

Education Practice

How technology is shaping learning in higher education

New McKinsey research shows that students and faculty are eager to continue using new classroom learning technologies adopted during the pandemic, but institutions could do more to support the shift.

This article is a collaborative effort by Claudio Brasca, Charag Krishnan, Varun Marya, Katie Owen, Joshua Sirois, and Shyla Ziade, representing views from McKinsey's Education Practice.



The COVID-19 pandemic forced a shift to remote learning overnight for most higher-education students, starting in the spring of 2020. To complement video lectures and engage students in the virtual classroom, educators adopted technologies that enabled more interactivity and hybrid models of online and in-person activities. These tools changed learning, teaching, and assessment in ways that may persist after the pandemic. Investors have taken note. Edtech start-ups raised record amounts of venture capital in 2020 and 2021, and market valuations for bigger players soared.

A study conducted by McKinsey in 2021 found that to engage most effectively with students, higher-education institutions can focus on eight dimensions of the learning experience.¹ In this article, we describe the findings of a study of the learning technologies that can enable aspects of several

of those eight dimensions (see sidebar “Eight dimensions of the online learning experience”).

In November 2021, McKinsey surveyed 600 faculty members and 800 students from public and private nonprofit colleges and universities in the United States, including minority-serving institutions, about the use and impact of eight different classroom learning technologies (Exhibit 1). (For more on the learning technologies analyzed in this research, see sidebar “Descriptions of the eight learning technologies.”) To supplement the survey, we interviewed industry experts and higher-education professionals who make decisions about classroom technology use. We discovered which learning tools and approaches have seen the highest uptake, how students and educators view them, the barriers to higher adoption, how institutions have successfully adopted innovative technologies, and the notable impacts on learning

Eight dimensions of the online learning experience

Leading online higher-education institutions focus on eight key dimensions of the learning experience across three overarching principles.

Seamless journey

Clear education road map: “My online program provides a road map to achieve my life goals and helps me structure my day to day to achieve steady progress.”

Seamless connections: “I have one-click access to classes and learning resources in the virtual learning platform through my laptop or my phone.”

Engaging teaching approach

Range of learning formats: “My program offers a menu of engaging courses with both self-guided and real-time classes, and lots of interaction with instructors and peers.”

Captivating experiences: “I learn from the best professors and experts. My classes are high quality, with up-to-date content.”

Adaptive learning: “I access a personalized platform that helps me practice exercises and exams and gives immediate feedback without having to wait for the course teacher.”

Real-world skills application: “My online program helps me get hands-on practice using exciting virtual tools to solve real-world problems.”

