EDUCAUSE CENTER FOR ANALYSIS AND RESEARCH

ECAR Study of the Technology Needs of Students with Disabilities, 2020

EDUCAUSE

Contents

Introduction	3
Key Findings	5
Overview	7
Online Access to Materials and Resources	8
Teaching with Technology	14
Accommodations and the Importance of UDL	20
Recommendations	23
Methodology	25
Acknowledgments	27

Author

Dana C. Gierdowski, EDUCAUSE
Joseph D. Galanek, EDUCAUSE

Citation

Gierdowski, Dana C., and Joseph D. Galanek. *ECAR Study of the Technology Needs of Students with Disabilities, 2020*. Research report. Louisville, CO: ECAR, May 2020.

EDUCAUSE

EDUCAUSE is a higher education technology association and the largest community of IT leaders and professionals committed to advancing higher education. Technology, IT roles and responsibilities, and higher education are dynamically changing. Formed in 1998, EDUCAUSE supports those who lead, manage, and use information technology to anticipate and adapt to these changes, advancing strategic IT decision-making at every level within higher education. EDUCAUSE is a global nonprofit organization whose members include US and international higher education institutions, corporations, not-for-profit organizations, and K–12 institutions. With a community of more than 99,000 individuals at member organizations located around the world, EDUCAUSE encourages diversity in perspective, opinion, and representation. For more information, please visit educause.edu.

Introduction

For many learners with disabilities, technology is vital to their education. From screen-reading tools that convert documents for those who are blind or have low vision, to captioning for the d/Deaf and hard of hearing, to digitized class notes for the student with dyslexia, technology plays a critical role in leveling the playing field so that students with disabilities have the same opportunities for academic success as their peers. Students with disabilities are a vulnerable population in higher education, as their dropout rates are substantially higher and their graduation rates are significantly lower than those of nondisabled students.[1] They experience barriers to education that many other students do not, and they can have both visible and invisible needs. Nineteen percent of undergraduate students in the United States reported having a disability in 2015–16,[2] yet the real percentage is likely higher given that many choose not to disclose their disability to their institutions.[3] The findings from our 2018 and 2019 student studies suggest that there's a lot of work to be done to improve the IT support provided to students with disabilities. In 2019, only about half of student respondents who said they had a disability gave good or excellent ratings for institutional awareness (50%) and support (53%) of their technology needs, and about a quarter rated these as poor or fair.[4] To better understand these quantitative data, we turned to the words of the students themselves.

In this report, we focus on the open responses collected in our 2019 student study from individuals who identified as having a physical and/or learning disability that required accessible technologies or accommodations for their coursework. These responses allow students to share, in their own words, what they need most from their instructors in order to improve their academic success. In our analysis we identified two overarching themes, as well as prominent patterns within those themes, that best explain and organize their answers. These include:

- Online Access to Materials and Resources
  - Class notes and slides
  - Assignments, tests, and quizzes
  - Recorded lectures
  - The LMS and the user experience
- Teaching with Technology
  - Mobile devices in the classroom
  - Training students and faculty in using technology
  - Multiple methods of presenting course materials
  - Engagement through the use of technology

In this report we share illustrative quotations concerning each theme and category, to shed light on ways faculty can use technology to improve the learning and overall success of their students with disabilities.

Key Findings

- **Students want their instructors to make all course materials and resources accessible online, but class notes and presentation slides were the most commonly requested, followed by assignments/tests and lectures.** Respondents reported that having online access is important because it lets them review the content both before and after class, complete their work in suitable environments, and catch up on information they miss when taking notes or if they are out sick.
- **The learning management system (LMS) is considered key to providing access for students with disabilities to online course content, and they would like faculty to use it more.** Students want an LMS layout that is intuitively structured, organized, clearly labeled, and updated so that they can find the materials they need with ease.
- **Students want to use their mobile devices in the classroom to take notes.** Most students told us that they would like to use their laptops to take notes, as they often can't handwrite notes fast enough to keep up with their instructors' lectures. They also reported that using devices in the classroom allowed them to more easily access online materials to follow along with lectures, make notes directly into the online PowerPoint, record lectures, take photos of any items on the classroom's board, or make voice memos.
- **Students want training for themselves and their instructors on how to use the technology on their campus and for their classes.** Many students reported that they needed training and direction in using software for their courses, as well as help in navigating the LMS. Students also observed that instructors needed to be trained in how to use the technology they expected their students to use.
- **Greater use of videos or other media in the classroom and online can benefit students with disabilities by presenting course materials in multiple formats.** Many students want course materials presented in alternative formats, such as video or pictures, rather than solely through lecture, reading, and PowerPoint. They reported that these modes assist in comprehension and could also make face-to-face classes more engaging and interesting.
- **Students with disabilities want to have a more engaging classroom experience through the use of interactive technology.** Students told us they want to have educational games and polling to foster a more interactive classroom rather than passively following lectures. Some indicated that gamification of course materials (e.g., Kahoot) could increase the interactivity of their classroom experience by allowing them to actively use their mobile devices for learning.

- **Assistive/accessible technology such as captioning and text-to-speech software is important to their academic success, and students with disabilities would like instructors to account for this when developing their courses.** By captioning videos, selecting digital materials that have an audio option, and/or formatting files so they are compatible with text-to-speech applications, instructors can offer students more ways to process information. Students also recognize that incorporating more of these options increases access to all learners and fosters a more inclusive environment.

