



PERSONALIZED APPROACH TO LEARNING

An Insider's Guide to Adaptive Technology



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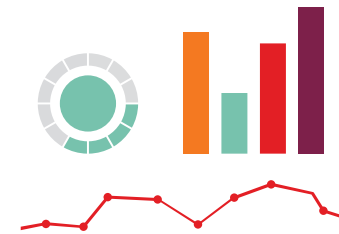
The right experience at the right time for the right learner based on data.

By combining the power of software automation with the human insights and judgments of skilled educators, adaptive learning technology can provide mastery learning and personalized programs for learners. This technology allows instructors to use their resources and time more effectively, stimulating student engagement as well as results.

Introduction

Today's classrooms offer a more positive environment for personalizing learning than ever before. Technology has become more commonplace in the classroom, as school infrastructures have improved and those creating educational software continue to incorporate more robust assessment tools and adaptive technology. This combination of influences makes digital tools that assess and respond to student input a viable solution for personalizing the learning experience.

School and district leaders who want to pursue personalized-learning curricula have ample resources at their disposal but may find it difficult to make comparisons between them. Each educator has a unique set of goals and challenges, but all educators can benefit from understanding the best practices for choosing adaptive technologies.



Adaptive Learning Technology

In the not-so-distant past, students who struggled were often left behind, while those who needed a greater challenge were expected to wait for the rest of their class to catch up. Now, educators can use personalized learning strategies, tools, and resources to adapt existing curricula and instructional practices for every learning level. This empowers them to provide remediation for struggling students, supportive practice for on-level students, and enrichment for advanced students, so every student has an equal chance to achieve their full potential.

To help every student reach his or her full potential, goals must be identified, benchmarks set, and students must feel personally invested in the process. Adaptive tools can also assess student progress in real-time, which is motivating to the student and informative for teachers.

Adaptive tools can allow for students to be more prescriptive in their learning and can save teachers time by enabling more meaningful interactions with their students. Understanding how each student is progressing enables teachers to adjust presentations and lectures or group students in ways that support their learning. Teachers can also assign adaptive lessons as homework so that students are better able to participate in discussions when they are in class.

Personalizing Learning to Empower Every Student

Personalized learning instructional solutions can be part of an environment where learners experience rigorous and engaging learning experiences that will prepare them for college and careers.

In order to provide all students with rigorous and engaging learning experiences that will prepare them for college and career, McGraw-Hill Education strives to continually develop advanced personalized learning instructional solutions. Personalized learning requires that students and teachers collaborate to determine learning needs, plan, and design while emphasizing the role of student voice and purposeful technology. McGraw-Hill Education digital learning solutions harness the power of learning science to make personalized instruction accessible and transformative for every student.

Clarifying the Terminology

Personalize – Teacher and Student working together to design learning experiences that meet the learner’s unique needs.

Blended Learning – A mix of technology and face-to-face interaction, where classroom and digital instruction are combined to meet the needs of the learner.

Adaptive Technology Software – Technology that creates a learning environment in which materials delivered are based on student input.

Steps to Personalize – Attempts at moving away from one-size fits all

Differentiation	Individuation	Personalized
The teacher drives instruction and adjusts learning design for groups of students	The teacher drives instruction and adjusts learning design for the individual learner	The student and teacher collaborate to drive learning and determine needs
<i>Teacher for groups</i>	<i>Teacher for individual students</i>	<i>Teacher and Student for a single student</i>

Not all uses of these terms will adhere to these definitions, of course, but a clear set of definitions can help to assess systems that offer personalized tools.

What is Adaptive Learning Technology?

Adaptive learning technology is any system that collects information on a student's skill, knowledge and confidence levels, and uses it to change the material or tasks presented to that student. The goal of adaptive learning technology is to personalize the course to suit the individual's needs, by building on their strengths to meet goals. This will allow for better retention and progress through the course at a pace and in a direction uniquely suited to them.

Adaptive learning technology is a tool that serves personalized learning that creates a learning environment in which the material delivered is based on the student's input.

