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Personalized Education

From Curriculum to Career with Cognitive Systems

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In many parts of the world, education is considered to be failing its stakeholders, be they students, educators, or employers. This narrative is rooted in the belief that education is too expensive and fails to provide value for the amount of money paid to acquire it. There is a growing disconnect between what education delivers and the skills being demanded in today's ever-changing global marketplace. The net result is that upon leaving full-time education, many young people are ill prepared for the world of work. At the same time, we are seeing unprecedented levels of change across industries and professions, with digital technologies serving as agents of transformation. Businesses are increasingly faced with a simple proposition: reinvent or die. However, in education, the same sense of pressure and urgency seems to be lacking. This may simply be because educators may be lacking clarity on the correct path to pursue. From our discussions with educators around the world, a harder-working, more dedicated and caring profession would be hard to find.

At IBM, our view is that education's "stakeholder failure narrative" does not have to play out in this way. We believe that education is potentially at the dawn of a new era, and in this chapter we will explain how

- despite challenges, digital education services are being embraced by educators;
- cognitive systems will enable personalized education and, ultimately, the educational experience will be improved when data can be used to benefit students and the entire learning community.

Data-driven cognitive technologies will enable personalized education and improve outcomes for students, educators, and administrators. Ultimately, educational experiences will be improved when data can accompany the student throughout his or her lifelong learning journey.

ABOUT THE RESEARCH

In this research, we set out to discover how educators are using digital education services and cognitive systems to deliver personalized education (a combination of educational programs, learning experiences, instructional approaches, academic-support strategies, and technology that is intended to address the distinct learning needs, interests, aspirations, or cultural backgrounds of individual students). We wanted to cut through the industry hype and understand from early adopters how it worked in real life: What are the challenges, what can we learn from successful implementations, and what are the results? What did vendors think was possible, and what did students actually experience? The chapter is based on four research inputs:

1) In-depth interviews with 47 educational providers and 6 vendors in the United States, India, South Africa, and the United Kingdom (UK)
2) A survey of 126 IBM interns based in the UK
3) Interviews with three IBM Watson partners who are working on cognitive systems for educators
4) Social listening from more than 150,000 tweets relating to conversations around education

TERMINOLOGY

Most countries organize their education systems into three phases:

1) Primary/elementary: < 12 years old

2) Secondary/high school: 12–18 years old
3) University/college: > 18 years old

We use the terms *primary* and *elementary* interchangeably, as well as the terms *secondary* and *high* school, except where specifically referencing quotes.

- *Teacher*. We use this term to refer to educators in primary/elementary and secondary/high school.
- *Lecturer/professor*. We use this term for educators in universities/colleges.
- *Education management*. We use this as an aggregate term to cover a range of management roles such as provost, vice chancellor, and head teacher.

IT'S A DIGITAL WORLD

Over the past few decades, the role of technology in education ("EdTech") has continually evolved. In classrooms and lecture halls, "chalk and talk" has increasingly been complemented by digital tools and platforms, which typically vary in scope and sophistication according to where the student is on his or her educational journey.

It is clear that student appetite for digital tools across the whole gamut of education is strong (e.g., Cortez 2017). This fosters a learning environment that is more engaging, more hands-on, more meaningful and memorable, and creates better learning outcomes. In a sense, this is a reflection of how today's students live their lives beyond education. This trend is putting pressure on education professionals as they seek to meet the growing demands of "digital natives." As a primary-school teacher commented, "The kids we're getting now have grown up on technology. They're learning how to use it. . . . They're a lot better than we are, and that's a scary element."

Transformative approaches that may become more widespread include elements of gamification, whereby groups of students can connect and collaborate across different schools and geographical boundaries. Schools are experimenting with innovative "glocal" classrooms

(characterized by both "global" and "local" tendencies), in which the lesson is brought to the student to overcome challenges of distance and income found in the developing world. Add to this the potential for virtual-reality field trips, 3-D printing, and foreign-language video conferencing sessions with schools in different countries, all of which point to exciting possibilities for students and educators.