Overview

Among the 2,224 students who identified as having a physical and/or a learning disability that required technology for their coursework,[5] 1,819 answered the open-ended question "What is ONE thing you would like your instructors to do with technology to enhance your academic success?" Of those who responded to this question, the majority (63%) reported that they had one or more learning disabilities, while a quarter said they had a physical disability (26%), and 11% had both a physical and a learning disability. More identified as female (63%) than male (37%), and most (75%) were between the ages of 18 and 24. Most respondents identified as white (65%), followed by Hispanic/Latinx (15%), black/African American (10%), Asian/Pacific Islander (9%), American Indian/Native American/Alaskan Native (4%), and 3% identified as "other." Additionally, 11% of these respondents identified as being of more than one ethnicity. About a third (29%) of our sample are first-generation college students. Thirty-seven percent reported they were eligible for Pell Grants, and 39% told us they didn't know if they were eligible. In terms of these demographic characteristics, respondents from our 2019 student survey who did not report a disability were generally similar to respondents who did. One notable difference, however, is that respondents reporting disabilities were slightly older: 25% were 25 or older (mean age 24), compared with 16% among students without disabilities (mean age 22).

Survey question for students with disabilities:

What is ONE thing you would like your instructors to do with technology to enhance your academic success?

Online Access to Materials and Resources

The most prominent theme we identified concerned the students' need to have online access to course materials and resources. The responses illustrated a desire to have increased access to class/lecture notes and slides; assignments, tests, and quizzes; and recorded or streaming lectures. Students expressed the importance of having course materials organized for ease of navigation and use in the online learning environment, as well as having instructors adopt or increase their use of the institution's LMS.

Class Notes and Slides

"Put all of the notes online."

The materials that students with disabilities most commonly requested to be online were class/lecture notes and presentation slides; these account for over half of their responses. Many students specifically asked that class slides from PowerPoint presentations and instructor notes of what was covered in class be posted online. When students offered reasons for wanting materials shared online, their responses were frequently related to a desire to study this content outside the classroom. As one student told us:

> Some professors do a better job than others of putting lecture notes online. More professors could have information from class more easily accessible for students who would like to review the information outside of class.

Many of the respondents also noted how important it was for them to have notes and slides ahead of time so they could prepare for class, follow along during class, and supplement those materials with their own ideas. ("I can use them to write notes and add to the lecture notes on the paper.") Some of their answers also suggest that students are concerned about falling behind with their note-taking. For example, a third-year health sciences major said that if more instructors would share their materials online, then "we are able to have their notes and not miss important things if you can't keep up with note pace."

Other students discussed their need for having online access to these resources ahead of time in terms of their disability and/or the accommodation they received from their office of student disability:

> Ensure digital copies of slides are always available before class, to allow for reading during class (eyesight disability). It's stated as a requirement from [disability services],[6] but for some instructors, it can be almost impossible to get such access.

> As a student with a learning disability, I do not retain information from lectures; I go home and teach myself. I appreciate instructors who post all class content online, and I especially appreciate it ahead of time. That way I can go to class prepared, and I have access to these resources when I am studying at home.

These examples demonstrate that having class notes and presentation slides is critical to students' engagement with their coursework and overall learning. For example, students with sensory disabilities, such as the student who mentioned eyesight, might not be able to see the slides projected in the classroom. Having slides and/or notes beforehand allows students to print them, enlarge them if necessary, and bring them to class and use as a guide. When instructors provide these digitized materials, students can also access them via their own devices during class and view them in a size and format that works best for them. Those with language processing disorders might also need more time to study the class material.[7] Many students experience steep barriers to full participation if they are not given access to these online materials both before and after in-person meetings.

Assignments, Tests, and Quizzes

"They should use technology to allow people to take more tests online."

Students also frequently said having more assignments, tests, and quizzes online would improve their academic success (e.g., "Put quizzes and exams online," "all tests online"). Many said they want to take assessments online so that they can control their testing environment. For example, one student told us, "Giving all exams and quizzes online would be the biggest help, as it would allow me to work in a quiet place with no distractions." Another respondent stated that online testing allows them "to be sure I have a well-suited environment for my session."

"Giving all exams and quizzes online would be the biggest help, as it would allow me to work in a quiet place with no distractions."

Those who wanted more online submission of assignments noted that this format helps them save on printing costs and trips to the classroom. Offering an option to turn in assignments online can be especially helpful to students who have conditions that impact their ability to be physically present in class. One student explained that "turning in homework online would be ideal, considering walking is exhausting [and] my physical disabilities keep me home a lot." Submitting work online might also help students who have learning disabilities that affect their attention and organizational skills.[8] As one student wrote, "Online homework submission drastically helps with me actually getting completed assignments in, which has been a struggle since elementary school."

Offering all students—not just students with disabilities—multiple options for submitting work allows them to choose the format that is most appropriate for their needs. As outlined in the principles of Universal Design for Learning

(UDL), providing learners with multiple means of action and expression acknowledges the different ways that individuals "can navigate a learning environment" and share what they know.[9] Providing more opportunities for students to test online using their own devices can also ease some of the resource burden that disability service offices experience when providing alternative testing sites and proctors for students who need them.

Recorded Lectures

"Record and post lectures online so we can go back over what was taught."

Many of the respondents in our study told us that they'd like their instructors to record their lectures (e.g., "record lectures," "upload lectures," "post the lectures online"), and they said that having access to review them later would boost their learning. For example: "Provide recordings of classes through an online portal to disabled students with attendance, sensory disability, and/or comprehension issues related to their disabilities."

Some respondents also referenced the use of specific lecture-capture and recording platforms (e.g., Panopto, Echo360), which suggests that they know these platforms could be used in class. The most common reason given for wanting lectures online was the need to review material that could have been missed during class. One student said that having lecture recordings would be especially helpful for picking up information she might miss in her note-taking when the "instructors go too fast and move on to the next topic." Another suggested, "Most of my instructors are already amplified through a microphone. Why not record it? It really helps if the instructor talks too fast to understand the lecture." Such a format gives learners the chance to start, stop, and review content at their own pace and on their own time. As one student pointed out, hearing a lecture more than once via a recording "aids my comprehension and studying."