Adaptive learning is not a new concept. Any learning experience that is adapted to the individual—whether in terms of pace, the order of presented concepts, type of assessment, or other means—can be considered adaptive. Educators of all stripes have been striving to make their educational offerings adaptive for as long as there has been education. What is new is the technology that can allow instructors to offer adaptive learning at an unprecedented scale and with unprecedented efficacy.

The best adaptive learning technology collects information about the student's skills, knowledge, and confidence levels, and uses it to choose material, tasks, and scaffolds that match their need.

The Role of Adaptive Digital Tools in Personalized Learning

Adaptive learning takes a sophisticated, data-driven, and in some cases, a non-linear approach to instruction and remediation, adjusting to a learner's interactions and demonstrated performance level and subsequently anticipating what types of content and resources learners need at a specific point in time to make progress.

Adaptive learning tools can also help ensure the rigor of curriculum by aligning instruction with state standards and ensuring that students are mastering challenging content before moving on, rather than simply covering it and continuing forward. By reducing the gaps in learning that undermine progress, these tools help lay a solid foundation along the way.

Some learning programs adapt based on the results of a digital assessment at the end of a lesson while others monitor student work in real-time and adjust content to a student's performance. For those choosing an adaptive learning platform,

understanding how it adapts to a student's learning over time can be an important factor in the decision-making process. Ask these questions to determine how adaptive a program is:

- How often and accurately does the program evaluate student progress?
- Does the program respond to assessment results by altering lessons in real-time?
- Does the adaptive program identify and strengthen foundations before presenting new content?
- Is the program backed by scientific research?
- Does the program encourage the transfer of knowledge and learning from mistakes or does it include open-response answers?

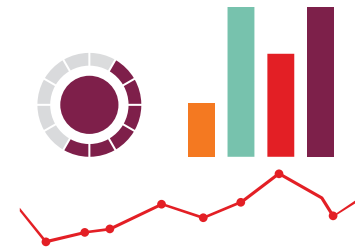
One of the great benefits of using adaptive technology in the classroom is that it allows students to make choices about how, and how quickly, they will progress through the content. The learning environments that educators develop should be flexible and encourage exploration and collaboration while keeping students focused on their individual learning goals.

An increasing number of adaptive learning systems deliver digital content that complements textbook content at flexible speeds. Choosing the most effective and efficient learning approach for each student will help ensure the best outcomes.

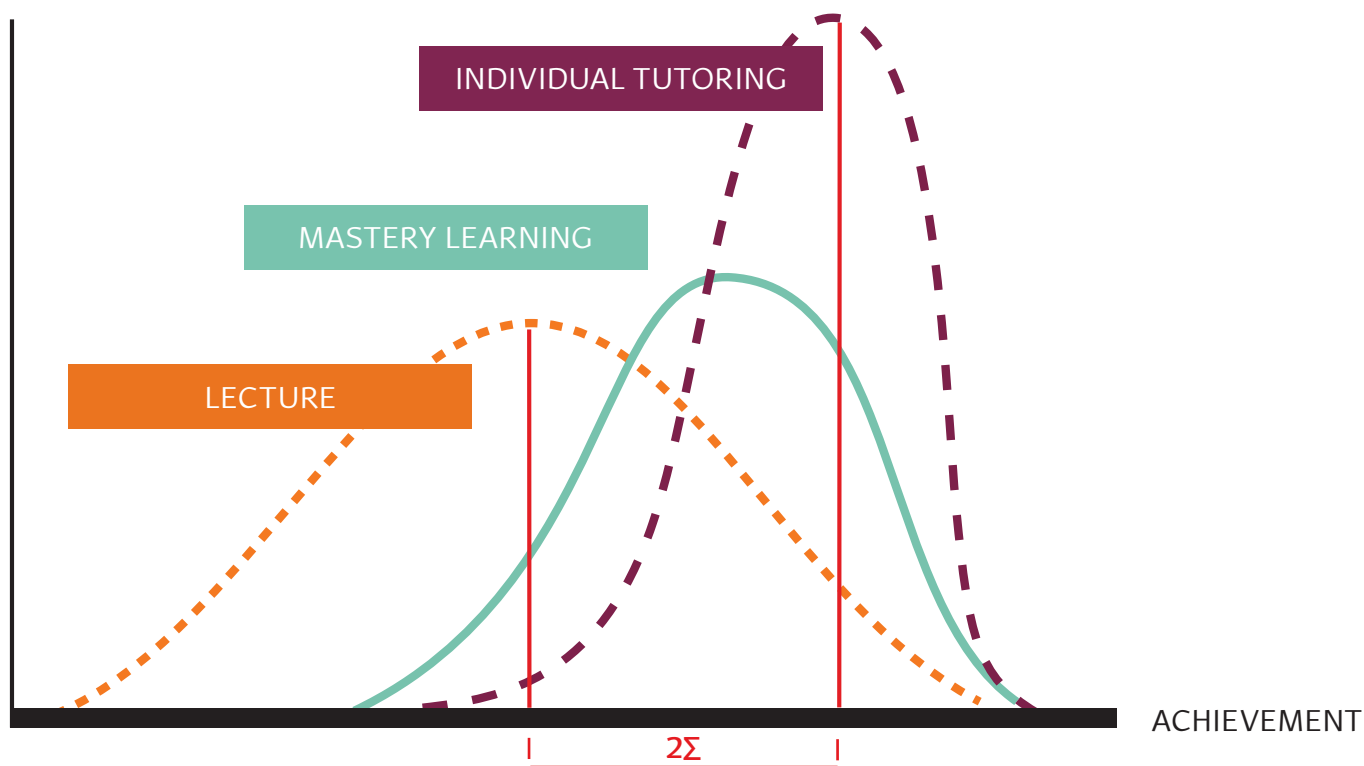
The Educational Research Underlying Adaptive Learning