"The kids are very engaged with technology. . . . Any time we can incorporate technology in a lesson, you're adding visual, you're adding audio, you're adding tactile. When they're hands-on with a piece of technology, it sticks better because we are using all modalities of learning," says an educator at a U.S. high school.

CHALLENGES IN ADOPTING THE NEW TECHNOLOGIES

Educators may legitimately ask, "Haven't we been here before?" Many report poor experiences with technology, which they say failed to deliver against expectations and was difficult to use and impossible to integrate with existing and new technologies. Many issues conspire against greater use of digital technologies (see Table 16.1). Furthermore, concepts such as blended learning (an educational program that combines online digital media with traditional classroom methods) and flipped classrooms (a teaching model in which the typical lecture and homework elements of a course are reversed, so that short video lectures are viewed by students at home before the class session, while in-class time is devoted to exercises, projects, and discussions) simply cannot be implemented if students don't have Internet access at home. And this is not just a developing world challenge: the use of digital tools within educational establishments appears to be fairly laissez-faire, rather than strategic. For instance, at a South African university, a source says, "Experience of using digital services really depends on the lecturer. Some lecturers use it widely and some use it very little. There is no one practice in the university."

There are also generational issues to consider. Many teachers never used such tools when they were learning, so they question their pedagogical efficacy. Moreover, educational professionals choose the

Table 16.1 Challenges for the Adoption of Digital Education Today

Market	Extreme competition and fragmentation of digital learning services market leads to information overload and confusion in the mind of the end consumer (educational institutions).
Integration	Lack of integration between current digital learning solutions makes it difficult to track learning outcomes and measure return on investment.
Operational	It is difficult to implement personalized learning pedagogies in classrooms where students are at varying skill levels. Teachers struggle to manage multiple log-ins across platforms.
People	Lack of a dedicated information technology (IT) team to resolve technical issues, causing frustration and a drop in usage among students and faculty. Teachers are not trained to use the technology in the classroom and are resistant to using anything outside their traditional teaching methods.
Economics	Schools have limited budgets, with a pushback for rising tuition costs and reductions in state and federal funding and limited funds to invest in digital learning solutions.

SOURCE: Authors' compilation.

extent to which digital tools are present in their teaching toolbox, if at all. According to a professional education organization from the United Kingdom, "The major challenge is getting professors to deliver content in a digital form. Most professors have been teaching the same content for years and don't want to start delivering audio or video lectures and designing online courses."

There are also risk issues when it comes to adopting new digital technologies. Will new tools integrate with existing IT investments, and will they meet curricular standards? As new vendors arrive on the scene, diversity of choice only adds to these risk factors. As a teacher from a U.S. elementary school responds, "One of the questions we have to answer is: Are these resources meeting common core standards? Are they using state standards, or are they using district standards? My biggest challenge is I don't know what the best apps are out there to support my curriculum."

While such challenges are difficult, they are not insurmountable. We identified a number of leading practices that educational establishments are testing and implementing (Box 16.1).

TRAINING THE TRAINERS

Many teachers are frustrated that training is inadequate, based on our interviews with educators and monitoring of social media discussions on education. Because technology changes so quickly and upgrades are common, the sheer pace of change is difficult to keep up with. The consensus view is that training works best when it is not delivered as a week-long preterm event but is provided continuously, in bite-sized chunks.

Institutions often implement staff mentoring programs such as "digital champions" or "buddy-up schemes" for colleagues to learn from each other. Many report that this often works by having younger, more tech-savvy teachers working with older-generation teachers in a "reverse mentoring" program. Says a source from one high school, "If 'old teacher in Room 30' sees 'new teacher in Room 31' and [the new teacher's] kids are all fired up and excited walking out of that class, he/she's going to ask, 'What are you doing in there?' [The other teacher]

Box 16.1 Digital Leading Practices in Education

- Appoint a formal digital learning leader or team.
- Encourage and reward teacher enthusiasts, champions, and advocates and use them as mentors.
- Employ "reverse mentoring" by having recent graduate teachers advise an older generation of teachers on digital tools.
- Establish focus groups to continually understand student needs.
- Use digital armbands (flash drives) to permit offline working.
- Offer interactive and continuous training for teachers.

