interest to that consumer.

Like social media, these new learning tools can be accessed easily over the hand-held devices used every day. Being able to download and work with adaptive learning tools on their smart phones, tablets or laptop computers empowers students to drive their own learning by putting increasingly intelligent technology into their hands.

McGraw-Hill Education, a leader in the field of adaptive technology, provides technology-enabled products like LearnSmart, Power of U and ALEKS that yield positive, measurable learning outcomes. The company has been working with customers to build and evolve these offerings and continues to make extensive investments to enhance these learning solutions along the way.

McGraw-Hill’s LearnSmart, for example, added 100,000 new users in February of 2012 alone, bringing the total number of LearnSmart users to nearly 800,000 since its inception in the fall of 2009. LearnSmart is accessed by a U.S. college student every five seconds. ALEKS has been used by millions of students in over 50 different mathematics, science, and business courses at thousands of K-12 schools, colleges and universities throughout the world. And McGraw-Hill’s Power of U is scheduled to deliver more than 250,000 hours of personalized instruction to students during the 2011-2012 school year.

Speaking at the 2011 China International Forum on Education last October, McGraw-Hill Education President, Robert Bahash, noted that

What do adaptive learning technologies offer that teachers don’t already provide?

“It’s true that you can’t have good adaptive learning without good adaptive teaching, but education has changed a lot since I first began teaching, which is longer ago than I’d like to admit, and we need to keep up with those changes.”

“I’m not just talking about changing technology either. In fact, educational technology has been slow to keep up with the changes that have been going on in education.”

What kinds of changes?

“The students themselves have changed – their attitudes and approaches towards learning have changed. When I started teaching, the students had to keep up with us. Now it’s our responsibility to keep up with them.”

“Students learn differently today, and a lot of them are smarter than we were. My own children are certainly quicker than I am when it comes to navigating new media. And that’s as it should be.”

“Young people move easily among the web and tech tools available to them and they’re very cheerful shoppers -- for educational content as well as for shoes and games. We have to provide them with interactive educational materials that can compete with YouTube and Tumblr and all the rest. We have to adapt to what resonates with the students as they are today, not the way we were.”

“The educational objective today is to move them ahead academically and let them think they’re doing it all on their own. That empowers them.”

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research conducted by psychologist, Benjamin Bloom, more than fifty years ago “found that the closer teaching comes to a one-on-one interaction, the more effective it is.” Today’s sophisticated software platforms are helping teachers achieve Bloom’s ideal of individualized instruction.

 “[This] innovative technology,” Bahash told the international forum, “has the potential to open the door to unparalleled student achievement and success around the world.”

Adaptive Learning: What it is – and isn’t.

“Adaptive Learning” is just one of the terms used to describe interactive, digital and usually web-based software programs and platforms, like McGraw-Hill’s LearnSmart, Power of U and ALEKS.

Based on more than 25 years of solid research and development by hundreds of cognitive researchers and education professionals, these “smart” programs are designed to assess an individual student’s current and changing state of knowledge on a given subject. They incorporate and build on an initial assessment – continually updating it – and provide the learner with precisely-targeted, pedagogically-impeccable instructional materials that increase in difficulty as the student moves from novice to mastery in the subject.

In effect, adaptive learning tools are student-centric, transforming students from their traditional role of being passive recipients of information into active collaborators in the education process.

One of the most important features of all effective adaptive learning programs is real-time tracking of student progress or the lack of progress. These tools maintain a continuously updated inventory of what a student has and has not yet learned. In this way, the student is provided with new material based upon existing knowledge at the time he or she is fully prepared and ready to

How do Connect and LearnSmart make that happen?

“LearnSmart allows me to have an almost game-like environment in the classroom. We can set up teams, with three or four students on a team, and you can watch them as they rip through the LearnSmart questions and answers, each team competing against all the others.”

“As this is going on, all the team scores are projected in the top right-hand corner of the screen for everyone to see. The students become so fiercely engaged and competitive that they don’t realize how much they are learning. They think we’ve taken a break from the class, but what we’ve really done really is move the class into learning hyper-drive.”

What about Connect?

“There are a couple of things I love about Connect. One is that I can see who has done the assigned reading and who hasn’t. So if a student begins asking questions in class that he or she would have known if they’d only done the reading, I can say ‘that question was covered in the reading and I see you haven’t had a chance to do the reading yet, so let’s put that question aside until you have read that section.’ This prevents the unprepared student from monopolizing class time.”