In 1984, **Benjamin Bloom**—the educational researcher best known for Bloom’s Taxonomy—published a paper on the “2 Sigma Problem”. Bloom’s research divided students into three groups. Group 1, the control group [**Lecture Group**], received conventional, class-based instruction and periodic assessments to track how much they had learned. Group 2 received conventional, class-based instruction but were given formative assessment tasks throughout the course, designed to help them learn the material and establish when they had mastered a topic and were ready to progress [**Mastery Learning**]. Group 3 received the same formative, mastery-based feedback as group 2, along with one-on-one tutoring [**Individual Tutoring**].

Bloom’s results were striking. Students who had received individualized tutoring showed improvement over the control class by two standard deviations (or grades), with many of the tutored students surpassing 98 percent of students in the controlled group. Meanwhile, mastery learning boosted results one standard deviation above the control group. The mastery students also surpassed 84 percent of the students in the control group.



The results, which have subsequently been reproduced and expanded upon, suggest that a combination of mastery learning and personalized tutoring allows learners to achieve their potential. These techniques can also play a substantial role in narrowing the achievement gap. This was a problem for Bloom in 1984. As effective as mastery learning and personal tutoring were for learning outcomes, they were entirely too labor-intensive to achieve realistically—it simply wouldn't be possible to provide every student with a personal tutor. However, today's adaptive learning technology provides both in a way that is more affordable and less labor-intensive.



Adaptive Learning Technology Rests on Other Well-Established Concepts in Educational Psychology



[CONCEPT 1] Deliberate Practice

One of the most common bases for adaptive learning is the idea that the students who are most prepared to put in the effort, are the ones most likely to reap the benefits. This concept has been given a variety of names, with subtle (albeit often important) differences between them, but the basic principle is consistent: conscientiousness, grit, self-control, deliberate practice, and willpower, all have in common the notion that practicing something difficult will eventually lead to success in that arena. Adaptive technologies are designed to make that practice efficient, constructive, and rewarding.



[CONCEPT 2] Metacognition

Metacognition is another concept that is central for certain adaptive learning technologies. This is the ability to think about one's thought process or observe one's learning. Flavell, the psychologist credited with developing our understanding of the importance of metacognition in education, writes that "I am engaging in metacognition if I notice that I am having more trouble learning A than B; if it strikes me that I should double-check C before accepting it as fact."

