Four Key Conditions for Student Success

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Four Key Conditions for Student Success

Through the science of learning, we know how students learn best. Now, powerful technologies enable us to apply those lessons effectively in the classroom. When implemented with fidelity by skilled teachers, aided by strong school leadership, success naturally follows.

Sean Ryan, senior vice president of McGraw-Hill Education, says this is the most exciting time to work in education. For years, “we’ve known a lot about how the human mind best absorbs, retains, and retrieves information,” he says. “But we’ve been very slow to integrate that knowledge into day-to-day instruction.”

There have been very good reasons for this. Applying the science of learning to make sure every child succeeds requires a level of personalization that simply wasn’t scalable or feasible in classrooms before.

But with advancements in technology and significant declines in student-to-computer ratios, “we’re now getting to the point where we can take what we know about spaced repetition and Ebbinghaus curves and make sure that the presentation of content is tuned precisely to each individual, based on what we know about that student,” he says.

McGraw-Hill Education’s digital curriculum solutions use what we know about the science of learning to deliver content in ways that schools never could before—adapting to the needs of each learner to improve outcomes significantly.

“We can keep track of students’ response times and confidence, as well as accuracy, and dynamically adjust the presentation of content for students in select domain areas,” Ryan says. This ability “is something that is only going to grow over time.”

In this Ed-Tech Point of View, Ryan explains how new technologies allow educators to apply the science of learning to instruction in powerful ways. He also reveals two other key elements that are critical for student success.
What Science Tells Us About How Students Learn

Back in the late 1800s, the German psychologist Hermann Ebbinghaus ran experiments showing the decline of memory retention over time.

The Ebbinghaus curve (also known as the “forgetting curve”) represents how information is lost over time when there is no attempt to retain it. Ebbinghaus hypothesized that the rate of forgetting depends on a number of factors, such as the difficulty of the material, whether the student has an emotional connection to the content, and physiological factors such as stress and sleep. Since Ebbinghaus’s original work, other scientists have reached similar conclusions, most recently in 2015 (Murre, J.M.J. and Dros, J.).

Students can overcome the forgetting curve by transferring information from their short-term to their long-term memories. While students can use various mnemonic techniques to do this, how the information is presented also plays a role—and “spaced repetition” has been shown to improve memory retention.

With spaced repetition, information is presented and then repeated after increasingly longer intervals of time until it is committed to long-term memory. Material that is harder to learn appears more often, and material that is easier to learn appears less often—with the level of difficulty determined by how easily a student produces a correct response.
“What you want to do is present the right information at the right time,” Ryan explains. “The right time is remarkably consistent across individuals, but the content might be different. The right time is just before the student is about to forget the information. That might vary depending on whether there is an emotional connection to the content, or whether the student has the pre-knowledge necessary for understanding.”

If you present the information too early, Ryan says, “then you’re wasting an opportunity to introduce something else. If you present it too late, it’s like starting over again. So, you want to find that ideal moment to introduce a concept so that students are most likely to retain it for the long term.”

Adaptive learning technology can find that “ideal moment” to present information to students, by analyzing each student’s progression through a learning pathway and then delivering precisely the right information at the right time.

“We break subjects such as algebra into smaller concepts and discrete skills,” Ryan says. “And we have literally trillions of data points regarding common pathways for groups of students within a particular domain. As our software learns more about each student and his or her learning needs, it can begin to identify which pathway the student is taking through that domain.”

Knowing what information to present to a student next requires understanding what that student already has mastered—as well as how a particular body of knowledge builds upon itself.

“We know that students have to understand two-digit multiplication before they can tackle three-digit multiplication,” Ryan says. “If students are successfully multiplying three-digit numbers, there’s no reason to go back and present two-digit multiplication, even if they have skipped it for some reason. So, knowing the progression within a domain is important. If you’ve moved along a continuum, you can assume a degree of mastery for things that are earlier on that continuum.”