SOURCE: Authors' compilation.

will reply, 'I'm doing this. . . . I'll help you.' We try to get the teachers who are excited to be the evangelist for their department."

So rather than a top-down, vendor-led training approach that is often difficult to digest in one go, the leading-practice approaches are piecemeal, ongoing, and informally driven by the staff themselves. As a primary teacher commented, "We have what's called 'Technology Thursdays,' with different things offered each Thursday. It really has to be a gradual, iterative process. There are three of us who are technology-oriented. We've picked three other teachers that we work with."

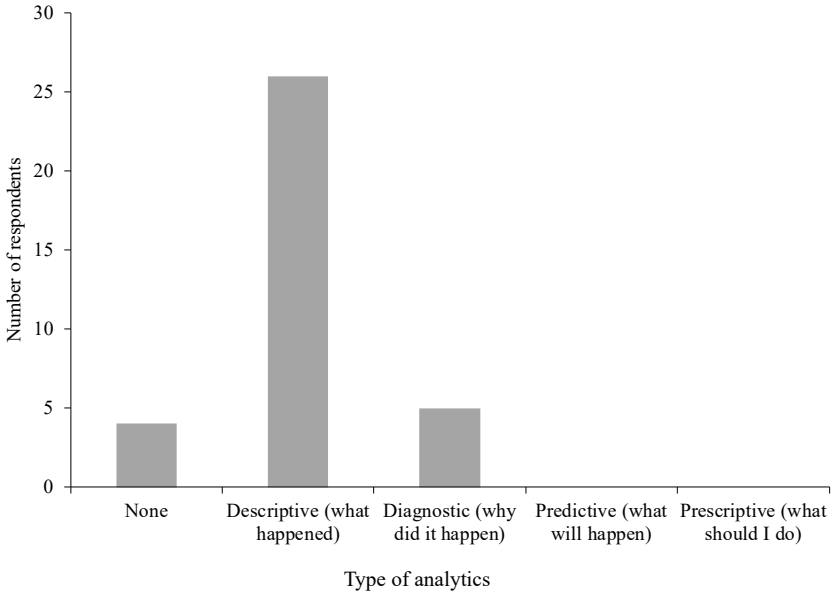
HOW ARE ANALYTICS HELPING?

The majority of educational establishments we interviewed are using analytics in a limited "rear view" way (descriptive ["What happened?"] instead of predictive ["What will happen?"]; see Figure 16.1). This university's experience is fairly typical of those we spoke with: "On the spectrum of analytics capabilities, we're at the diagnostic level," says the educator from the South African university. "Our system can alert us to students' defaults and would usually tell us which students are at risk of failing. This is what we mostly use it for right now. I am sure it can do a lot more, but this is how we use it for the moment."

Where analytics *are* used, the existing analytics tools are often underutilized. A representative of a UK professional education organization explains that personnel often don't take advantage of the tools because they're not sure how to. "Our university isn't unique in saying our LMS (learning management system) has a lot of analytics within it, but they probably use 10 percent of this," the representative says. "A deeper understanding of analytics is going to be a big trend in the next five years." Such an understanding would make use of the analytics not only of descriptive ("What happened?") and predictive ("What will happen?") but of diagnostic ("Why did it happen?") and prescriptive ("What should I do?"), the four categories shown in Figure 16.1.

We did not find much use of analytics to measure the efficacy of learning. The most cited reason is too many variables, making it impossible to isolate any one thing. "It's not necessarily one technology or two, so it's very hard to measure the impact," the South African

Figure 16.1 Most Educational Establishments Are Only Using Limited Analytics Capabilities



SOURCE: Authors' compilation.

university professor says. "Generally, pass rates have gone up and retention rates have increased, but it would be hard to pinpoint if this is because of a 'flipped classroom'; there are so many reasons."