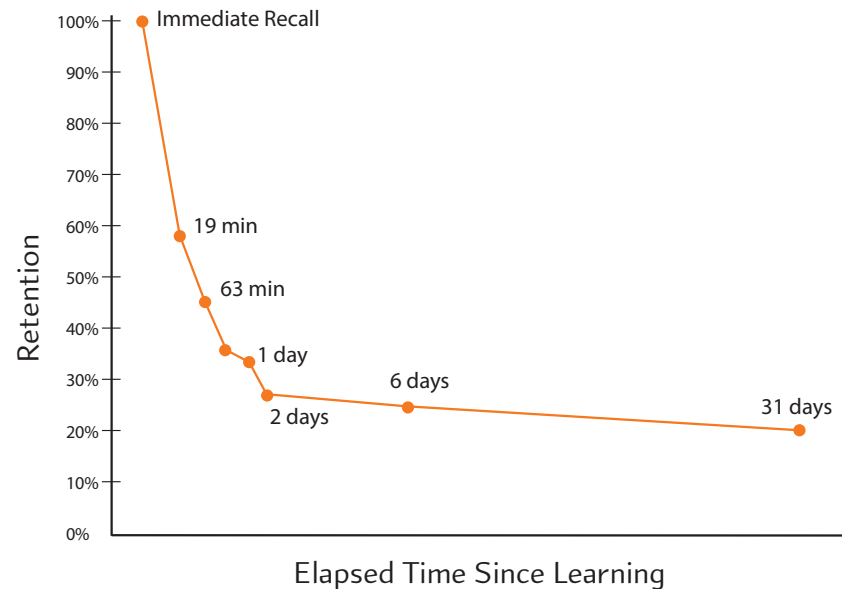
Enhanced metacognition has been found to improve students' understanding in a variety of disciplines, including mathematics, physics and reading comprehension, also helping to transfer skills to new settings. Adaptive learning can help students develop their metacognition by breaking down each skill into its respective components, monitoring their progress towards learning goals, repeating questions where they showed lower confidence and indicating discrepancies between self-assessed certainty and actual performance on a task. Highlighting these discrepancies can boost low confidence, moderate unduly high confidence, and determine when repetition is necessary – even with a correct, but guessed, answer. All of these strategies combine to give students a realistic view of their performance and help them better understand their areas of improvement.



[CONCEPT 3] Ebbinghaus Forgetting Curve

It is possible for adaptive learning technology to not only help students learn information but also retain it. This is based on theoretical work with roots back to the 19th century, like the Ebbinghaus forgetting curve, which mathematically models the rate at which people lose information after first learning it.

Some adaptive learning systems use these models to establish the best time for students to review information they have already learned, contributing to the long-term retention of information. Using these models also discourages cramming, which results in information being lost immediately after assessment.



Finding Optimal Adaptive Solutions for Personalized Learning

Before implementing an adaptive digital solution to advance a personalized learning curriculum, school leaders should have a clear idea of how it will differ from what happens in their classrooms today, and how new strategies will align with their district's current curriculum or instructional frameworks. When evaluating and adopting personalized, adaptive learning programs, McGraw-Hill Education's intervention and acceleration team advises educational leaders to keep seven criteria in mind to help ensure all students are college and career ready.



Seven Criteria for Evaluating Adaptive Technology

1. Purpose

Purpose-driven adaptive technology should be packed and paired with engaging and impactful content that delivers valuable student-data insights. Adaptive curricula should provide opportunities for any time, anywhere, real-world learning objectives and standards (Worthen, 2017). Content should be aligned to state and national standards to ensure accountability.

2. Pathways

Student-centered adaptive software should deliver content and assignments dynamically, using a differentiated path that is optimally aligned and individually paced. Flexible pathways are customized and aligned to the student's zone of proximal development—the zone in which guidance and support are needed for learners to become independently competent—and variably paced to provide the right amount of practice. The software dynamically assesses prior knowledge and current understandings and identifies potential challenge areas by standard, topic, and activity, which informs and constantly adapts the individual curriculum.