To explain how this works in more detail, Ryan points to two math curriculum products from McGraw-Hill Education, ALEKS and Redbird Mathematics.

ALEKS, which stands for Assessment and Learning in Knowledge Spaces, grew out of research from the University of California at Irvine. It’s a personalized learning solution for students in grades 6-12.

This highly adaptive online program uses artificial intelligence and open-response questioning to identify what each student knows and doesn’t know, and then it delivers a personalized learning path that covers the exact topics students are most ready to learn.

Developed by Stanford University, Redbird Mathematics is an adaptive online curriculum for students in kindergarten through sixth grade that uses gamification and project-based learning to engage students. Students learn key math concepts and apply them to real-world scenarios. Finally, they demonstrate mastery by developing solutions to real-world problems through complex, STEM-based projects.
“In both cases, what we’re talking about doing is being able to assess where the students are—quite quickly—through an adaptive assessment engine,” Ryan says. “If something is answered correctly, the problems get harder; if something is answered incorrectly, the problems get easier. In this way, the software zeros in on where students are currently, which informs what is presented for them to learn next.”

In these digital curriculum solutions, assessment “becomes embedded in the learning process,” he says, “as opposed to this monolithic process where you wait until the end of the semester and then give students a high-stakes, high-pressure exam that includes material they learned in September and maybe haven’t revisited since then.” With McGraw-Hill’s products, “we’re constantly revisiting the content until concepts are encoded into students’ long-term memory.”
Earlier generations of adaptive learning technology were fairly linear in nature. Students would answer a series of multiple-choice questions, and depending on their responses, the content would get slightly easier or slightly harder. But the technology has progressed by leaps and bounds since then.

Both ALEKS and Redbird can assess students on the fly, using free-response questions with embedded tools that allow for rich responses. Because each domain is broken into discrete skills, and because each student’s abilities will vary, no two students will have the same result or be taken through the exact same learning path.

The Essential Role of the Classroom Instructor

While these digital curriculum solutions are powerful learning tools, they are not intended to replace the classroom teacher, Ryan says. In fact, they make teachers more effective instructors by giving them detailed information so they can more effectively plan whole-class instruction, group students for small-group lessons, intervene with individual students one-on-one as necessary, and ensure that all students are meeting their learning goals.

“You have assessment, followed by instruction, followed by reporting, both at the student and concept levels,” he says. “The software also allows for aggregate reporting, so that concepts in need of being addressed for entire student groups can be handled by the teacher in a live teaching environment.”

In ALEKS, for instance, teachers and administrators receive a wealth of information about student progress, including last login, duration of all sessions, individual and class performance, and much more. Bar graphs allow teachers to quickly grasp each student’s performance at the time of his or her last assessment (appearing in dark blue), progress in Learning Mode (light blue), and the remaining in gray.

Teachers and administrators can monitor any student’s progress or the progress of an entire class through various reports. In addition, ALEKS can create groupings of students according to chosen criteria, enabling teachers to focus groups of students on topics they are ready to learn.
Teachers and administrators also can access a comprehensive progress report for each student. This report will show the student’s current progress chart, what he knows, what he is ready to learn, and his progress in the system.

In this new generation of learning tools, curriculum, assessment, and reporting come together to provide truly data-driven instruction. “It’s all part of one solution,” Ryan says, “and those distinctions between the instruction, assessment, and data analysis are becoming increasingly meaningless in the most elegant solutions on the market.”

Sometimes, K-12 ed-tech leaders have a tendency to think of technology as a silver-bullet solution, Ryan says. But that’s the wrong approach to take. “First of all, it’s not true. Secondly, it alienates your key constituency—teachers. And most importantly, it ignores the reality of how you ensure engagement and motivation and understanding the totality of students and their circumstances. Those things cannot be addressed through just a technological solution,” he says.