“The second thing I like about Connect is that it allows students who learn at different speeds – fast or slow – to all benefit. The more astute students can get as much as possible out of the course. They can work at a higher level or even move ahead at a faster pace. And the students who need more time to work have the time and resources to keep up and pass the course – as long as they work. It still comes down to work ethic. If you work hard, you pass the course.”

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incorporate it. This offers each student a clear and sequential learning path with no gaps, facilitating a full and complete understanding of the discipline being mastered.

As noted earlier, adaptive learning is much like a GPS navigation system, with one crucial difference: transportation maps do not change all that often whereas many education disciplines are continually adding to and refining their state of knowledge. That is why textbooks are regularly revised. But revisions in traditional print textbooks can only occur every few years. With subscription-based adaptive learning programs like LearnSmart, ALEKS and Power of U, content can be seamlessly and continually updated as advances are made in any given field.

Advances in pedagogy and new, more effective methods of presenting the material can be continually tested, evaluated and implemented and the algorithms driving the instruction can constantly be tuned and improved as well. In effect, these programs become “smarter” and more closely adapted to individual student needs over time.

Adaptive learning educational tools do not “think” in the same way that we use the term when speaking of human thought. What these programs do is employ sophisticated algorithms to “learn” and “adapt.”

Smart tutoring programs like LearnSmart, Power of U and ALEKS are most effective when they are: (1) employed in conjunction with a formal course; (2) aligned with a corresponding textbook (ebook or traditional print); and (3) informed by an institution’s or instructor’s pedagogical philosophy and approach. Many of the teaching and learning systems available now contain features that allow instructors to record their lectures, create assignments, grade homework and monitor the progress of both individual students and entire groups.

“The need for academic excellence has increased dramatically over the past few decades, although I agree that the level of student preparedness has decreased. These technologies allow us to bridge that gap.”

Are the programs difficult for the students to learn?

“Not at all. The programs are very intuitive, and students catch on right away. The only time I’ve ever had to teach anyone how to use this has been to other faculty members. Some faculty members are resistant but as soon as they realize how easy it is – and how it improves efficiency for both them and their students – they become enthusiastic users.”

Anything else you’d like to add?

“Just that I love my job more now than when I first started, and I think the efficiencies and fun we get from using new technologies in the classroom is a big part of that.”

“It’s a real privilege to have a job that allows me to stay up to date with what’s going on.”

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The Alliance for Excellent Education (AEE) reports that some education researchers talk about teachers moving from being “sages on stages” to “guides on the side.” Greg Whitby, the executive director of schools for the Catholic Diocese of Parramatta, Australia, prefers to describe the new role of teachers in the 21st century as “educational designers.”

Teachers are both a scarce resource and essential to the education process. Smart systems do everything possible to maximize scarce resources, and programs like LearnSmart and Power of U help to maximize the efficient use of teacher resources by identifying places in the process where they are most needed and allocating them intelligently.

The fact is that with or without adaptive learning tools, students only achieve mastery by studying hard, paying attention and becoming proficient at each level of the subject or skill they want to learn before going on to the next degree of complexity or difficulty. Teachers know this. Adaptive learning programs enable this by precisely tailoring this process to each student’s individual needs, and by providing teachers with new tools that can help each student realize his or her maximum learning potential.

As communications and software technologies continue to develop, it may soon be possible to provide all students at all levels of education with the adaptive learning tools that provide virtually the same service as a human tutor at a much lower cost. Already, products such as McGraw-Hill’s LearnSmart and ALEKS are providing this technology to college and university students across the U.S. Moving this technology into the K-12 education environment is the next step already in progress.

Adaptive learning will revolutionize education and its success rate at all levels by providing a depth of individualized assessment and personalized instruction heretofore only available to those with the resources to hire subject matter experts as personal tutors.

Growing Support for Adaptive Learning

Others in business, government and education have also seen the promise and potential to significantly improve outcomes through adaptive learning.