3. Diagnostics

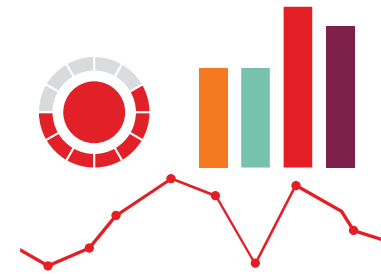
Personalized, adaptive learning programs should conduct automated initial and ongoing diagnostic assessments to pinpoint more accurately where students are in their learning progressions, identify areas requiring more practice, and help teachers keep apprised of student progress. Adaptive software uses smart algorithms that assess, adapt, and scaffold student learning, measuring and moving students toward higher standards and more in-depth learning.

4. Gamification and Games

Programs should contain interactive game-based instruction to thoroughly engage students in learning and help them gain awareness of their own level of understanding. Game-based instruction is more motivating when it is personalized by adapting the user-interface, the level of difficulty, the pedagogical scenario, and the feedback.

5. Feedback

Adaptive learning curriculum programs should provide immediate feedback through proactive, interactive support for problem-solving, both during learning and during formative and summative assessments. Interactive support delivers a continuous stream of intelligent responses, prompting students to rethink approaches that will create success. Providing scaffolding and instruction at the time of impasse is extremely effective and is something that the right software can do immediately on an individual basis.

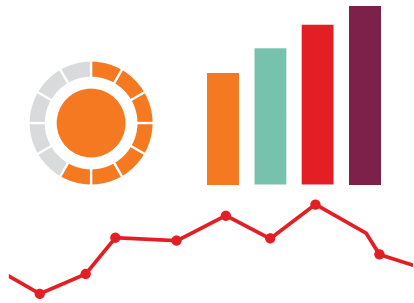


6. Simulations

Adaptive learning involving interactive simulations challenges and engages students in ways that few other activities can. Experiential games and virtual projects stimulate learning, add variety to instruction, increase students' attention spans, and mitigate discipline issues. Digital adaptive programs contain interactive games, simulations, and gamification to thoroughly engage students in learning and help them gain awareness of their own level of understanding. Project-based learning in adaptive software allows students to explore problems, showcase proficiency, and create solutions. Students should be challenged, and never frustrated or bored.

7. Proof

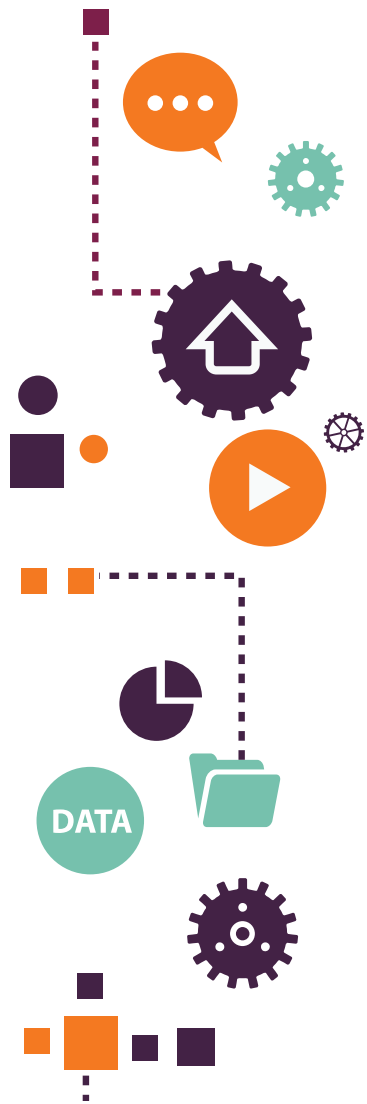
Educators must design personalized learning environments that maximize the use of research-proven programs and resources aligned to student needs. Personalized learning curriculum programs must reflect a proven, research base using sound, evidence-based pedagogy, rigorous instruction, and current academic standards. Educators are highly advised to evaluate and implement programs and practices that have reliable scientific evidence of being effective with the students who are using them. Research and efficacy should be at the core of each educational leader's vision to unlock the full potential of each learner. Choose curriculum partners who use research to guide their work and whose products are tested, retested, and continually updated to meet educators' high standards.



Finding the Right Adaptive Learning Solutions

Before implementing a personalized learning curriculum districts and schools should have a clear idea of what will differ from what happens in classrooms today and how new strategies will align with the district's current curriculum or instructional frameworks.