Caring network

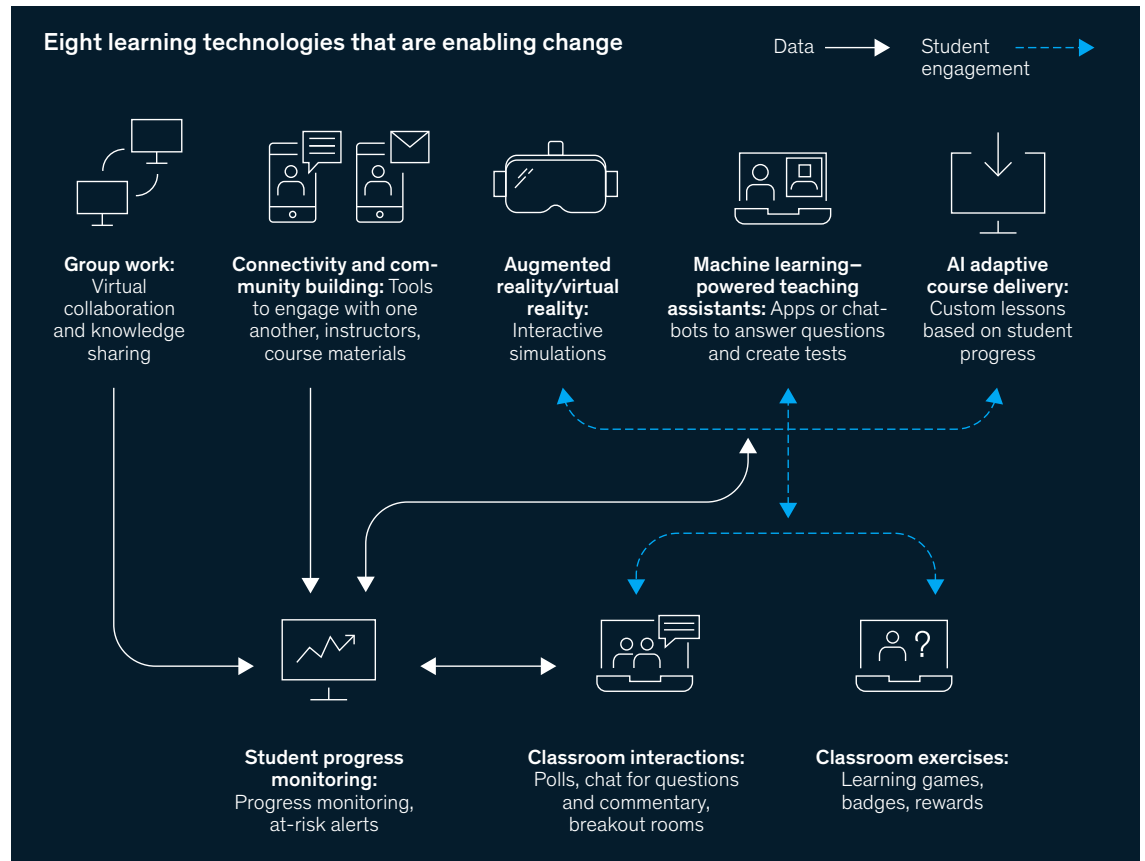
Timely support: “I am not alone in my learning journey and have adequate 24/7 support for academic and nonacademic issues.”

Strong community: “I feel part of an academic community and I’m able to make friends online.”

¹ Felipe Child, Marcus Frank, Mariana Lef, and Jimmy Sarakatsannis, “Setting a new bar for online higher education,” McKinsey, October 18, 2021.

Exhibit 1

Higher-education institutions have leveraged technology to improve aspects of the learning experience during the pandemic.



(for details about our methodology, see sidebar “About the research”).

Double-digit growth in adoption and positive perceptions

Survey respondents reported a 19 percent average increase in overall use of these learning technologies since the start of the COVID-19 pandemic. Technologies that enable connectivity and community building, such as social media-inspired discussion platforms and virtual study groups, saw the biggest uptick in use—49 percent—followed by group work tools, which grew by 29 percent (Exhibit 2). These technologies likely fill the void

left by the lack of in-person experiences more effectively than individual-focused learning tools such as augmented reality and virtual reality (AR/VR). Classroom interaction technologies such as real-time chatting, polling, and breakout room discussions were the most widely used tools before the pandemic and remain so; 67 percent of survey respondents said they currently use these tools in the classroom.

The shift to more interactive and diverse learning models will likely continue. One industry expert told us, “The pandemic pushed the need for a new learning experience online. It recentered institutions to think about how they’ll teach moving forward and has brought synchronous and hybrid learning

Descriptions of the eight learning technologies

- **Classroom interactions:** These are software platforms that allow students to ask questions, make comments, respond to polls, and attend breakout discussions in real time, among other features. They are downloadable and accessible from phones, computers, and tablets, relevant to all subject areas, and useful for remote and in-person learning.
- **Classroom exercises:** These platforms gamify learning with fun, low-stakes competitions, pose problems to solve during online classes, allow students to challenge peers to quizzes, and promote engagement with badges and awards. They are relevant to all subject areas.
- **Connectivity and community building:** A broad range of informal, opt-in tools, these allow students to engage with one another and instructors and participate in the learning community. They also include apps that give students 24/7 asynchronous access to lectures, expanded course materials, and notes with enhanced search and retrieval functionality.
- **Group work:** These tools let students collaborate in and out of class via breakout/study rooms, group preparation for exams and quizzes, and streamlined file sharing.
- **Augmented reality/virtual reality (AR/VR):** Interactive simulations immerse learners in course content, such as advanced lab simulations for hard sciences, medical simulations for nursing, and virtual exhibit tours for the liberal arts. AR can be offered with proprietary software on most mobile or laptop devices. VR requires special headsets, proprietary software, and adequate classroom space for simultaneous use.
- **AI adaptive course delivery:** Cloud-based, AI-powered software adapts course content to a student's knowledge level and abilities. These are fully customizable by instructors and available in many subject areas, including business, humanities, and sciences.
- **Machine learning–powered teaching assistants:** Also known as chatbot programs, machine learning–powered teaching assistants answer student questions and explain course content outside of class. These can auto-create, deliver, and grade assignments and exams, saving instructors' time; they are downloadable from mobile app stores and can be accessed on personal devices.
- **Student progress monitoring:** These tools let instructors monitor academic progress, content mastery, and engagement. Custom alerts and reports identify at-risk learners and help instructors tailor the content or their teaching style for greater effectiveness. This capability is often included with subscriptions to adaptive learning platforms.