Former governors, Jeb Bush of Florida and Bob Wise of West Virginia, released a report on digital learning in December of 2010 in which they wrote that “technology has the power … to customize education, so each and every student learns … at his or her own pace, … [while offering] teachers an effective way to overcome challenges and better educate students of all learning needs …”

The point was expressed even more poignantly by News Corporation Chairman and CEO, Rupert Murdoch, in his keynote address to the Foundation for Excellence in Education Summit in San Francisco last October:

“Our children are growing up in a ‘Steve Jobs’ world,” Murdoch said, referring to the celebrated and recently deceased Apple founder and CEO. “They are eager to learn, and quick to embrace new technology. … We need to tear down an education system [that was] designed for the 19th century — and replace it with one suited for the 21st.”

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Education today is definitely behind the curve when it comes to the level of personalization enabled by new technologies. While technology has made life more effective and efficient in just about every field of endeavor – from business to health care to the military – education ranked last among fifty American industries in terms of its use of information technology, according to a December 2003 U.S. Department of Commerce report.  

Because the K-12 U.S. education system is decentralized into individual districts, each with its own budget and unique characteristics, the scalability of adaptive learning is an issue. The cost of implementing new educational digital tools and training teachers in using them effectively can be a barrier despite the fact that such systems could prove cost-effective in the long-term, if not in terms of dollars spent, in terms of achieving better, more effective education outcomes faster. This is particularly true during the current environment of tight budgets at the state and local level.

In the higher education system, the challenges are different. Colleges and universities are further along in providing digital and adaptive learning tools, but greater penetration is hampered by closed legacy platforms and web portals that can lock an institution into a proprietary system, constricting its pool of potential partners. Some post-secondary institutions devoted resources in the ‘90s and early ‘00s to installing systems not fully compatible with others.

The desire to quickly address market needs drove some educational content providers to develop standalone, closed platforms, but this has proved to be an inhibitor in the cutover to digital education tools. Faster development of interactive adaptive learning programs is further stymied, to some degree, because many education solutions providers are reluctant to devote resources to the development of new adaptive learning programs without common standards for content and data interchange that will allow them to be run on any platform. They want to know whether they will have access to a national and global market based on universally-accepted standards – for both the educational content and the technology delivering it.

The new model for delivering educational content digitally is Steve Jobs’ Apple. Apple succeeded in distributing music online successfully after many record labels failed to crack the online market. Jobs and his colleagues at Apple understood that purchasers of online music wanted a singular, federated, catalog that focused on the music itself and the artists – not dissimilar from a record store. This is what consumers truly cared about – not which record label had signed the artist. As a result, Apple’s iTunes is now the primary distributor of music after only five years – online and offline.  

Steps are already being taken to address these impediments to a wider acceptance of adaptive learning tools, such as the move towards Common Core educational standards in the U.S., and the decision of McGraw-Hill and other education companies to move toward a subscription model that more closely resembles the iTunes approach. But one of the largest obstacles to greater acceptance remains the


many misconceptions among the general public – and even among professional educators – about what adaptive learning really is, what it is not, how it works, and why it is the indisputable wave of the future.

The Educational and Economic Benefits of Adaptive Learning

The Alliance for Excellence in Education (AAE) has stated in its January 2012 report and previous documents that all children should graduate from high school ready for college, or technical training leading to a career, and – most importantly – with the learning skills they will need to compete in today’s rapidly changing economy.

These skills include “not only mastery of core content but also the ability to think critically, solve complex problems, work collaboratively, communicate effectively, and be self-directed and incorporate feedback.”

According to Education Week’s special Diplomas Count 2010 issue, only 72 percent of U.S. students earn a high school diploma. More than one million U.S. students drop out of high school before completion, and percentages among African-American, Hispanic and Native American students are unacceptably higher than they are for White or Asian students. Only 58 percent of Hispanic students, 57 percent of African-American students, and 54 percent of American Indian and Alaska Native students graduate. In contrast, 77 percent of White students and 83 percent of Asian Americans finish high school.

Studies quoted by AEE research suggest that students drop out of high school because of a lack of interest in the curriculum and a feeling that there is nothing relevant there for their lives. Giving students more say in designing their own career paths and courses of study could reverse that perception. Digitally-based, interactive adaptive learning tools provide an opportunity to engage students more effectively by offering more courses, varied instructional methods, and content that they see as being relevant to their lives. A more personalized learning program that builds on different learning styles, interests, and abilities, allowing students to follow their own interests and work at their own pace, could persuade more students to stay in school.