“We see our products as part of a teacher’s arsenal. Our goal is to make teachers more effective, but also in less time. More than anything else, we feel there are time constraints in one of the hardest jobs in the world. We are looking to help teachers become more effective, but equally important, we want to make sure the technology is easy to implement and that it does not add more burden to teachers. That is key.”
Implementation with Fidelity Requires Effective Leadership

McGraw-Hill Education is seeing rapid adoption of its learning science-based digital solutions in K-12 schools—and where these solutions are being used effectively, schools are achieving impressive results.

“The precursor to student success is implementing the software with fidelity,” Ryan says. “Where schools are implementing these solutions with fidelity, we’re seeing gains far in excess of a single school year of academic gain in a particular domain.”

“With fidelity” varies by the type of program, the needs of each student, and how much you want students to gain over a set period of time. “If you want a more ambitious outcome, you’re going to need a more aggressive definition of fidelity,” he notes.

Successful implementation requires establishing an environment and a culture where students have plenty of bandwidth to log on, where teachers feel supported and know how to use the software effectively. That environment and culture start at the top, with a clearly articulated and communicated vision.

“District leadership is the foundation,” Ryan says. “Leaders have to understand the current state of affairs across the district. That means knowing what your infrastructure is, what your curriculum is, and your pedagogy—as well as the climate. How open are educators and building leaders to doing things differently?”

There also must be some degree of stability at those leadership levels. “That doesn’t mean it has to be the same person in those positions, but you don’t want to throw out your strategic plan every year,” he explains. “And your mission statement shouldn’t be changing every year. These are things that should move gradually and infrequently, so that people can build upon those ideas.”
It is the cultural piece that is perhaps most important, Ryan says—and also the element where many districts struggle.

“You have to make sure you’re working with educational coaches, with teachers, and with building leaders to make sure they are comfortable with technology and comfortable with interpreting data at some basic level,” he says. Failing to transform the culture “is like buying a NordicTrack and having it sit in your bedroom and never using it. It becomes an expensive clothes rack, and you don’t improve your fitness. So many technologies are purchased and not used, and so many technologies that are used are not used completely or with fidelity.”

Having a partner like McGraw-Hill Education, which is not just a solutions provider but a full ally in the digital transformation process, can be very valuable. “For school districts that are dealing with complex issues that extend beyond the classroom, partnerships can help with the teaching and learning component,” Ryan says. “We have the knowledge and the expertise to help districts evaluate their programs and make sure our solutions are effective.”

**Tying It All Together**

McGraw-Hill Education’s digital curriculum solutions use principles of learning science to deliver just the right information to each student at the right time, personalizing the learning experience and helping teachers to be more effective. When implemented with fidelity by capable teachers supported by strong leadership, students can achieve lasting success.

“Year over year, we’re seeing a significant increase in usage of more than 40% across the country,” Ryan concludes. “To see teachers recognizing the impact our solutions are having on student learning, and doing whatever needs to be done based on their local circumstances to make sure that kids are interacting with these systems, is incredibly encouraging. It motivates our teams of scientists, product developers, trainers, and support folks to invest even more time and energy into the next generation of personalized learning solutions. The best is yet to come!”
About McGraw-Hill Education

Our vision is to unlock the full potential of each learner.

Our mission is to accelerate learning through intuitive, engaging, efficient, and effective experiences—grounded in research.

At McGraw-Hill Education, we believe that our contribution to unlocking a brighter future lies within the application of our deep understanding of how learning happens and how the mind develops. It exists where the science of learning meets the art of teaching.

Educators have been and always will be at the core of the learning experience. The solutions we develop help educators impart their knowledge to students more efficiently. We believe that harnessing technology can enhance learning inside and outside of the classroom and deepen the connections between students and teachers to empower greater success.

By partnering with educators around the globe, our learning engineers, content developers, and pedagogical experts are developing increasingly open learning ecosystems that are proven to improve pass rates, elevate grades, and increase engagement for each individual learner while improving outcomes for all.

Why? Because learning changes everything.

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