This in turn may make the return on the investment in digital tools difficult to measure and justify. There is certainly a role here for policymakers. Recently, in a consultation paper published by the Department for Business, Innovation, and Skills (2015), now called the Department of Business, Energy, and Industrial Strategy, the UK government sought to address the need for institutions to provide more insight on teaching efficacy through deeper analytics. "The government's teaching excellence framework seeks to drive increasing use of analytics, and one of the challenges is to understand student pain," says a representative from a UK professional education organization. "Are students having specific problems? Are they whizzing through stuff and achieving high standards, meaning the course is too easy? These are all questions that can be answered with good analytics" (IBM 2016).

HOW COGNITIVE SYSTEMS CAN ENABLE PERSONALIZED EDUCATION AND IMPROVE OUTCOMES

While the tools and concepts discussed in the previous section have undoubtedly moved education forward, the impact of technology on education as a whole has been evolutionary rather than revolutionary. However, we believe that education is now on the precipice of a transformative next step: the capability to deliver learning on a more individualized basis. New digital tools, coupled with advanced analytics and cognitive systems (more on these later), will eventually facilitate the utopia of teaching—personalized learning.

As observed in other industries, when new digital tools gain traction, this eventually leads to a tipping point of mass adoption, and disruption is caused when the value proposition becomes so overwhelming that it displaces the status quo (think Amazon or Uber). Ultimately, this culminates in the balance of power shifting to the end user, in this case the learner.

As yet, there has not been an "Uber moment" for education. We have, however, seen pockets of disruption taking place. Early successes have served as a postscript to formal education in the form of massive open online courses (MOOCs). In these platforms, learners plug skills gaps with microlevel credentials and pull relevant content on demand rather than being pushed toward completing a one-size-fits-all course: "Rather than going through an entire certification program, users are going through the courses they want to go through," says a representative from a U.S. professional education organization. "We are seeing the balance of power shift to the end user, with more focus on timely training that solves the learning needs and a deemphasis on certifications."

Another possible indicator of early-stage disruption is that 59 percent of IBM's interns say they are discovering digital tools themselves, versus 43 percent who say they discover them as a result of recommendations from faculty.[1] In addition, we are seeing the use of digital tools increase as students climb the rungs of academia. One lecturer observed that "PhD students were very interested in talking about their use of MOOCs, and [they] access experts from all over the world."

Elements of personalization are also taking shape in traditional university settings to deliver a better, more holistic learning experience: "The thing that we're trying to do, particularly in our business school, is to personalise the learning experience," writes a UK university educator. "This supports the students far better in achieving their learning and education goals. I can actually see evidence that this is working at our university. We're trying to understand what is special about each individual so that we can help them meet their potential."

There have often been attempts within education to differentiate across students either through setting (grouping students within a particular subject area based on their having similar abilities in that subject) or streaming (grouping students of similar abilities in a class that stays the same for all subjects rather than regrouping them for each individual subject depending on their ability in that particular subject). Traditionally, teaching capacity limits this to generalized cohorts of students, although in recent years data is increasingly being used to aid educators in this process. However, this process still requires considerable manual data interpretation, making it a complex, time-intensive task. Cognitive systems will "unburden" this task by augmenting and being complementary to the skills of the teacher/tutor. In the long term, through machine learning and natural language processing, there is the promise of a holistic personalized learning that is continuously adapted through life. This marks the beginning of a significant change, moving education from a one-to-many homogenous experience to a one-to-one deeply immersive, personalized learning experience. Forward-thinking establishments see digital tools as part of the answer: "Digital is so obviously the way to go," says a UK primary-school teacher. "Traditional methods lack rigour and the ability to tailor learning to specific needs. Every child will learn at a different pace, and currently we can't support each child. We have to bundle [students] into 'special educational needs' and maybe 'fast learners,' and they get [the] most attention. This is clearly not effective."

A U.S. elementary teacher echoes this thought. "You're teaching to a bell curve," the teacher says. "You've got your gifted kids in there, and you've got your special-ed kids in there. You've got to reach them all, and that's very difficult."

