Personalized learning could transform education

By Kayla Webley, Time

Sitting at a computer in her school library in the far western reaches of the Phoenix suburbs, Taylor Beattie logs on to her digital dashboard to find something she has never seen before. Taylor's eighth-grade class has not yet studied units, but the program knows she is ready.

The first question comes immediately: "Franz is writing Christmas cards for friends. He wrote for 2 1/3 hours and wrote 70 cards. How long did it take him to write each card?" After some quick calculations, Taylor, 14, picks answer E, one of five options on the screen. Her choice zips through Amazon's massive data servers in the cloud to an algorithm programmed by a team of engineers in New York City that takes into account the time it took Taylor to answer the question, the answer itself, her answers to hundreds of other questions and the answers of hundreds of thousands of other people to similar questions, to determine the next question on her screen. The entire process takes milliseconds.

That math program is a product from Knewton, a New York City-based education-technology start-up with deep pockets and bold claims about its potential to revolutionize how students learn. The more Taylor and her classmates at Festival Foothills Elementary use Knewton's program, the better the company's algorithm gets at predicting how they will best perform.

Knewton's goal is to be able to tell not just what students do or do not do well but also what time of day they learn best, whether they're likely to pass a quiz, their final grade in the course and even how they will score on the SAT. If all

goes according to Knewton's plan, the information it gathers will be used to form a learning profile, a sort of anonymous permanent record that travels with a student from school years through college and on to employment. Think of it like the statistics on the back of a baseball card (though with a string of numbers in place of the player's name), there for all to see and analyze.

"There's going to be one company in the world that does this," says Jose Ferreira, Knewton's high-motor founder and CEO. "People are going to insist on having their profile that knows how they learn travel with them across schools, across teachers, across grade levels, across countries. There will be one company, and I think it's going to be us because we're so far ahead now."

Knewton is part of a wave of companies marketing "adaptive learning" technologies, which promise to use data to personalize education and eliminate the one-size-fits-all curriculum. The concept has been embraced by education reformers who see predictive data analysis as key to solving one of America's most persistent problems. And it has attracted investments from heavyweights in Silicon Valley, who are betting that the reformers are right—and that the solutions will be lucrative.

But all of this promise comes at a cost to individual privacy. Like Facebook, Knewton has built its business on the reams of data it gathers from its users. It's too soon to tell if Knewton will become essential for students learning, say, algebraic equations, but it is clear that the more students use its programs, the more money the company stands to make.

Knewton's downtown Manhattan office has all the hallmarks of a well-funded start-up: beer is on tap, dinner is ordered in nightly, and a third of the space is given over to a lounge area with overstuffed leather chairs and a ping-pong table. (Knewton regularly hosts friendly matches against other tech

companies.) Only 25 of the about 110 full-time employees are former schoolteachers.

“We’re trying to build a very big data-infrastructure platform with very cutting-edge stuff,” Ferreira says. “We need really top data scientists, statisticians and programmers.” Ferreira doesn’t have an office; he sits instead at the end of a row of desks housing the marketing team.

On a recent visit he was wearing cargo pants and a loose fleece pullover, blending in among his casually dressed charges (some of whom were wearing T-shirts reading KNERD, which the company has embraced as a term for employees and fellow travelers).

Ferreira, 44, might be king of the Knerds now, but long before he memorized the dictionary because he was bored in college, he was a kid who got bad grades in school. He says he always had a sense that his performance had more to do with the way subjects were taught than with his intelligence.

“I always blamed the system for my repeated failures,” he says. “Some kids just through sheer luck happen to be better fits for that system, and other kids like me and millions of others are not.”

In the early 1990s, Ferreira joined Kaplan Inc.’s standardized-test-prep division. After being promoted to product director for Kaplan’s GRE line, he led the development of a system to personalize content on the basis of student-performance data. While the technology of the time couldn’t support the product, one of his former bosses there says it was the “alpha version” of a system that later became a central Kaplan offering. Feeling restless, Ferreira left for business school at Harvard, followed by a stint at Goldman Sachs and a failed start-up, DizzyCity, which he describes as a proto Google Street View. After that flopped, Ferreira returned to Kaplan in 2002, this time tasked with revising the

CPA-prep business, then left two years later to work for the presidential campaign of his uncle John Kerry.