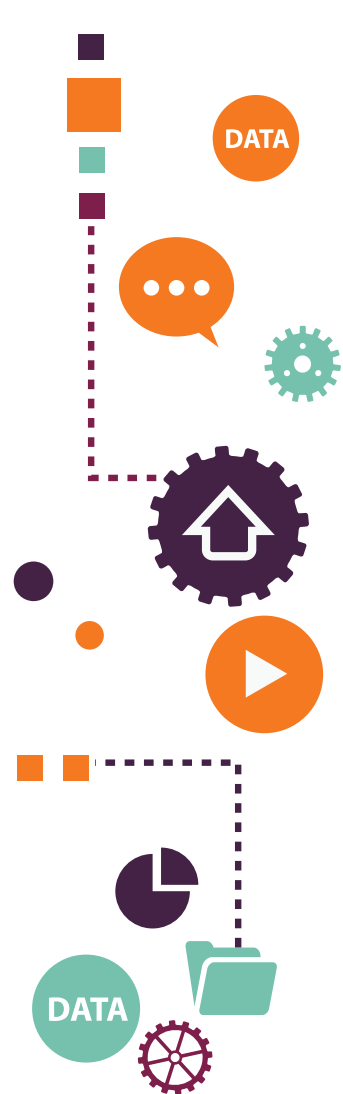
When evaluating and adopting personalized, adaptive learning programs, educational leaders should consider several criteria to consider including tech infrastructure; on-going teacher development; parent support; goals such as standards, frameworks, competencies and more; and which collection of resources will be available to teachers and learners.



One of the Major Strengths of Adaptive Learning is the Amount of Data Gathered by the System

Different technologies gather different kinds of data about students, depending on how they work. Some of the learning analytics available within adaptive learning technology include:

- ▶ Individual students' performance (for example, how many questions each student got correct on a particular assessment)
- ▶ Individual students' engagement with the system (for example, the time spent using it, how that time was spent, or the number of assignments submitted)
- ▶ What sections have been mastered by a student, and what sections, or how much of each section, still remain to be mastered
- ▶ Students' improvements or deterioration over time
- ▶ How sections, questions or objectives were received across a class group, helping to highlight what the class as a whole found easy or difficult

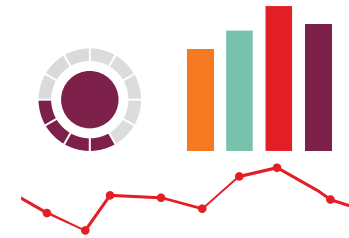


- ▶ Which questions have been missed or answered incorrectly the most
- ▶ Which learning objectives are the most challenging
- ▶ Individual assignments (for example, how many have been submitted, and average, high, and low scores across the class)
- ▶ Comparisons between students' performance, showing whether a student is ahead of the curve, or behind it
- ▶ Students' self-assessment of their own understanding
- ▶ Students' motivation and/or frustration
- ▶ The interaction between students within the system
- ▶ Skills that are needed to bolster performance

Adaptive System Data Provides Actionable Insights for Both Students and Instructors

For students, access to data like this is a huge step forward from simple, limited information like a single grade, or even information on which questions were incorrect. With learning analytics, students are able to gain insights that can actually guide their learning. Students can see which sections they struggled with the most (potentially difficult to spot in a test or exam that scatters questions from a single section, making it difficult to get a unified picture), where they are struggling to self-assess their knowledge, and what courses they should take to improve their learning skills.

For instructors, this is a far cry from simple, limited information like bell curves of student results—all these methods can tell instructors is whether course material is generally too difficult or too easy. Instructors can get a much broader and more granular review of their students' performance, not just a simple matter of questions right and wrong, but also whether students understand their own lack of knowledge, whether they are motivated and engaged, and whether certain sections are particularly problematic.



Aside from providing far more detailed information on *what* has happened, and allowing students and instructors to identify *why* it happened that way, learning analytics can also allow for prediction and extrapolation by modeling expected trends. This can allow both students and instructors to predict, for instance, how a student will perform in a particular section or course based on past performance.