A digital services vendor notes that technology can address this problem by providing a way to teach to this wide range of abilities

within a classroom. “With technology, it is easier to send each student down a different learning track,” the vendor says. “Once you do that, there are huge levels of possibilities. You are no longer restricted by just having one teacher teach 30 kids the same thing.”

And Satya Nitta, director of IBM’s Cognitive Sciences and Education Technology, seconds this notion. “Deeply immersive interactive experiences with intelligent tutoring systems can transform how we learn,” he says.

In a classroom of 30 students, a teacher typically divides a classroom into three or four cohorts of learners: strugglers; a middle group, which may be subdivided into those above and below average; and a few higher achievers (gifted and talented). The promise of personalized learning is the delivery of a more customized approach, where each and every child is treated uniquely and is always at his or her optimal level of learning.

While some educators are achieving results from deploying digital services, others are not. Of the educational institutions we surveyed that were using digital education services, more than half said they had seen only very little or some impact on learning outcomes. Part of the challenge is that with hundreds of digital services available and a classroom of 30 students, there are too many variables for a teacher to handle.

Could it be that these services are necessary but not sufficient to achieve the utopia of personalized learning? Could some sort of teacher’s assistant be required? What if an intelligent (cognitive) system could discover all the available resources, understand where they achieve their best outcomes, and use this to create a personal plan for each student?

What Do We Mean by “Cognitive”?

Until recently, computing was programmable—based on human-defined inputs, instructions (code), and outputs. Cognitive systems are in a wholly different paradigm of systems that understand, reason, and learn. In short, systems that can think. What could this mean for educators? We see cognitive systems as being able to extend the capabilities of educators by providing deep insights into the domain of education and expert assistance through the provision of information in a timely,

natural, and usable way. These systems will play the role of an assistant, which is complementary to and not a substitute for the art and craft of teaching. At the heart of cognitive systems are advanced analytic capabilities. In particular, cognitive systems aim to answer the questions "What will happen?" and "What should I do?" (Box 16.2).

The notion of cognitive systems to drive adaptive learning is certainly welcomed by the education professionals we interviewed. A U.S. high school teacher says, "To have some kind of prescriptive/diagnostic program where I could look at the actual question stemming [i.e., the creation of multiple-choice questions] to figure out which questions were most understandable and tailor our teaching to that student would be phenomenal, and every teacher would be in love with that idea."

While establishments can see the value of cognitive systems, many envision the realization as being a long way off. However, the future

Box 16.2 Example: A Teacher and Student (Cordelia) Engaging with a Cognitive Teacher's Assistant

Teacher: Cordelia, you did OK on your latest mathematics test; you got 72 percent. It looks as though the algebra questions were areas where you struggled. Is that a fair assessment?

Cordelia: Yes, I'm not sure I really get algebra. Are there any particular areas where I could improve?

Teacher: Well, let's see what my assistant suggests.

Cognitive-enabled teacher's assistant: From an analysis of Cordelia's learning profile and her last five tests, algebra is a relatively weak area for her in mathematics. Based against learning outcomes of 1.2 million similar Year-8 students with matching learning characteristics, her understanding could be improved by either reviewing algebra module 2.3 or looking at instructional video 7.

Teacher: Cordelia, I think you would find the video suits your learning style better. I suggest that you start with that and then we'll see how you get on.

SOURCE: Frase (2016).

may be nearer than we think. For those students in education today, chances are they will still be working 40 years from now. It's a daunting question, but will the skills learned today still be in demand by then?

THE WORLD OF WORK AND EDUCATION IN 2056 IS A REALITY FOR STUDENTS ENTERING THE JOB MARKET TODAY

There is a popular doomsday narrative circulating today, in which many predict significant job losses as technology increasingly usurps people's jobs from the workplace. This is not our view. Across industries and professions, we believe there will be an increasing marriage of man and machine that will be complementary in nature. This man-plus-machine process started with the first industrial revolution, and today we're merely at a different point on that continuum. At IBM, we subscribe to the view that man plus machine is greater than either is alone.