Even when U.S. students do finish high school, it is often no guarantee that they are ready for either college, a career, technical training or the military. An American College Testing (ACT) profile report on the class of 2011 shows that only 25 percent of students who do graduate and go on to college are meeting college-readiness benchmarks in English, reading, mathematics, and science. Fully half of all high school graduates entering a community college will need remediation and 20 percent will need extra help when they enter a four-year institution.

“Not surprisingly,” the AEE report notes, “students who start their college career in remedial classes are far less likely to graduate.”

A Pentagon report released in 2009 found that as many as 75 percent of young people age 17 to 24 are not fit for military service, with 25

\[7\] High School Dropouts in America, AEE, 2009.


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percent of those not admissible because they lack a high school or general equivalency diploma (GED).  

These numbers are particularly distressing when one considers that post-graduate education – either college or technical career training – is becoming essential for job success in the 21st century. According to forecasts by the Bureau of Labor Statistics (BLS), 71 percent of the jobs expected to show growth by 2016 will require post-secondary credentials, while a recent Georgetown University Center on Education and the Workforce report notes 63 percent of all jobs in the near future will require some college or above.

Digital education tools that can assess student progress and provide the right learning tools quickly are game-changers that can transform the status quo, quickly moving education beyond its current lackluster performance with benefits that go beyond helping students learn and teachers teach more effectively.

At the higher education level, campus administrators, college and university presidents, deans, provosts and information technology staff would gain the ability to increase or open up new revenue streams and realize greater efficiencies among their institution’s existing resources.

Other stakeholders in the public K-12 arena who would see gains from a greater use of adaptive learning and other digital educational tools include parents, administrators and public education officials at all levels.

Greater use of assessment and other data allows schools to assess students and compare results quickly across districts, their state and the nation. It gives administrators more efficient ways of identifying school needs to better serve students and to communicate fuller student information to parents. It also allows districts to communicate better and collaborate with their colleagues in other districts, and to offer expanded learning opportunities for students, as well as greater and more effective professional development opportunities for teachers and administrators. Although this might sound like “more testing,” adaptive learning assessment, in general, is ongoing in the background as students go through their normal classroom and homework learning experiences, so there is no complaint about more frequent measurement.

In making the case for a greater use of technology in K-12, many have pointed out that the typical 21st century classroom still looks a lot like it did in the early 20th century. But the students sitting in rows at their desks do not look the same. Students today are ethnically and culturally diverse. There is also a wide range of academic abilities and learning styles among today’s student populations at all levels.

Robert Bohannon, assistant superintendent for the Perry Township, Indiana school district, has suggested that the problems with today’s classrooms are that “we tell students to ‘power down’ their devices when they walk into the school building, when we should be telling them to ‘power up’.” Their education and future is going to be intertwined with devices and changing technology, Bohannon added.

9 Ready, Willing and Unable to Serve: 75 Percent of Young Adults Cannot Join the Military; 2009 Mission: Readiness - http://www.missionreadiness.org/


“and if we don’t ask them to do that now in school, when do we ask them to do it?”

A 21st century classroom includes gifted students, students who struggle with different subjects or concepts, students with disabilities, and students for whom English is their second language. Add to all of that the fact that students have individual learning styles and it becomes clear that the current “teach to the middle” philosophy that still guides most K-12 education cannot reach enough students to be truly effective in preparing our children to compete in the 21st century global economy.

A Glimpse of the Future: Products on the Market Now

Data-enabled learning systems, initially pivoting out of earlier and accepted homework systems, have emerged in the market as “smart” platforms. These platforms personalize the assessment and practice parts of the study experience.

McGraw-Hill Education is the adaptive education leader, and is committed to realizing the vision of providing all students at all levels of education with a highly personalized learning experience that will prepare them for the high-tech, global economy in which they will be working and competing for jobs.

Cutting-edge products like McGraw-Hill Education’s Power of U, LearnSmart, and ALEKS use algorithms to constantly assess a student’s knowledge of a topic and his or her ability to apply critical thinking skills. These offerings continuously update a student’s knowledge profile and carefully select topics and intervals for reinforcement. They are the next-generation systems that will move education away from the old industrial production model of education toward a path where instructors and students both benefit from technology advances inside and outside the lecture halls.

Below are brief descriptions of three of McGraw-Hill Education’s individualized study programs, tutorial systems that utilize adaptive intelligence and allow students to assess, remediate or reinforce, and master concepts and skills as they move through their coursework.