into focus.” Consequently, many US colleges and universities are actively investing to scale up their online and hybrid program offerings.

Some technologies lag behind in adoption. Tools enabling student progress monitoring, AR/VR, machine learning–powered teaching assistants (TAs), AI adaptive course delivery, and classroom exercises are currently used by less than half

of survey respondents. Anecdotal evidence suggests that technologies such as AR/VR require a substantial investment in equipment and may be difficult to use at scale in classes with high enrollment. Our survey also revealed utilization disparities based on size. Small public institutions use machine learning–powered TAs, AR/VR, and technologies for monitoring student progress at double or more the rates of medium and large

About the research

In November 2021, McKinsey surveyed 634 faculty members and 818 students from public, private, and minority-serving colleges and universities over a ten-day period. The survey included only students and faculty who had some remote- or online-learning experience with any of the eight featured technologies. Respondents were 63 percent female, 35 percent male,

and 2 percent other gender identities; 69 percent White, 18 percent Black or African American, 8 percent Asian, and 4 percent other ethnicities; and represented every US region. The survey asked respondents about their:

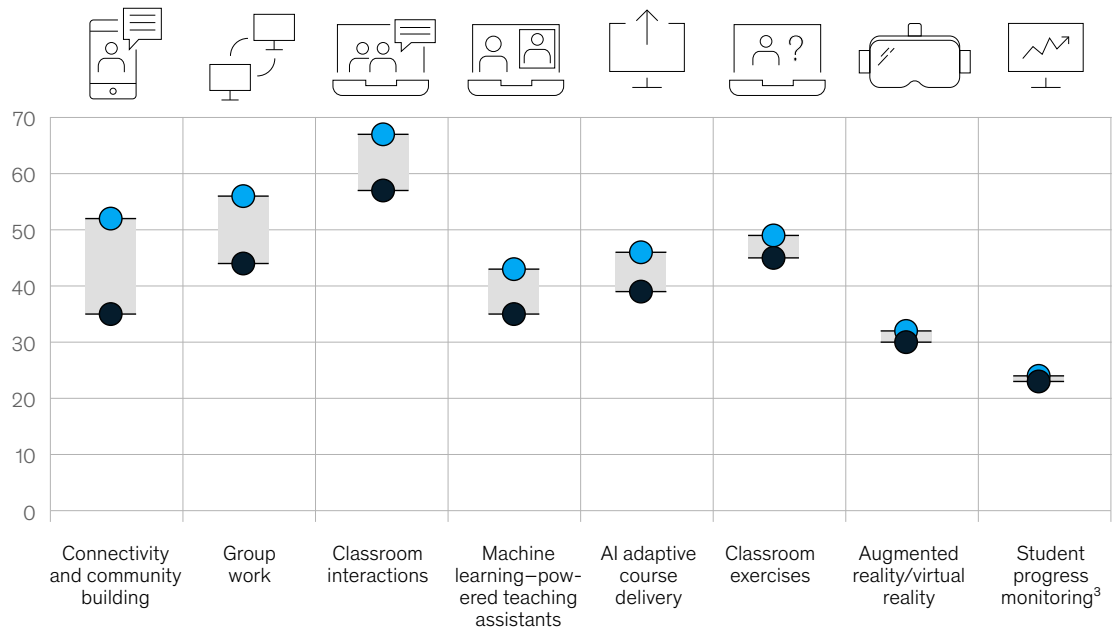
- experiences with technology in the classroom pre-COVID-19;

- experiences with technology in the classroom since the start of the COVID-19 pandemic; and
- desire for future learning experiences in relation to technology.