Today's millennial generation sees it this way, too. We asked IBM's UK-based interns what types of skills might be needed in the workplace 40 years from now. They recognize the need for continual skills development—98 percent see a need to keep learning throughout their working lives—and they see a pathway to career longevity by focusing on skills such as communication, leadership, teamwork, problem solving, people management, and critical thinking. These skills underline the rising conflict between traditional education as essentially a memory test culminating in a "paper and pencil" exam, versus modern skills-based learning, which demands teamwork and problem solving.

Cognitive systems are seen as a means to

- improve speed of intervention;
- reduce university dropout rates by creating better candidate selection processes based on more robust data;
- identify students who may need extra help;
- provide a richer analysis of why students fail tests; and
- ensure students are at the optimal level of attainment.

"The benefits of cognitive learning systems and prescriptive analytics are immense," notes a South African professional education organization. "We have students with vastly different backgrounds entering our system, and personalized learning and early intervention would have a positive effect."

A key cause of students dropping out of educational programs is that the pace of a one-size-fits-all course is beyond the capabilities of some students. As one digital provider explains, this can be addressed through systems that are more in step with the learner: "If more students had access to adaptive curriculum material," the digital provider says, "it would make a tremendous difference in solving problems of high dropouts and create better engagement in the classroom. If students were always learning within their level of proximal development, if they were always at the right level, you would have greater success."

For cognitive education services to be effective, they need to be immersive experiences for the student, while being complementary to the art and craft of teaching. They also need to reduce the administrative burden on the teacher, effectively giving time back to the teacher to teach.

We believe that technology will help educators improve student outcomes, but that it must be applied in context and under the auspices of a "caring human." The teacher-to-system relationship does not, in our view, lead to a dystopian future in which the teacher plays second fiddle to an algorithm. The teacher's role changes to a higher-value plane, with less focus on lesson creation or formal lecturing and an increasing focus on facilitating and coaching.

Increasingly, what we will see across teaching, and indeed all professions, is that tasks considered to be of value today will change in terms of how we come to perceive value over time. This is not a new phenomenon but part of a natural evolutionary process. Take, for example, the ability of a machine to assess 100 multiple-choice answers in a matter of milliseconds. It does not get tired, does not need a break, and does not make any errors. We take it for granted today that such a task is ideally suited for a machine. In the future, systems will be capable of analyzing essay-style answers, which will permit teachers to spend more time on higher-value activities. This is a concept that is well articulated in the following quotation: "A lot of teacher time can be taken up by analysing the answers to a long-answer based test," writes a

UK secondary-school teacher. "The insights don't come out very easily. There are things that might have come out of that test in another 10,000 cases elsewhere that they can't see. Comparing demonstrated answers and abilities and looking for those nuances using AI, you could generate a student profile that would be very helpful indeed for a teacher, who doesn't have the capability to analyse 10,000 tests."

But cognitive systems are only as good as the data available to learn from (what we refer to as the "corpus"). If the corpus is restricted to a single educational establishment or service, this is not as insightful as having access to a wider data pool, such as statewide or countrywide data. In the following section, we explore the concept of electronic data education records to understand whether educators thought this would bring benefits, and what they thought might need to be resolved to make this achievable.

THE EDUCATION EXPERIENCE WILL BE IMPROVED WHEN DATA CAN ACCOMPANY STUDENTS THROUGHOUT THEIR LIFELONG LEARNING JOURNEY

In health care, most developed countries have—to varying degrees of efficacy—a common data record in the form of electronic health care records (EHRs) containing lifelong data for individual people. It is useful to remember that this data serves two scenarios. In one scenario (the doctor/patient discussion) the data is personal to the patient and highly sensitive. In the second scenario (in which the doctor searches all available medical data for a next-best action), the data is rendered anonymous. Similar parallels exist in education, in which a personal record follows the student throughout his or her educational journey, with the anonymized data corpus being used by cognitive assistants to help a teacher choose the best options for that individual student.