These innovative programs have the potential to create a “class of one” for all learners – an experience that is personalized, customized and mobile, and that can extend the learning experience well beyond classroom walls and hours.

1. LearnSmart

LearnSmart is an interactive study tool that adaptively assesses students' skill and knowledge levels to track which topics students have mastered and which require further instruction and practice. Based upon student progress, it then adjusts the learning content based on their knowledge strengths and weaknesses, as well as their confidence level around that knowledge.

LearnSmart’s adaptive technology also understands and accounts for memory degradation. It identifies the concepts that students are most likely to forget over the course of the semester – by considering those that they had been weakest on or least confident with – and encourages periodic review by the student to ensure that concepts are truly learned and retained. In this way, it goes beyond systems that simply help students study for a test or exam, and helps students with true concept retention and learning. Dynamically-generated reports document progress and areas for additional reinforcement, offering
students real-time feedback on their content mastery. By monitoring student progress, educators have the ability to instantly evaluate the level of understanding and mastery for an entire class or an individual student at any given time.

The powerful artificial intelligence behind LearnSmart allows instructors to focus on advanced topics, application of material, and in-depth discussion in class, because LearnSmart has been shown to improve students’ class and test preparation outside of the classroom. At the same time, instructors have the ability to assess student performance gaps and focus on concepts that need reinforcement and re-teaching.

LearnSmart guides students – at their own pace and on their own time – through the basic knowledge and skills covered in a course, so that they come to each class with a solid foundation of concepts that will be covered. For professors like Paul W. Thurston, Ph.D., assistant professor of marketing and management at Siena College, who strive to have students attend class prepared to discuss the assigned material, LearnSmart is invaluable. In his Organization & Management class, Thurston found “students who were engaged in the online LearnSmart modules participated more and performed better on quizzes and in class projects.” When students come to class prepared, instructors can cover more advanced topics and have time for more facilitated classroom discussion, critical thinking and practical application assignments, which all lead to deeper student engagement.

Professor Thomas Norman, who teaches Management at California State University, Dominguez Hills, requires students to complete the LearnSmart learning modules correlated to the following week’s content on the Sunday prior to lecture. This allows him to use the LearnSmart reports to provide a snapshot analysis of student performance on the assigned topics, and then adapt his lecture based upon his overall class knowledge.

“I spend class time reviewing the content areas in which students have the most difficulty in LearnSmart. I skip several sections where the mastery is quite high.”
-Professor Thomas Norman, California State University, Dominguez Hills

An independent study of over 700 students studying Anatomy & Physiology I at six distinct institutions across the country found that students using LearnSmart increased their performance in the course. Students increased their grade by one full letter, with more B students getting A’s, and more C students getting B’s.

In addition, community colleges participating in the study reported significant improvements in average pass rates (+12.5 percentage points) and in retention rates (+10.5 percentage points).

2. Power of U

Power of U is a revolutionary, digitally rich learning model that enables teachers to create an adaptive and individualized instructional environment through assessment, real-time data and technology. Power of U is an easily scalable model that can enhance and potentially transform K-12 education in the 21st century.

Through formative assessment, Power of U analyzes how each student masters each skill, and then recommends student grouping, instructional techniques and appropriate content to the teacher.
The *Power of U* platform allows teachers to follow student progress in real-time and respond immediately with personalized instruction. *Power of U* is data-driven; it analyzes exactly how each student learns particular skills required for subject matter mastery. It then recommends to the teacher the appropriate student grouping, instructional technique and content to meet that student’s unique and daily learning needs. *Power of U* sifts through all of the possible instructional pathways to learning success and provides each individual student with the path best suited to his or her own current level of knowledge and learning style.

*Power of U* is not only good for the individual student, but for all students in the school as a group. While *Power of U* is adapting to the needs of each student, it also evaluates how those decisions will affect all of the other students in that school competing for the same resources, allowing schools to do more with less. This is a significant benefit unique to *Power of U* and particularly useful in times of tight budgets.

*Power of U* also offers a wealth of pedagogically sound instructional resources developed by McGraw-Hill, a leader in developing new and state-of-the-art educational materials for more than one hundred years. Building on an open source, subscription model, the *Power of U* platform does not restrict students to accessing only McGraw-Hill materials or any other single educational content provider.