Based on information like this, both students and instructors are equipped to make informed decisions. Instructors are able to give more personalized feedback to students, and deliver more precise interventions to students who are struggling. It can even help instructors identify students with low motivation who are at risk of dropping out, allowing them to intervene quickly. Adaptive systems are ideal for use in flipped classroom environments as the analytics can substantially qualify what a teacher should expect walking into the classroom thus allowing the instructor to focus on the lesson and higher level topics of discussion.

Data reports and visualizations can also help instructors to adapt their own courses, improving their offerings after each course cycle. These reports allow for comparisons of how actual student results matched initial expectations, and information to help instructors understand why deviations from expectations occurred. They can also allow for comparisons between different courses that differed in small but meaningful ways, allowing instructors to make adjustments for each iteration of a course and improve it consistently over time.

The capabilities of data analytics in robust platforms extend far beyond just showing what skills students are struggling with, providing a comprehensive picture of student performance that takes into account motivation, confidence, and metacognition.



The beauty of adaptive learning is that it caters to students.

Striving students are provided with the support they need, while advanced students are able to bypass material they find basic and spend their time on more challenging material.

With systems based on models of knowledge retention, students are able to spend more time working to learn or retain material they don't yet know or remember, rather than studying material, they already know. In combination with learning analytics, students are able to develop their metacognitive skills, allowing them to understand their own learning more thoroughly. This individualized pacing and greater awareness are precisely what allows for the boosted results and reduced achievement gap found by Bloom.

Adaptive learning systems also have an important impact on student engagement, encouraging deliberate practice and creating tangible, incremental signs of improvement and progress. For all students, but especially those who are builder greater confidence and motivation, this encouragement and visible progress can make or break engagement with—and success in—a course.

Adaptive learning is grounded in well-established pedagogical theory, but as a new technology, robust evidence of results are only beginning to be published. Early results indicate that the promise suggested by Bloom is being fulfilled by the best adaptive learning technology, which results in boosted student performance and engagement. Some promising early results suggest that adaptive learning technology has the potential to improve student engagement and motivation, reduce course drop-out rates, and help students to achieve learning outcomes more efficiently.

For instructors, one of the primary benefits of adaptive learning technology is the change in how effectively time can be used. Far from replacing the human element of education, the software liberates it. Instructors are able to offload tasks to adaptive learning software that would normally be spent on the repetitive and time-heavy task of grading.

Instead, that time can be spent learning how individual students are coping with the material, developing and recommending resources, and generally taking on the role of coach and mentor. Additionally, because students are able to receive better individual support on foundational concepts in their own time through adaptive learning software, class time can be used to work on higher-level concepts, stimulate discussion and interaction, and focus on skills like critical thinking. This also means increased time for instructors to engage with students on an individual level, offering help where it is most needed.

Conclusion

Today's K-12 educators must facilitate learning for students coming in at all levels, and although every student has unique challenges that require personalized solutions, teachers are faced with limited time for one-on-one interactions. Adaptive technology harnesses learning science research to assess a student's knowledge or skill level and determine the most effective, efficient path for that individual student to learn and master content and skills.

Districts and schools interested in implementing digital personalized learning programs must define their own needs and expectations before making side-by-side comparisons of available adaptive technologies. Understanding what adaptive technology is capable of, and choosing programs that are research-proven to work with each learner's age and academic level, will give educators confidence that they have chosen well. Adaptive learning curriculum programs enable more effective personalized and differentiated learning, ultimately helping develop future-ready, lifelong learners who are prepared for achievement and success in school, college, and careers.

Just because the system adapts, doesn't mean it's an adaptive system. It has to respond by prioritizing the records of experience to identify what the learner needs.

The Future of Learning

Considering the diversity of students, the spread of adaptive learning technology seems inevitable. By providing the benefits of mastery learning and a personal tutor without the added personnel or time, adaptive learning is impacting education on all fronts – from studying to class prep, grades and more. The next step is determining the right adaptive learning technology for your needs and effectively implementing it.



Want to find out more about
the benefits of adaptive learning
for students and instructors?

Request a demo today!

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.

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