Exhibit 2

Connectivity and community-building tools in colleges and universities had the broadest adoption during the COVID-19 pandemic.

Use of technology in the classroom,¹% of respondents (n = 1,452) —●— Prepandemic —●— During pandemic²



¹To measure prepandemic usage, question 1: "Prior to the pandemic (ie, prior to Mar 2020), have you had experience using any of the following types of technologies in the classroom?" To measure usage during the pandemic, question 2: "Since the pandemic (ie, since Mar 2020), have you had experience using any of the following types of technologies in the classroom?"

²During the pandemic (Nov 2021).

³Students were not asked about the use of tools for monitoring student progress—responses shown are from faculty members only.

Source: Nov 2021 McKinsey survey of 634 faculty members and 818 students from public, private, and minority-serving colleges and universities

Differences in adoption by type of institution observed in the research

- Historically Black colleges and universities (HBCUs) and tribal colleges and universities made the most use of classroom interactions and group work tools (55 percent) and the least use of tools for monitoring student progress (15 percent).
- Private institutions used classroom interaction technologies (84 percent) more than public institutions (63 percent).
- Public institutions, often associated with larger student populations and course sizes, employed group work and connectivity and community-building tools more often than private institutions.
- The use of AI teaching-assistant technologies increased significantly more at public institutions (30 percent) than at private institutions (9 percent), though overall usage remained comparatively higher at private institutions.
- The use of tools for monitoring student progress increased by 14 percent at private institutions, versus no growth at public institutions.

public institutions, perhaps because smaller, specialized schools can make more targeted and cost-effective investments. We also found that medium and large public institutions made greater use of connectivity and community-building tools than small public institutions (57 to 59 percent compared with 45 percent, respectively). Although the uptake of AI-powered tools was slower, higher-education experts we interviewed predict their use will increase; they allow faculty to tailor courses to each student's progress, reduce their workload, and improve student engagement at scale (see sidebar "Differences in adoption by type of institution observed in the research").

While many colleges and universities are interested in using more technologies to support student learning, the top three barriers indicated are lack of awareness, inadequate deployment capabilities, and cost (Exhibit 3).

Students want entertaining and efficient tools

More than 60 percent of students said that all the classroom learning technologies they've used since COVID-19 began had improved their learning and grades (Exhibit 4). However, two technologies earned higher marks than the rest for boosting academic performance: 80 percent of students cited classroom exercises, and 71 percent cited machine learning-powered teaching assistants.

Although AR/VR is not yet widely used, 37 percent of students said they are "most excited" about its potential in the classroom. While 88 percent of students believe AR/VR will make learning more entertaining, just 5 percent said they think it will improve their ability to learn or master content (Exhibit 5). Industry experts confirmed that while there is significant enthusiasm for AR/VR, its ability to improve learning outcomes is uncertain. Some data look promising. For example, in a recent pilot study,² students who used a VR tool to complete coursework for an introductory biology class

² "Immersive biology in the Alien Zoo: A Dreamscape Learn software product," Dreamscape Learn, accessed October 2021.

Exhibit 3

Lack of awareness emerges as the top reason new learning tools are not adopted in higher-education institutions.

Top 5 barriers to using learning tech,¹ % of student and faculty respondents (n = 1,429)