Other respondents discussed how important lecture capture is for sick days and that such a resource "can be a life-saver if an illness causes an extended absence." Lecture capture can make courses more accessible to students who have a variety of conditions, such as a chronic illness, limited mobility, or disorders that are so severe that physically being in class hinders their learning.[10] Several students also wanted to watch class via live streaming. An engineering student reflected on why this would be important to him: "I would like to watch the lectures [in] real time and be able to ask questions [in] real time, but also have the recording to go back to if needed."

The LMS and the User Experience

"Actually use Canvas."

In their open responses, students frequently talked about the importance of the LMS,[11] and two prominent patterns emerged: students want their instructors to adopt or increase the use of the LMS, and they want their LMS course sites to be user friendly. Many of the responses suggest that some instructors do not use the LMS at all. ("Use Blackboard more often. Some professors love it, but a lot refuse to use it.") And for some students, this can be frustrating. For example:

> Properly utilize Canvas, or just use it at all. I've only had about 50% of my instructors use it, and the rest don't want to learn how to use it.

> I won't even take classes with the professors who don't use Canvas. It's far too inconvenient and roundabout to not use the program that was designed for a classroom setting. We made these programs to make education easier and more effective; I would rather take a class that uses it.

A few students stated that using the LMS should be required for instructors. Others also said that using one LMS platform consistently would enhance their academic success, as managing different platforms could be challenging or even expensive:

> Either all use Blackboard or all don't. Professors are increasingly using other sources like Google Classroom to manage their class rather than Blackboard. Everyone needs to jump ship or stay onboard. I hate using different sites to complete tasks.

> Most of my classes use Blackboard, but most semesters I have one or two classes that use another website or organization that often requires you to pay for a subscription out of pocket.

The most common suggestion from students to instructors, however, was to ensure that their LMS course site is organized and easy to navigate. Students discussed the need for course sites that are intuitively structured, clearly labeled, and updated. Their comments suggest some have had experiences wherein materials were difficult to locate, with assignments "scattered everywhere." A first-year business major told us, "Some files are incredibly hard to find because teachers put them under different places," and another added that finding what they need can "sometimes be confusing." Several respondents suggested that having a consistent organizational layout for LMS courses would be a helpful time-saver. One student said that finding the syllabus or assignments can be time-consuming "because there is no uniformity in using the learning platform among instructors at my institution."

Respondents also said that having LMS sites updated regularly, with live links and current dates for assignments, would help their learning: "Keep modules organized, listing weekly class info with dates. Verify [that] links and documents are accessible to students in every semester; some links direct to [an] error webpage." This comment is a reminder of the importance of formatting documents and other web materials following Web Content Accessibility Guidelines (WCAG) 2.0 so that all students, regardless of the kinds of assistive or accessible technology they might or might not need, can access the course content.

EDUCAUSE research on faculty and information technology has consistently found that "the most common faculty uses of the LMS are all operational, course management functions…that require little or no interaction between the instructor and the student."[12] A portion of the responses in this study demonstrate that some students want their instructors to leverage more of the advanced features of their institution's LMS, including the online gradebook, to enhance their academic experience. As one student told us, "I don't feel like instructors use programs like Blackboard to their fullest extent." A social sciences major at a public institution went further and recommended adopting specific tools within the LMS:

> I would like them to use D2L with accuracy, consistency, and to its full capacity. Use the checklist function, label your readings by week, update grades, and communicate changes via announcements. (Ex: date your syllabus; if you change it, tell us!) Most teachers use the minimum, and it's messy and outdated with last-term deadlines and mistakes that should have been caught before the term started.

Our findings in the larger theme of "access to course materials and resources online" underscore the importance of the LMS for students with disabilities. These platforms are integral for sharing course information and helping students manage content, assignments, due dates, and grades. Their responses tell us they see the LMS as the logical default place to share materials in an organized and easy-to-navigate format. Students know the LMS is a resource available to both students and teachers, so it makes sense that they think it should be used to its fullest extent to improve accessibility. The most effective way, then, for instructors to help fill the "access tank" is to share class notes, slides, assignments, tests, and recorded lectures with students via their college's or university's LMS. It is a critically important tool for making courses accessible, not only to students with disabilities but for *all* students (figure 1).

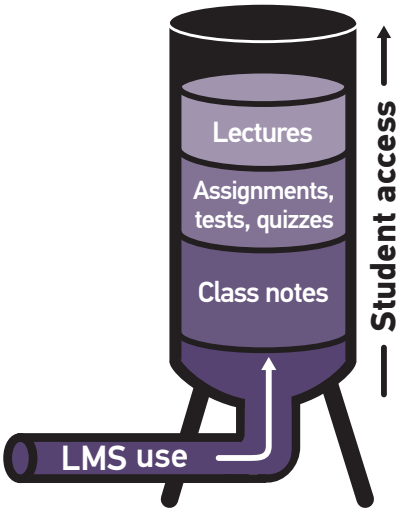

Figure 1. LMS functions allow increased access for students.

However, campus-wide adoption of the LMS does not help students if the tools and content within that system are not accessible to begin with. To lower some of the barriers that all learners might experience, institutions should provide LMS applications that check for common accessibility issues and that allow students to download files in different formats on the basis of their learning needs.[13] IT units should also test the LMS for accessibility and provide alternatives to fill in any access gaps. And training faculty on the principles of UDL can encourage them to set their content free to increase access for all learners.[14]

Teaching with Technology

The second largest group of responses focused on how instructors could incorporate more technology into their teaching. Students told us they want their instructors to increase use of mobile devices in the classroom and to use technology to increase student engagement; they also want training for both themselves and their instructors to use technology more effectively.

Mobile Devices in the Classroom

"Letting us use our laptops in class makes it easier to follow along with the lectures."