The platform also provides students with the potential for long-distance and online virtual learning from any source available on the Internet.

In 2010 and 2011, *Power of U* conducted a pilot in the Metropolitan School District of Perry Township in Indiana. Perry Township was looking for innovative new ways to increase the classroom engagement and academic standing of their students and McGraw-Hill wanted to test *Power of U*’s effectiveness in raising student achievement scores.

Students were divided into “Treatment” and “Comparison” groups. In pre-testing prior to the start of the trial, the Comparison group students had mean scores that were slightly higher (+4) than those in the Treatment group, the students who would be experiencing *Power of U*. Both groups improved their Math test scores, but *Power of U* Treatment students raised their scores 10 points, while Comparison students receiving more traditional math training showed an improvement of only three points.

As a result of the program’s success, in August 2011 *Power of U* was formally adopted as the 7-8 grade math curriculum for Perry Meridian Middle School and Southport Middle School for the start of the 2011/2012 school-year. More than 1,200 middle school students are currently enrolled in the program. In January 2012, the pilot program expanded to include middle school students in Loveland, Colorado.

3. **ALEKS**

One of the pioneer products to use adaptive learning technology, *ALEKS* (Assessment and Learning in Knowledge Spaces) is a web-based assessment and learning system created by the ALEKS Corporation and distributed exclusively to colleges and universities by McGraw-Hill Higher Education. *ALEKS*, which has been used by
millions of students in more than 50 academic subjects at thousands of institutions throughout the world, employs adaptive questioning to quickly and accurately determine exactly what a student knows and doesn't know in a course. ALEKS then instructs the student on the topics he or she is most ready to learn. As a student works through a course, ALEKS periodically reassesses the student to ensure that topics learned are also retained. ALEKS also provides the advantages of one-on-one instruction, around the clock, from virtually any web-based computer for a fraction of the cost of a human tutor.

When a student first logs on to ALEKS, a brief tutorial shows the student how to use the program’s answer input tools. ALEKS then assesses the student's current course knowledge by asking a small number of questions. ALEKS chooses each question on the basis of answers to all previous questions. Each student, and, therefore, each set of assessment questions, is unique. It is impossible to predict the questions that will be asked.

By the time the student has completed the assessment, ALEKS has developed a precise picture of their knowledge of the course, knowing which topics have been mastered and which topics haven’t.

In 2007, the mathematics department at the University of Illinois began a new placement program using ALEKS, “which was chosen for the ability of students to be assessed remotely via the Internet with immediate reporting and for the ability of ALEKS to provide personalized remediation.”

A dramatic example of ALEKS’ ability to improve student performance took place in Professor Eden Donahou’s Basic Algebra class at Seminole State College in Florida between 2010 and 2011. While participating in an ALEKS pilot project, Professor Donahou found that students enrolled in sections of her course utilizing ALEKS enjoyed pass rates of 76 percent, versus 51 percent for students in different sections of the same Algebra class who did not use ALEKS. Exit exam pass rates were 23 percent higher and student retention by 12 percent when compared with sections where students did not have access to the ALEKS assessment and learning system.

Professor Donahou reports that the stunning success of her students using ALEKS led to a greater use of the program by her colleagues at Seminole State College.

“We’ve gone from offering two ALEKS classes in 2010 to 94 ALEKS classes in 2011,” Professor Donahou said.

Conclusion - A Vision of the Future

Advances in education, information and high-speed global communications technologies means that education no longer needs to be thought of as taking place in a particular building or classroom with a teacher, tutor or even a lab partner who must reside in the same geographical location.

Speaking to an international audience of professional educators and others in China,

Cont’d
McGraw-Hill Education President Bob Bahash said:

*Digital innovation alone will not be enough to solve the world’s educational challenges. But, it will be a powerful driver of value, just as it has been in journalism, music, entertainment, and almost every information-based field. Alongside other investments and reforms, technology has the potential to elevate teaching and learning to the level demanded by the global knowledge economy. … As the technology matures and our application of it becomes more refined, we can expect such adaptive, individualized learning platforms to transform the way education occurs in classrooms around the world.*

Adaptive learning, which is ongoing and continually updated, may serve to dispel the notion that education is primarily for the young, or that it takes place during a set number of years in a person’s life – that it “finishes” at a certain age after a student graduates from a high school, college, technical program or even from an advanced graduate program.

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