Technology finally caught up to Ferreira's adaptive-learning vision, and he launched Knewton in January 2008 to capitalize on it. His goal was for Knewton to be not a test-prep company or an appmaker but an adaptive-learning platform powering those products. But nobody was buying. "No one believed in adaptive learning or thought it would work. It sounded like space talk," he says.

So Ferreira and what was then a three-person team built a math course to prove their concept. It caught the attention of administrators at Arizona State University, who incorporated Knewton's product into a redesigned remedial-math curriculum for incoming freshmen in summer 2011. The effect was notable: one year after the overhaul, more students passed the course (75 percent, up from 64 percent the year before) and fewer dropped out (7 percent, down from 15 percent the previous year).

Suddenly Knewton was in demand, raising $33 million from investors in October 2011. Among those who bought in: the Founders Fund, a venture-capital firm whose partners include the founders of PayPal and Facebook's first president, and Pearson, the world's largest education company. The investment round valued the company at over $150 million.

In a separate deal, Pearson contracted Knewton to provide the adaptive technology for part of its higher-education digital textbooks. Since then, Knewton has become the platform for math and English products Triumph Learning designed to align with the new Common Core public-education standards, and it has dipped a toe into the English-as-a-second-language market through deals with international education companies. Last month, Knewton reached an agreement with Houghton Mifflin Harcourt to incorporate its technology into products used by some 10 million U.S. students. Not one for modesty, Ferreira

expects Knewton will eventually be part of the HMH products used by nearly 60 million students around the world.

These deals have allowed Ferreira to turn Knewton into the company he intended it to be. Though the math course it built as a calling card is still used by 14,000 students and earns the company about $1.24 million per year, Knewton is no longer in the business of creating courses. Just as Mark Zuckerberg famously said he didn't want to build a Facebook phone—he wanted Facebook to be on every phone—Ferreira is convinced Knewton can be the infrastructure for the emerging field of adaptive-education technology. "We're not building applications that we can sell to schools. That's what everybody else is doing," he says. "The whole point of Knewton is that it has got to be a platform that anyone else can work with."

Working with Knewton costs clients a one-time integration fee between $100,000 and $250,000, depending on the organization's needs. That's not spare change—and Knewton's algorithm improves with every user it adds—but it isn't enough to sustain a growing company and pay off those investors. For that, the Knerds are hard at work on a second platform. By the beginning of next year, Knewton plans to release a retail edition that will allow any small business or tutor to make a course, content or product adaptive.

"Everybody is going to produce adaptive applications one day — everybody," Ferreira says. "Every school will. Every publishing company will. There will be thousands of them." If Knewton can be the engine powering many of those, well, then you're starting to talk real money.

Teachers have always led a very basic form of personalized learning: students needing a challenge are given extra-credit assignments, while those struggling are given more attention and supplemental work. But packed classrooms and the demands of rigid curricula make it impossible to sustain at any scale,

leading to the common teacher lament of being forced to teach to the middle – pushing slower kids on to the next level before they're ready while the faster learners become disengaged.

"Our pacing schedule says when a kid doesn't get something, you keep moving forward and provide remediation as necessary when time allows," says Ben Newman, a math teacher at Festival Foothills. "At the same time, you have to challenge the smart kids so they're not sitting there bored. It's always, 'You already mastered that? Well, why don't you help your neighbor?' You can only ask someone to help their neighbor for so long."

"The concept of differentiating instruction on the student level has been around for years. That's sort of the holy grail of what teachers are supposed to be doing, but it's incredibly hard when you have 30 kids in your class," says Adam Newman of Education Growth Advisors, a consulting firm. Researchers have long touted the benefits of one-to-one tutoring. "It's not hard to imagine why there would be more learning that takes place with a skilled tutor than if you have a kid in a classroom of 30 spending the same amount of time getting one-size-fits-all instruction," says Chris Dede, a professor in learning technologies at Harvard's Graduate School of Education.