Students with disabilities hold the same attitudes as their peers when it comes to using technology in the classroom: they want to use their personal devices to enhance their learning, and, more specifically, they want to take notes on their mobile devices. Students who offered reasons why they want to use their laptop or tablet for note-taking told us that they could take notes faster and keep up with the pace of the lectures. A fourth-year communication student told us:

> Make use of laptops more and always allow laptops to take notes. It's unfair when you're expected to handwrite all of the notes but the instructors go so fast and don't put the slides up later. You're asking your students to fail.

A student studying social sciences discussed how faculty should accommodate students' preferences on the basis of what works best for the students:

> I think that students should be able to take notes using whatever method is most comfortable to them, whether that be on paper or on a laptop or tablet.

Similarly, some students who said they want to use their phones for note-taking brought up the issue of lectures being too fast to keep up with using pen and paper. Respondents also told us they want to follow lectures while accessing online materials, make notes directly into online PowerPoint slides, record lectures, take photos of any items on the classroom's board, or make voice memos.

A few students also stated that using mobile technology in the classroom could increase engagement and offer students additional learning opportunities during class time. A student suggested, "Have [technology] be more accessible and acceptable to research concepts in class to further the discussion." Finally, a student working on a bachelor's degree at a doctoral institution summed up a crucial issue when it comes to mobile-device bans in the classroom:

> Stop telling me about studies that say using technology in classrooms is a distraction. Adaptive technology seems to be overlooked often in this constant speech.

This last comment brings up an often overlooked aspect of the tech ban debate: Where is the acknowledgment that students with disabilities might need to use adaptive technologies to aid in their learning?[15] For example, iPads and other tablets are widely used by people without disabilities, but they can be particularly useful among students with visual impairment because of the devices' dictation and font adjustments.[16] Bans on mobile devices have been shown to disproportionately affect students with disabilities, who consider these technologies critical for their learning.[17] And if an instructor bans personal devices, students who have otherwise "invisible" disabilities and who use these devices as part of an accommodation are then "outed" to the rest of the class, essentially terminating the confidentiality and privacy these students are guaranteed.[18]

Adhering to UDL principles so that all students can use technology in the classroom on the basis of what works for them is an approach that offers the best strategy for inclusiveness. Allowing students to engage with course materials this way and offering options for enhanced perception of materials adheres to UDL while also providing an environment in which all students have opportunities to succeed. This approach is literally at our fingertips, since mobile devices have built-in features such as the ability to increase text size and use voice commands, both of which can increase inclusivity. Implementing UDL principles also ensures that students with disabilities are not left without the tools they need for learning. One student who was allowed to use a smartphone in a course commented, "Integrate smartphones more, because the few professors who did really stood out, and it helped keep me engaged." Before banning mobile technologies in their classrooms, faculty should identify whether this could do more harm than good for their students' engagement and learning.

"Stop telling me about studies that say using technology in classrooms is a distraction. Adaptive technology seems to be overlooked often in this constant speech."

Training Students and Faculty in Using Technology

"Spend time teaching how to use the technology properly."

Instructors shouldn't assume that students have the skills to use the technology needed for their courses. And without the appropriate skills, no amount of software or computing power will increase student engagement or contribute to student success. So although students with disabilities are likely familiar with assistive or adaptive technologies (such as screen readers for students with low vision), their responses reflected a need for training on the technologies that all students at their institution use, either general tools, such as the LMS, or course-specific software. One student suggested, "Go a little slower for students who are newer to using laptops, Blackboard, Word, and PowerPoint." Many simply wanted to generally increase their skills, as illustrated when this second-year AA student studying communications told us:

> I would have liked to receive some more instruction than I did about how to use the technologies that are available on campus. I'm a nontraditional student who doesn't use much technology. If they could maybe give lists of terms or simpler explanations about some of these apps and whatnot, I would appreciate it!

Students wanted very clear instructions on how to use the technology available on their campus and how to use technology to achieve their academic goals. A student suggested that instructors could "better explain assignments that use technology that students are unfamiliar with." Such responses suggest that students have gaps in their knowledge on how to use technology for their courses.

Students also wanted specific training in how to use technology to complete course requirements, such as accessing texts and completing assignments:

> Teach us how to use online textbooks—how to get it to work.

> Explain the ways programs and online assignments work better.

> Have the homework system better explained rather than have me fumble through it.

> Explain how to go about submitting assignments in more detail.

Some students wanted training on how to use software specific to their courses in order to complete assignments. For example, a respondent suggested, "Show demos of how the software works." Another student said that even more foundational instruction was needed: "Understand how to download software so we don't have to figure it out by ourselves." Another respondent suggested, "Have at least one day dedicated to teaching us how to use specific programs and tools." Based on these responses, students want to use the technology that's available, but they need explicit direction to successfully do so. Finally, a second-year education major at an MA institution outlined what she wanted from her instructors when it comes to providing effective instruction:

> Have clear-set expectations and guidelines for the ways in which they will be using technology, how they want us to use the technology, and how much technology we are able to use.

Overall, student confidence in their technology use has been positively associated with their engagement in computer-based learning.[19] Students with disabilities are requesting the training and direction necessary to foster this confidence, and this skill-building is one important factor that *all* students need for engaging with technology. A way to ensure that students receive appropriate direction and training is for faculty to model the behavior for their students.[20] Showing their own expertise through demonstration can increase students' ease and confidence.

As stated earlier, students with disabilities want increased use of the LMS, but they also want instructors to use the LMS effectively, as there are gaps in instructors' knowledge of how to use the LMS and other software. Therefore, some student responses indicated that some faculty need training. The most prominent suggestion, accounting for nearly half of responses in this category, was that students want faculty to increase their skills in using the LMS. One student suggested, "We use Canvas, but some of the teachers still do not quite understand how to operate it, so it would be cool if they had to take at least one class about it."

If faculty increase their expertise in technology through professional development and training, they can confidently demonstrate to their students the most effective ways to use the technology at hand. By showing students that technology such as the LMS can be used simply and productively, instructors can contribute to their students' comfort and confidence in using a new software or device for their course.