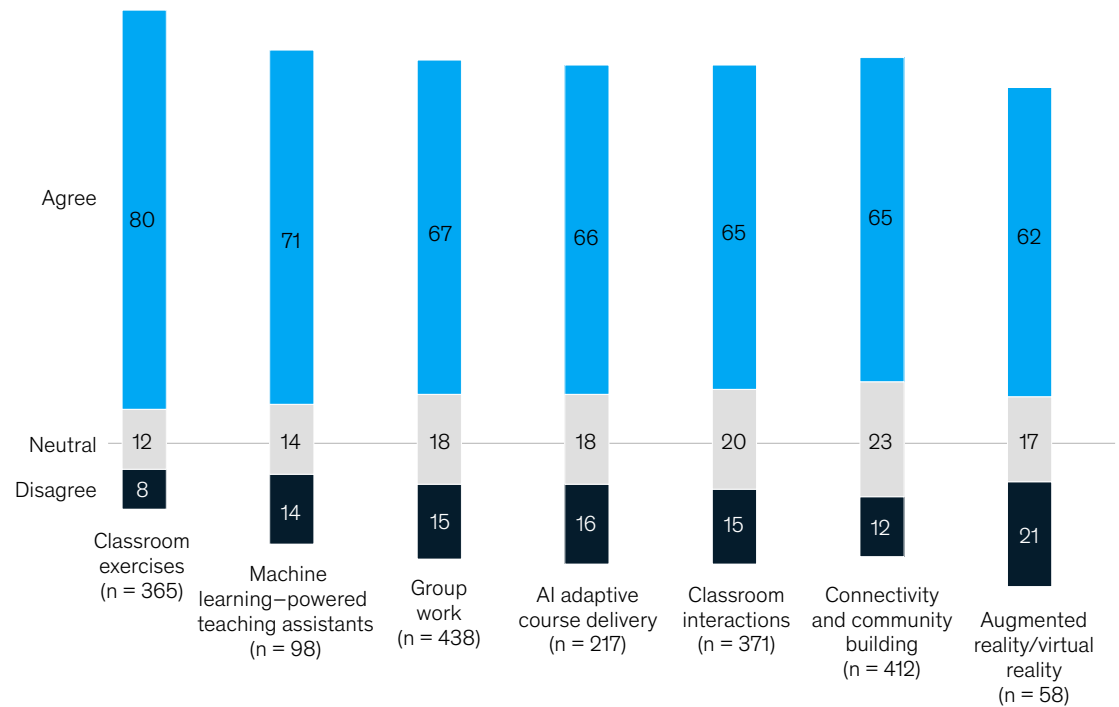


¹Question: For the technologies you have not had experience using in the classroom, what are the potential reasons or barriers as to why? (Select all that apply.)
 Source: Nov 2021 McKinsey survey of 634 faculty members and 818 students from public, private, and minority-serving colleges and universities. Survey respondents ranked the primary barriers to adopting new learning tools

Exhibit 4

All the learning technologies analyzed are viewed positively by most students.

Impressions of learning technology,¹ % of student respondents

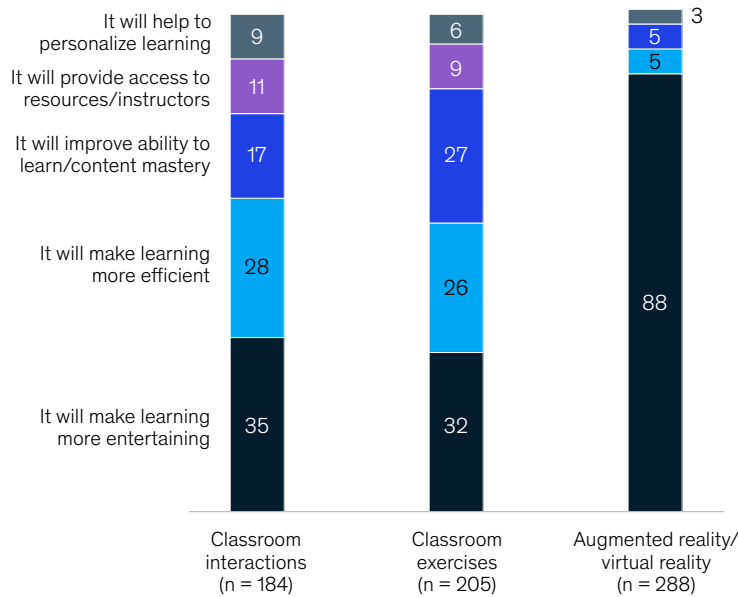


Note: Student progress monitoring is not included, because it is not used by students.
¹This technology helps me to improve my learning and my grade.
 Source: Nov 2021 McKinsey survey of 634 faculty members and 818 students from public, private, and minority-serving colleges and universities

Exhibit 5

Students in higher education are most excited about tools that make learning more entertaining and efficient.