It's impossible to provide one-to-one teaching on a mass scale, but technology enables us to get closer than ever before. As schools increasingly invest in computers and other digital products, students have access to a wider range of study materials, and teachers and administrators have the ability to view precise analyses of how they respond to that material, adjusting as needed. Proponents claim that these tools will allow teachers to help struggling students before they fail a test rather than discovering problems too late. The promise of these predictive metrics has set off a gold rush in education technology.

The global education market is estimated at nearly $4.6 trillion in 2013, according to research by asset-management firm GSV Advisors. A minuscule portion of it is spent on technology, but experts expect the balance to shift as the industry becomes increasingly digitized. Education-tech start-ups aimed at the K-12 market attracted more than $425 million in venture capital last year, according to the NewSchools Venture Fund. “Investors are looking at education and saying, ‘Holy cow, there’s a huge number of dollars being deployed here. If we can wrest free some of it, there’s a huge opportunity to make money here,'” says Michael Horn, executive director for education at the Innosight Institute.

Knewton is far from the only company selling personalization. Textbook giant McGraw-Hill Education launched an adaptive product line in 2009 and has tailored it to more than 200 textbooks across 30 subjects. Amplify, the education company owned by media giant News Corp., plans to launch an adaptive curriculum in 2014, and IBM has developed systems to evaluate student performance and improve instruction that are used by public schools in Alabama and Tennessee. Kaplan, Ferreira’s old employer, says it generates more revenue from adaptive products than anyone else. Many start-ups are also in the fray, including the nonprofit Khan Academy, whose adaptive-exercise engine has over 6 million registered users doing some 3 million exercises per day and which is releasing a more sophisticated version this fall. “The space is changing very fast right now, and there are a lot of people making plays at it,” Horn says. “I think next we’ll start shaking it out and see who’s real and who’s not.”

In the past five years, the department of Education has made changes to student-privacy laws that make it much easier for companies like Knewton to gather data on kids. Student information can now be passed, without parental consent, to a third party that a school deems to have a “legitimate educational interest in the records,” as when a district hires

a contractor to perform a service that cannot be carried out without access to student data. “If a school is using a service, the school is the steward of the data and is subject to the same privacy requirements as always,” says Richard Culatta, acting director of the Department of Education’s Office of Educational Technology. “We encourage schools to be transparent—to make sure parents are aware of how student information is being used.”

That latitude has led to an outcry from those concerned about the potential invasion of student privacy and the ability of private companies to profit from it. “Schools are availing themselves of these free or low-cost services and not seeing the real cost to student privacy,” says Khaliah Barnes, administrative law counsel at the Electronic Privacy Information Center, which is suing the Department of Education over its changes to student-privacy laws.

Knewton says it doesn’t have access to any information that would identify a student. It assigns each student a lengthy identification number that is used to track performance and build a learning profile, but it does not know the student’s real name or Social Security number. “The data we collect is only ever used to drive the best possible recommendation for the next thing you do,” Ferreira says. “That’s it.” He acknowledges that Knewton “co-owns” the data, but he’s adamant that the company will “never advertise against it. Never, never.”

But that doesn’t mean it won’t profit from it, of course. And if Knewton is capable of delivering on its promise – and while it is a relatively young company, it does not have any peer-reviewed academic studies to back it up – then it won’t be the only one reaping the benefit.

“If you’re using student data to improve your algorithm, there’s value creation that’s being attributed to you, but what’s falling back to the students who are contributing the

data?” says Adam Newman of Education Growth Advisors. “If as a result, Knewton is able to help students learn more, learn faster, stay better engaged, is that a fair trade-off?”

For Ben Newman, Taylor Beattie’s math teacher in Arizona, the payoff is worth it.

“Their ability to collect large quantities of data and crunch it and tell us something about how we’re doing is pretty powerful,” he says. “I’m so used to other entities wanting information about my kids. Everyone is asking for data. As long as they are being responsible with that data, I don’t see it as being an issue.”