Multiple Methods of Presenting Course Materials

"Use technology to play videos to help me learn."

When it comes to harnessing technology in the classroom, students want their instructors to use videos, images, or other visuals to make face-to-face classes more engaging. This also opens the door to presenting course content in varied ways, which can aid students with disabilities. A student told us, "I would prefer if they varied the teaching methods with technology by using more videos, music, or things like that to keep our attention. PowerPoint slides get boring after a time." A few students also requested that instructors embed videos into PowerPoint for more engaging lectures and that they also use more videos in online classes. One student's response captured the essence of this approach when she told us, "Use visual aids alongside auditory lectures to support students of all learning abilities and preferences."

Most students told us that using video can assist in increasing comprehension and understanding of the course materials, and some reported that they could learn better with this medium. For example, a student said, "Visuals help me learn, and seeing related pictures and videos of what we are learning in class is a great help to me." A third-year humanities student told us how the use of videos in class could assist her, given the challenges she had with comprehension:

> I have a reading disability, which means that having assignments where we have to read eight chapters of a book is very hard for me. I would love it if more assignments involved watching videos or documentaries.

As with the other suggestions from students with disabilities, these requests to use video centered on addressing the needs that apply to all students. They also reflected a UDL approach to assignments and presentation of material; students want course material presented in multiple formats. A second-year education student at a BA institution said, "I would like the teacher to use technology to make homework varied. I would like professors to assign lectures for us to watch or podcasts to listen to instead of just having us read from a textbook."

Engagement through the Use of Technology

"Make it more interactive than just a PowerPoint."

Students want "more interactivity," more "hands on" activities, and more "engagement." And when students suggested technological solutions to increase engagement, they did not mean increasing visual presentations, such as PowerPoint, or as one student put it, "death by PowerPoint." Our respondents had very specific engagement strategies in mind. Some recommended educational software, such as Kahoot, to implement games, quizzes, and polling in class. A first-year health sciences student told us:

> I feel that if time allows, professors should use websites, like Poll Everywhere, Kahoot, etc., in class after teaching to see if students actually pay attention and remember what the professor said during lecture.

Although these types of activities can be done on laptops, another student suggested that instructors encourage their students to use other mobile technologies for these activities: "Do in-class learning check quizzes where students answer questions on their smartphone and the instructor can see live updates of answers."

In particular, having students use their phones for these types of activities can likely assist in decreasing off-task use of mobile devices, particularly if students are collaborating via team competitions during in-class quizzes. Using mobile devices already in students' hands also supports an inclusive "bring your own device" (BYOD) approach that doesn't penalize students for not owning a laptop. These types of in-class activities have been found to increase achievement and engagement, as well as decrease test anxiety.[21] Additionally, using interactive learning software also supports UDL principles because it provides different learning modalities that offer immediate feedback and interactivity with the instructor and peers. A student reflected on this, stating, "I would like [instructors] to continue to implement interactive quizzes to make sure we understood what was just taught." Students with disabilities have a strong opinion of what can increase engagement in class, not just for themselves but for all students. A third-year education major did not offer suggestions but instead provided details on what was working to keep class engaged:

> My teacher already uses our technology to the fullest extent during class time—such as playing YouTube videos, making it where we can see her screen (it's a WebEx class) and where we can chat with each other during class to get answers from our fellow classmates.

The type of classroom that many students with disabilities in our sample desire is one in which there are high levels of interaction, collaboration, leveraging of technology, application of knowledge, and immediate feedback. And adopting UDL is an effective way of offering learners multiple means of engaging in a course and demonstrating their knowledge, which makes room for learning variability. Faculty also need to take into account that providing students with choices allows them to select what works best for their own learning and personal situations. In effect, UDL acts as a valve that expands the impact of teaching with technology and opens opportunities for greater academic success (figure 2).

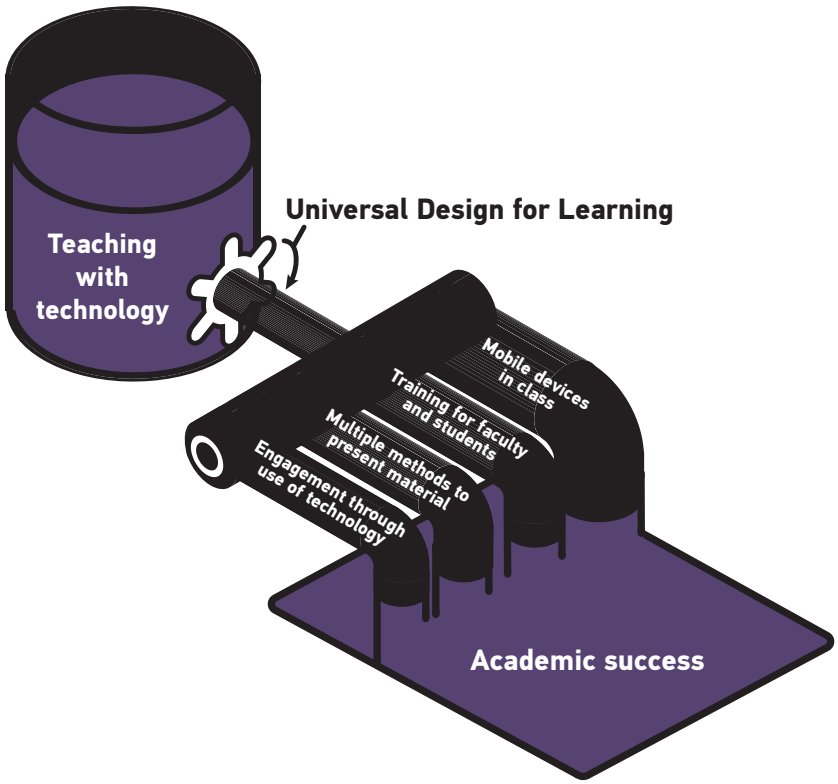

Figure 2. UDL can expand the impact of teaching with technology.