Why students are excited about using learning technology in the future,¹ % of student respondents²



Note: Chart shows data for three of the eight technologies studied.
¹Question: What is the primary reason you are excited about the technologies you selected?
²Figures may not sum to 100%, because of rounding.
 Source: Nov 2021 McKinsey survey of 634 faculty members and 818 students from public, private, and minority-serving colleges and universities

improved their subject mastery by an average of two letter grades.

Faculty embrace new tools but would benefit from more technical support and training

Faculty gave learning tools even higher marks than students did, for ease of use, engagement, access to course resources, and instructor connectivity. They also expressed greater excitement than students did for the future use of technologies. For example, while more than 30 percent of students expressed excitement for AR/VR and classroom interactions, more than 60 percent of faculty were excited about those, as well as machine learning–powered teaching assistants and AI adaptive technology.

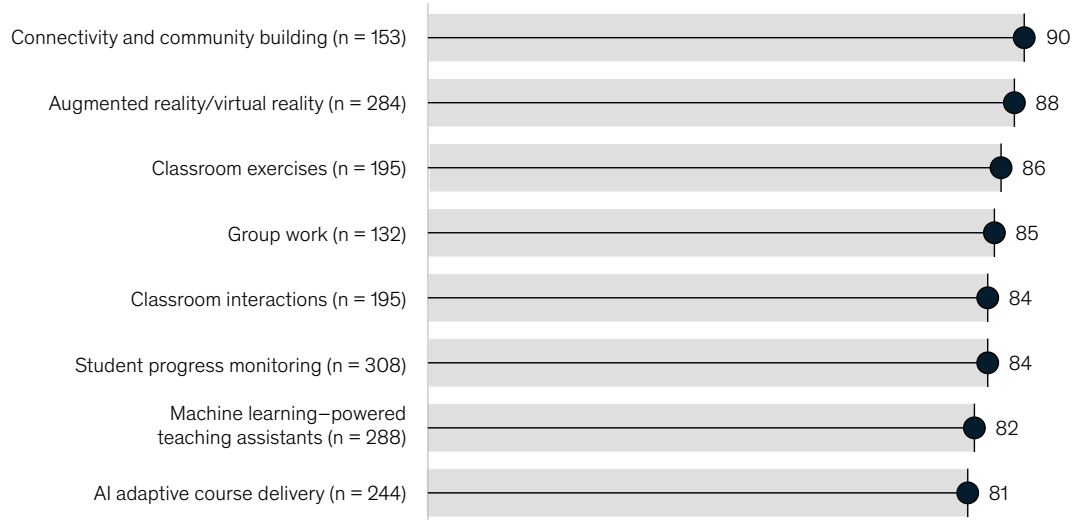
Eighty-one percent or more of faculty said they feel the eight learning technology tools are a good investment of time and effort relative to the value they provide (Exhibit 6). Expert interviews suggest that employing learning technologies can be a strain on faculty members, but those we surveyed said this strain is worthwhile.

While faculty surveyed were enthusiastic about new technologies, experts we interviewed stressed some underlying challenges. For example, digital-literacy gaps have been more pronounced since the pandemic because it forced the near-universal adoption of some technology solutions, deepening a divide that was unnoticed when adoption was sporadic. More tech-savvy instructors are comfortable with interaction-engagement-focused solutions, while staff who are less familiar with these tools prefer content display and delivery-focused technologies.

Exhibit 6

Faculty view learning tools as worth the time and effort it takes to deploy them.