We tested the idea of a similar concept for education, whereby education records and digital learning platforms would all join up to offer a lifelong learning data record that could follow the student from primary/elementary, secondary/high school, and college/university onward into education throughout his or her working life. Those records

would include more than test scores. They could include data on learning styles and difficulties that could be leveraged by other learning modules for the benefit of the student throughout his or her lifetime.

For the first scenario (a student's personal record), we found that, in the main, the concept is welcome. One U.S. secondary teacher commented, "I lose valuable time working with new students because I have to start all over each year to understand that student, learn how they learn best and what modality fits them. If I had that data, before my students walk in, I could know exactly where I need to start with each one and how I need to present my lesson. It would be incredible."

The idea of a universal digital education record can alleviate the problem exhibited by many education systems, in which each educational stage is siloed and has its own measures of success. Today, such systems in the transition phase (e.g., between primary/elementary and secondary/high schools) do not work smoothly, with the culminating effect of each failure in transition ultimately resulting in prospective employees saying they see far too many young people without the right skills.

While such a data record has clear benefits to both student and educator, there are some key considerations to be heeded, such as the authenticity, privacy, and security of data, including where and how data is stored. "Control has to be in the hands of the individual or it could lead to inequities," says a U.S. professor. "Say you have children who go to schools that are terrible, and they have these records from their early years. We know these schools have challenges. . . . If you lose all these contextual variables that are impacting students' achievement and if that is not visible in such a record, it could harm people who are already marginalized in our society."

We think that many of the issues raised are resolvable and that solutions are within reach. We have heard about various potential scenarios for addressing control and access to student data:

- Institutions share student records/academic certifications through a distributed database (such as Blockchain).
- Students post their data records (in whole or in part) to a public repository such as Facebook or LinkedIn and retain ownership of who has visibility of their records.

- An industry body or government creates a standardized solution, and users grant access to others (educators, prospective employers) as and when required.
- Users "mash" their own solution based around various digital tools or platforms and provide their education credentials in the form of an e-portfolio.

While most of the issues for the student's personal record are related to privacy and security, these problems disappear when looking at the use of large volumes of anonymized data to help a teacher choose the best personal options. Technically, such a common data platform and the cognitive systems that could drive such a platform are closer than many think, though the precise time line to realizing this is bounded by complex political, economic, and societal differences. "Anything that would provide information concerning how each student best learns would definitely help us in the classroom," says a U.S. primary teacher. "As long as you're in the field of education and in the process of teaching, you have access to it, just like a doctor would. I think it'd be extremely useful."

With such a rich data record, many interesting possibilities start to emerge. One example is a comprehensive career-adviser system enabling the learner to query an adviser as to what he or she might be good at based on a lifelong record of skills and interests. This could uncover career pathways that might not have been immediately obvious to the individual.

Another example could be reciprocal sharing of aggregated and nonidentifiable data between academia and industry. The latter could better understand what student populations are learning and advocate changes to education to better match industry needs. In effect, we create a virtuous circle of real-time data that potentially solves issues relating to student leavers lacking necessary skills.

"While the promise of data-driven decision making is at the heart of enabling personalized education, it is vital that we distinguish the narrow uses of personal data from the broader uses for anonymized data," says Katharine Frase, vice president of IBM's Watson Education unit for business development. "Being clear about this will lay the foundations for all the benefits that cognitive systems can bring."

HOW WE SEE THE JOURNEY FROM CURRICULUM TO CAREER WITH COGNITIVE SYSTEMS

Education as an industry is being challenged (as are the education professionals within it) by the storms of digital disruption to prove its relevance, to maximize value for stakeholders, and to find ways to reinvent itself. Educators will need to evolve by embracing cognitive systems to deliver personalized learning in order to drive improved outcomes for all. The twenty-first-century learner will demand and deserve no less.

Notes

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1. In the IBM intern survey, multiple responses were permitted to the question, "Thinking specifically about the MOOCs/apps/digital education platforms that you have used, how did you learn about these services? (Check all that apply.)" It must be noted that, although the results of this survey could be an indicator of an overall shift in the education sector, the sample size is very small at 126 interns who took part in the survey.

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