If faculty teach with the technologies and strategies students with disabilities have suggested to us, then they can offer additional ways to achieve academic success not only for students with disabilities but for all students.

Accommodations and the Importance of UDL

When students were asked what faculty could do with technology to aid in their learning, some respondents discussed their disability or condition in relation to an accommodation and/or accessibility need. Some individuals answered this question broadly (e.g., "Help with accommodation," "Make it more accessible"), while others were more specific. For example, several respondents told us they wanted instructors to use captioning and/or transcripts to accompany videos they developed for their courses (e.g., "Add subtitles to videos," "Provide audio transcripts/subtitles by default").

Students also told us they would like their instructors to use more of the kinds of assistive/accessible technology tools they use themselves. Text-to-speech tools can convert text materials—when they are formatted appropriately—into audio for people who need content in a read-aloud format. A number of students wrote about the significance of text-to-speech technologies and the benefits of audio for their learning. Increasingly, e-textbooks are being bundled with read-aloud features, and one respondent specifically called out the usefulness of those resources: "Please find e-books that are accessible to the reader to read out loud. It is so, so helpful for students with learning disabilities, like me."

"Learn to use text-to-speech software. And understand its importance to someone like me [who] has a learning disability."

In addition to aiding people with eyesight disabilities, text-to-speech software can be helpful for students with dyslexia or other conditions that make reading and decoding language a struggle.[22] But since a learning disability like dyslexia is not visibly apparent, instructors might not be aware that they need to provide course materials in more accessible formats for some of their students, as the following comment demonstrates:

> STOP SCANNING PICTURES OF BOOKS!!! My computer accessibility software cannot dictate them to me!! I have to print everything out and double if not triple the time spent studying plus increase of pain!

A digital scan of a book or an article produces only a picture of that resource, which is incompatible with screen readers; but many faculty might not know about optimizing PDF files using optical character recognition, an easily implemented process for making documents accessible. From these responses, we have more insight into some of the technology barriers students with disabilities experience and the added time and effort they must invest to access their learning materials. These comments also shed light on specific ways teachers can use technology to make their courses more accessible, thereby helping level the playing field for learners. But a learner doesn't have to have a disability to benefit from many of the technologies discussed in these responses. With a UDL approach, which advocates for offering learners multiple means of engagement, representation of information, and action and expression of knowledge,

educators can turn their attention away from the idea of "accommodation" (making one change for one student) to the larger notion of access in general.[23] All students can benefit when instructors adopt a UDL mindset, and some of the students with disabilities in our sample recognized this:

> Provide audio for all course reading to ALL students, not only for students who have Disability Service requirements.

> Encourage multiple ways of using technology in the learning process.

> To help use its versatility to enable a more inclusive environment.

By considering what students with disabilities tell us they want, instructors have the opportunity to not only address the needs of this population but also improve access for all learners on campus. For example, accurately captioning videos and providing open captioning for live events helps not only those who are d/Deaf or hard of hearing or individuals with certain learning disabilities but also students who are learning English as a second language and students working in noisy environments.[24] Providing materials that are formatted for/with text-to-speech software offers all students an audio option for readings and other assignments. Sharing class notes online, recording lectures, and leveraging institutionally provided LMSs increase access for everyone—for the student who has limited mobility or a chronic illness, as well as the student who must work an extra shift or has a child-care issue.

UDL is especially important when we consider that many students do not disclose their disability to their institutions. Because many research studies tell us disclosure rates are low, we also looked at open responses from students who *did not* identify as having a disability that required accessible technology. And several respondents shared specific learning needs even though they did not identify that they had a disability-related technology requirement.

> I have somewhat bad vision, so I would like it if all materials that were handed out in class could also be easily accessible online so I don't have to use my magnifier in front of my peers.

These responses demonstrate that some students who have more diverse needs or preferences might feel uncomfortable about openly using tools that aid their learning. Another student told us how helpful recorded lectures would have been during an extended absence due to illness:

> Though my attendance is near-perfect now, during my freshman year I really struggled due to having a panic disorder, and also experienced having to try to catch up with the work I missed after I was unexpectedly hospitalized.

These particular students might not have required specific assistive or adaptive technologies like a screen reader or text-to-speech software, but their comments highlight the significance of having all course materials shared in an online format for universal access. The UDL framework is important because it allows colleges and universities to advance support and resources to learners who choose not to use disability services, might be unaware of the services available to them, or might be unaware that they need support in the first place. Effective UDL implementation can also unobtrusively help students work through their courses without an approved accommodation.[25] That is, when technology is incorporated well into a course, the need for specific accommodations (which help one person in one way) is greatly reduced and, ideally, the number of requested accommodations decreases.

As some of the students said themselves, if instructors could "invest a little more thought and time" and "be more open to disability," and if they "were more willing to adapt," then "the higher education environment would be more inclusive and equal."

Recommendations

To help instructors better meet the needs of students with disabilities, institutions can:

- **Educate faculty on the technology barriers students with disabilities face and the benefits of incorporating Universal Design for Learning principles via professional development opportunities.** Encourage faculty to set content such as lecture notes and presentation slides "free" by posting these resources on the LMS.[26] Provide training on lecture-capture platforms, and share information about how online assignment submission and testing can benefit students, irrespective of whether they have a disability or, if they do, whether they choose to disclose it.
- **Invest in LMS accessibility applications and emphasize these as a key access feature in faculty orientations and workshops.** Products such as Blackboard Ally, which offer LMS accessibility score reports for instructors and alternate file formats for students, can be integrated into some LMS platforms to help faculty improve access to their courses.
- **Advise instructors in the early stages of course development so they keep student access in mind.** Partner with technology accessibility staff and disability services offices to recommend the selection of materials that are text-to-speech compatible. Offer faculty support in captioning videos, formatting files appropriately, and following WCAG 2.0 AA in designing online content. Such steps can lower or eliminate barriers to learning that any student might have, making the need for individual accommodations—and the disclosure of a disability—less necessary.
- **Improve faculty skills in using mobile technologies in classrooms as learning tools by increasing and incentivizing training and professional development for faculty.** Classroom bans on technology decrease a student's choice in how they can take notes or engage in learning. Bans on mobile technology also eliminate opportunities for students to use their devices in class for active learning. Device bans essentially "out" students with accommodations who use their devices in their courses, decreasing their confidentiality and privacy.
- **Train students and faculty on how best to use the technology required in their course.** One of the best ways to ensure that students have the skills to use the technology on their campus and for their courses is for instructors to model the use of the technology for them. Instructors need to consider that many students need this additional direction and informal training to successfully use technology for their courses.