Perceived return on investment of learning technologies, by type,¹ % of respondents who agree



¹Question: This technology was a good investment of time and effort relative to the value it provides (select "Agree," "Disagree," or "Indifferent").
Source: Nov 2021 McKinsey survey of 634 faculty members and 818 students from public, private, and minority-serving colleges and universities

According to experts we interviewed, learning new tools and features can bring on general fatigue. An associate vice president of e-learning at one university told us that faculty there found designing and executing a pilot study of VR for a computer science class difficult. "It's a completely new way of instruction. . . . I imagine that the faculty using it now will not use it again in the spring." Technical support and training help. A chief academic officer of e-learning who oversaw the introduction of virtual simulations for nursing and radiography students said that faculty holdouts were permitted to opt out but not to delay the program. "We structured it in a 'we're doing this together' way. People who didn't want to do it left, but we got a lot of support from vendors and training, which made it easy to implement simulations."

Takeaways from our research

Despite the growing pains of digitizing the classroom learning experience, faculty and students

believe there is a lot more they can gain. Faculty members are optimistic about the benefits, and students expect learning to stay entertaining and efficient. While adoption levels saw double-digit growth during the pandemic, many classrooms have yet to experience all the technologies. For institutions considering the investment, or those that have already started, there are several takeaways to keep in mind.

- *It's important for administration leaders, IT, and faculty to agree on what they want to accomplish by using a particular learning technology.* Case studies and expert interviews suggest institutions that seek alignment from all their stakeholders before implementing new technologies are more successful. Is the primary objective student engagement and motivation? Better academic performance? Faculty satisfaction and retention? Once objectives are set, IT staff and faculty can collaborate more effectively in choosing the best technology and initiating programs.

- **Factor in student access to technology before deployment.** As education technology use grows, the digital divide for students puts access to education at risk. While all the institution types we surveyed use learning technologies in the classroom, they do so to varying degrees. For example, 55 percent of respondents from historically Black colleges and universities and tribal colleges and universities use classroom interaction tools. This is lower than public institutions' overall utilization rate of 64 percent and private institutions' utilization rate of 84 percent. Similarly, 15 percent of respondents from historically Black colleges and universities and tribal colleges and universities use tools for monitoring student progress, while the overall utilization rate for both public and private institutions is 25 percent.
- **High-quality support eases adoption for students and faculty.** Institutions that have successfully deployed new learning technologies provided technical support and training for students and guidance for faculty on how to adapt their course content and delivery. For example, institutions could include self-service resources, standardize tools for adoption, or provide stipend opportunities for faculty who attend technical training courses. One chief academic officer told us, "The adoption of platforms at the individual faculty level can be very difficult. Ease of use is still very dependent upon your IT support representative and how they will go to bat to support you."
- **Agree on impact metrics and start measuring in advance of deployment.** Higher-education institutions often don't have the means to measure the impact of their investment in

learning technologies, yet it's essential for maximizing returns. Attributing student outcomes to a specific technology can be complex due to the number of variables involved in academic performance. However, prior to investing in learning technologies, the institution and its faculty members can align on a core set of metrics to quantify and measure their impact. One approach is to measure a broad set of success indicators, such as tool usage, user satisfaction, letter grades, and DFW rates (the percentage of students who receive a D, F, or Withdraw) each term. The success indicators can then be correlated by modality—online versus hybrid versus in-class—to determine the impact of specific tools. Some universities have offered faculty grants of up to \$20,000 for running pilot programs that assess whether tools are achieving high-priority objectives. "If implemented properly, at the right place, and with the right buy-in, education technology solutions are absolutely valuable and have a clear ROI," a senior vice president of academic affairs and chief technology officer told us.

In an earlier article, we looked at the broader changes in higher education that have been prompted by the pandemic.³ But perhaps none has advanced as quickly as the adoption of digital learning tools. Faculty and students see substantial benefits, and adoption rates are a long way from saturation, so we can expect uptake to continue. Institutions that want to know how they stand in learning tech adoption can measure their rates and benchmark them against the averages in this article and use those comparisons to help them decide where they want to catch up or get ahead.

Claudio Brasca is a partner in McKinsey's Bay Area office, where **Varun Marya** is a senior partner; **Charag Krishnan** is a partner in the New Jersey office; **Katie Owen** is an associate partner in the St. Louis office, where **Joshua Sirois** is a consultant; and **Shyla Ziade** is a consultant in the Denver office.

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³ André Dua, Jonathan Law, Ted Rounsaville, and Nadia Viswanath, "Reimagining higher education in the United States," McKinsey, October 26, 2020.

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