To make their courses more accessible for not only students with disabilities but for all students, faculty can:

- **Adopt new habits in the development of course content to make online materials more accessible.** Use accessible templates, headings, style features, and suitable fonts and colors when creating documents, LMS pages, and online assignments. Follow accessibility guidelines to appropriately label hyperlinks and add alt tags to images. These are basic steps to add to the course-planning routine that can instantly increase student access to online materials.
- **Leverage the institutionally provided LMS and design a user-friendly space for students.** Use the programmed templates and modules to develop a consistent and organized layout, keep due dates and links current, and take advantage of the gradebook feature to improve the user experience. Check LMS content against accessibility guidelines and checklists, and make adjustments as needed to ensure content is available to all students.[27]
- **Make course materials more accessible by creating different formats.** Start small by using a "plus one" approach, i.e., developing one alternate version of existing course content[28] and sharing that content online so students can access it anytime. When selecting e-textbooks, look for those that have audio/read-aloud options, to provide students with an alternative to print.
- **Use multiple means such as video, visuals, and multimedia to present information in the classroom.** Many students told us that being able to watch a video related to course content increases their engagement and comprehension. Instructors should seek to increase use of captioned videos in class to break up lectures, offer alternatives to the lecture note-taking process for learning, and give students additional/alternative means of knowledge acquisition.
- **Incorporate the use of in-class technology for note-taking, learning activities, quizzes, and assignments, to increase student engagement.** Students with disabilities told us that engagement and interactivity in the classroom are paramount for their learning, and many suggested using mobile technologies to support this type of experience. They also wanted their instructors to allow devices to help them take notes and engage with course materials while in class. By ending tech bans in the classroom, this approach also facilitates the use of an active-learning classroom for all students.

Methodology

The qualitative findings in this report were derived from open-ended responses from individuals who participated in the ECAR Study of Undergraduate Students and Information Technology, 2019. ECAR conducts this annual study to shed light on how IT affects the college/university experience. These studies have relied on students recruited from the enrollment of institutions that volunteer to participate in the project. After institutions secured local approval to participate in the 2019 study (e.g., successfully navigating the IRB process) and submitted sampling-plan information, they received a link to the current year's survey. An institutional representative then sent the survey link to students in the institution's sample. Data were collected between January 15, 2019, and April 6, 2019, and 53,475 students from 160 institutional sites responded to the survey. The quantitative findings in the 2019 report were developed using 40,596 survey responses from 118 US institutions.

Students with disabilities were identified through the following question in the 2019 survey: "Do you have physical or learning disabilities that require accessible technologies or accommodations for your coursework?" Response choices included: "no"; "yes, I have one or more physical disabilities"; "yes, I have one or more learning disabilities"; "yes, I have both physical and learning disabilities"; and "prefer not to answer." Among the 40,596 responses, 2,224 students identified as having a physical and/or learning disability that required technology for their coursework. From this subset, 1,819 participants responded to the open-ended question, "What is the ONE thing you would like your instructors to do with technology to enhance your academic success?"

Open-ended responses were uploaded to Atlas.ti (v.8) and analyzed using thematic content analysis. Both inductive (theory building) and deductive (theory testing) approaches were used to analyze the data. Responses were excluded if students did not answer the question or included nondescript answers such as "n/a." Two independent coders produced an initial codebook that they used to identify and organize patterns in the data. Inter-rater reliability was established using two iterative rounds of independent coding at 85% and 92% rates of agreement. Based on these results, a second codebook consisting of the final 35 research codes was produced and used to create the themes for this report.

Additionally, our findings showed a logical relationship, a hallmark of *credibility*. For example, many responses that focused on use of the LMS made sense in the context of previous EDUCAUSE student reports, which recognized that students want faculty to use the LMS for posting course content. We were also able to create conceptual models from our analysis, showing that our themes aligned

with previously observed students' experiences, such as students' desire to use their mobile devices in class. The *dependability* of this research was strengthened by subject-matter-expert review of findings, high levels of inter-rater reliability, a consistent use of a well-defined codebook during all stages of analysis, and data reduction through a constant comparative method. The authors reviewed coding processes frequently, engaged in further data reduction by merging codes, evaluated the applicability of codes to particular data, and revised and refined the codebook as necessary. Although qualitative research does not lend itself to generalizability, we have developed two models of how students with disabilities want their instructors to use technology, both in and outside the classroom. These models can be tested to determine applicability to other samples of higher education students.

Acknowledgments

The EDUCAUSE Center for Analysis and Research (ECAR) would like to first thank the students who took time to participate in the 2019 ETRAC student survey, from which these data were derived. Thanks are also in order to the survey administrators at the participating institutions who planned and deployed the survey to the students on their campuses. We also thank our accessibility subject-matter experts who offered their time and expertise in reviewing this study: Kirsten Behling, Associate Dean of Student Accessibility and Academic Resources at Tufts University, and Angela Jackson, Online Program Manager and Digital Accessibility Coordinator, Center for Teaching and Learning at the University of South Dakota. Their thoughtful feedback and suggestions have greatly improved the quality of the report.

Many thanks go out to the team of EDUCAUSE staff who made significant contributions to this report. Thank you to D. Christopher Brooks for his guidance, leadership, and support of this project from start to finish. A note of appreciation goes to Ben Shulman for his statistical review of the overview section of this report. Thanks also go to Kate Roesch for designing the engaging figures that helped us represent the relationships we identified in these data. We are grateful for Gregory Dobbin and the publications team for their attention to detail and editorial guidance, and for Lisa Gesner for her skilled content management and marketing of this project. Finally, thank you to Mark McCormack for his review of the manuscript and suggestions for making it stronger, as well as his enthusiasm and support for this important topic.

Notes

1. Derrick Kranke, Sarah E. Jackson, Debbie A. Taylor, Eileen Anderson-Fye, and Jerry Floersch, "College Student Disclosure of Non-Apparent Disabilities to Receive Classroom Accommodations," *Journal of Postsecondary Education and Disability* 26, no. 1 (2013), 35–51.
2. "Fast Facts: Students with Disabilities," National Center for Education Statistics.
3. Lynn Newman, "Postsecondary Education Participation of Youth with Disabilities," in *After High School: A First Look at the Post-School Experiences of Youth with Disabilities*, A Report from the National Longitudinal Transition Study-2 (NLTS2), eds. Mary Wagner, Lynn Newman, Renée Cameto, Nicolle Garza, and Phyllis Levine (Menlo Park, CA: SRI International, 2005).
4. Dana C. Gierdowski, *ECAR Study of Undergraduate Students and Information Technology, 2019*, research report (Louisville, CO: ECAR, October 2019).
5. A total of 53,475 students participated in the 2019 ECAR study of undergraduates.
6. For the purpose of this report, we have replaced references to the specific names of different campus disability offices with the term "disability services" to de-identify student responses.
7. Christy Oslund, *Supporting College and University Students with Invisible Disabilities: A Guide for Faculty and Staff Working with Students with Autism, AD/HD, Language Processing Disorders, Anxiety, and Mental Illness* (London & Philadelphia: Jessica Kingsley Publishers, 2014).
8. Ibid., Chap. 4, "Attention Deficit/Hyperactive Disorder (AD/HD)."
9. CAST, "The UDL Guidelines."
10. Oslund, *Supporting College and University Students with Invisible Disabilities.*
11. Students in our sample specified a variety of LMS platforms, such as Blackboard, Canvas, Sakai, D2L/Brightspace, and Moodle.
12. Jeffrey Pomerantz and D. Christopher Brooks, *ECAR Study of Faculty and Information Technology, 2017*, research report (Louisville, CO: ECAR, October 2017).
13. Mark Lieberman, "Technology Can Address Digital Accessibility—to an Extent," *Inside Higher Ed* (May 2, 2018); Wyatt Myskow, "ASU Course Documents on Canvas Are Now More Accessible for All Students," *The State Press* (February 25, 2020).
14. Thomas Tobin, "Taking IT Way beyond Accessibility: 5 + 4 = 1 Approach," *EDUCAUSE Review* (August 12, 2019).
15. AssistiveTech, "Adaptive Technology versus Assistive Technology."
16. Min Wook Ok, "Use of iPads as Assistive Technology for Students with Disabilities," *TechTrends* 62 (June 15, 2017): 95–102.
17. Joseph D. Galanek, Dana C. Gierdowski, and D. Christopher Brooks, *ECAR Study of Undergraduate Students and Information Technology, 2018,* research report (Louisville, CO: ECAR, October 2018).
18. Katie Rose Guest Pryal and Jordynn Jack, "When You Talk about Banning Laptops, You Throw Disabled Students Under the Bus," *Huffington Post* (November 27, 2017); Ruth Colker, "Universal Design: Stop Banning Laptops!," *Cardozo Law Review* 39, 2 (2017): 483–93.

19. D. C. Moos and R. Azevedo, "Learning with Computer-Based Learning Environments: A Literature Review of Computer Self-Efficacy," *Review of Educational Research* 79, no. 2 (2009): 576–600.

20. Ibid.

21. For a review, see Derya Orhan Göksün and Gülden Gürsoy, "Comparing Success and Engagement in Gamified Learning Experiences via Kahoot and Quizizz," *Computers & Education* 135 (March 2019): 15–29.

22. Luis Perez, "From Accommodations to Accessibility: Creating Learning Environments That Work for All," *EDUCAUSE Review* (April 27, 2015); Kyle Redford, "Mother Worry: Academic Support Away from Home," The Yale Center for Dyslexia and Creativity; "Text-to-Speech Technology: What it Is and How it Works," Understood For All.

23. Thomas J. Tobin and Kirsten T. Behling, *Reach Everyone, Teach Everyone: Universal Design for Learning in Higher Education* (Morgantown, WV: West Virginia University Press, 2018).

24. Morton Ann Gernsbacher, "Video Captions Benefit Everyone," *Policy Insights from the Behavioral and Brain Sciences* 2, no. 1 (October 1, 2015): 195–202; Katie Linder, *Student Uses and Perceptions of Closed Captions and Transcripts: Results from a National Study* (Corvallis, OR: Oregon State University Ecampus Research Unit, October 2016).

25. Tobin and Behling, *Reach Everyone, Teach Everyone*.

26. Tobin, "Taking IT Way beyond Accessibility."

27. See the following: Web Content Accessibility Guidelines 2.0; Quality Matters, Course Design Rubric Standards; "Best Practices for Ensuring Accessibility in Courses with Online Components," worksheet by Kirsten T. Behling, in Tobin and Behling, *Reach Everyone, Teach Everyone*; and "Improve Accessibility with the Accessibility Checker," Microsoft Office.

28. Tobin and Behling, *Reach Everyone, Teach Everyone*.