DEVICES IN THE CLASSROOM

Digital devices, such as laptops, tablets, and smartphones, are ubiquitous in society, across college campuses, and in college classrooms. A vast majority of college students bring and/or use a laptop in the classroom (**Patterson and Patterson, 2017**; **Elliot-Dorans, 2018**). In many ways, the ubiquity of these devices has been a boon to higher education—students can now respond instantaneously to online polls, collaborate in real time on written work, and engage with a range of media more flexibly than ever before. Using digital devices to teach remotely for a year and a half helped further demonstrate some of the ways they might be used in-person to promote learning.

However, we all know that digital devices can also be an impediment to education, insofar as they enable students who are prone to distraction to indulge in the illusion that they can multitask at no cost to their learning. In a 2015 survey of college students in 26 different states, undergraduates reported using their digital devices for non-classroom purposes an average of 11.7 times per day in class, accounting for an average of 21% of class time (**McCoy, 2016**). In a survey conducted by **Tindell and Bohlander** (2011), 92% of college students reported using their phones to send text messages during class.

Given this tension, how do you create a classroom and course where technology is used to engage, rather than distract, students? Looking at the research and our experiences using technology both in-person and remotely, we've found that using technology well involves being intentional, flexible, and transparent. Below you'll find some advice about how you might use technology to support your learning objectives, supplemented by research on how to prevent technology from becoming a distraction.

Distraction, not the device, is the problem

Let's be clear: the presence of electronic devices in the classroom is not, in and of itself, the problem. Rather, it's the way we incorporate electronic devices into situations in which we are already inclined to pay attention to too many things. Broadly, we are not wired to multitask well (e.g. **Mayer and Moreno, 2003**), which is precisely the temptation that many students report experiencing when they are in the classroom. Let's take a moment to look at what the research on in-class device usage tells us about multitasking; or, you may wish to **jump directly to our recommendations** below.

Studies of individual class sessions

A growing number of studies have found that off-topic device usage—whether on a phone or on a laptop—impedes academic performance (e.g. **Glass and Kang, 2019**; **Felisoni and Godoi, 2018**; **Bjornsen and Archer, 2015**; **Demirbilek and Talan, 2018**). Several studies have compared students who texted during a lecture versus those who did not. Those who texted typically took lower quality notes, retained less information, and did worse on tests about the material (e.g. **Kuznekoff and Titsworth, 2013**, and **Rosen et al, 2011**; **Lee et al, 2017**). Students themselves are aware that in-class multitasking does not promote learning; in one survey, 80% of students agreed that multitasking in class decreases their ability to pay attention (**Sana et al, 2013**).

In addition, device usage is distracting to neighboring students. In several surveys, students have reported that texting is distracting to nearby students (**Tindell and Bohlander, 2011**). A study on laptops in a simulated classroom found that students in the vicinity of another student who was multitasking on a laptop during class

scored worse on a test than those who were not near multitaskers (**Sana et al, 2013**). However, a follow-up study found that it matters what one's neighbors are doing on their computers; a neighbor who engages with off-task content has a more harmful effect on one's comprehension than if the neighbor is on-task (**Hall et al, 2020**).

Studies of semester-long courses

Much of the above data comes from simulated class situations, correlational studies, or studies of a single class session. What happens when students are not allowed to use computers in class for an entire semester? Two studies comparing actual college classrooms in which students were or were not allowed to use computers over the course of the semester found that students who bring a laptop to class earned lower grades than those who do not (**Patterson and Patterson, 2017**; **Carter et al, 2017**).

However, the evidence is not uniformly against laptops. Elliot-Dorans compared different sections of the same course that either banned or allowed laptops, and found that banning laptops led to lower quality of written work, lower attendance, and lower exam scores (**Elliot-Dorans, 2018**). The author surmised that students' note taking was worse without a laptop, which impeded their learning.

Our recommendations

Maintaining focus

Boredom is one of the main reasons that students report using a digital device during class (**McCoy, 2016**). By keeping your students engaged, thinking, and doing activities during class, they are less likely to be tempted by digital distractions. Two studies, one that asked students to use clickers to report lapses in attention (**Bunce et al, 2010**) and one that tracked students' eye gaze patterns during lectures (**Rosengrant et al, 2012**, summarized **here**), found that students' attention is highest during and immediately after a change in pedagogy or behavior of the instructor. Some examples of changes that can help students maintain focus include:

1. **Variety in pedagogical activities.** If you want students to pay attention to you, then you have to offer them something more interesting than your slides (which they're perfectly capable of reading for themselves). Look for opportunities to change up the interaction in the classroom. If you're lecturing, why not ask your students to provide examples of the concept you're describing? If you are leading a discussion seminar, why not design activities for students to talk to each other in small groups instead of just answering your questions for the duration of the class? For example, prompt students turn and talk to each other about a question or challenge you've posed. Technology can help promote engagement and collaboration during an activity like this; students could write and respond to each other in a shared Google Doc.

2. **Proximity to the instructor.** You are not a prisoner of the podium, or the front of the table, or however your classroom is set up. Of course, you can't be proximate to each student all the time—so move around! You can use your position in the classroom to change the flow of the conversation and the way that students direct their attention.

3. **Humor.** You probably already knew that students typically pay attention to jokes. But there's a lot more behind that surface observation: laughter in the classroom can make students more comfortable, lower their **affective filter**, encourage intellectual risk-taking, decrease anxiety, and establish a more productive student-teacher relationship.

Using technology for learning and engagement

Our recent experiences with remote learning have reinforced the idea that digital devices can be incorporated into the learning environment to great effect, often in ways that we might wish to continue to deploy in an in-person classroom. Technology can be helpful for collecting instantaneous feedback on student learning,

promoting collaboration, and helping students engage more closely with readings and other materials related to the course. For example, students can use a mobile device to respond to questions (multiple choice, open ended, and other formats) through applications such as **Poll Everywhere** and **Learning Catalytics**. This encourages class participation and provides instructors with instantaneous feedback about student learning. Collaborative tools such as Google Docs or Google Jamboard allow students to jointly contribute ideas to a shared project or give each other peer feedback, and **annotation tools** such as AnnotationsX or Perusal enable students to annotate a document. Additionally, students might use their device to look up information on the internet, or engage with a simulation or other educational app.

Furthermore, students may prefer taking notes on their computer rather than by hand. In one survey of college students, 70% of students report that having a laptop in class is helpful for their academic performance, with note-taking cited as the most important benefit (**Kay and Lauricella, 2014**). Additional reported benefits include engagement with in-class academic activities, and communication and collaboration with peers (**Kay and Lauricella, 2014**; **Fried, 2008**).

Technology as a technology of inclusion

While for many students banning devices from the classroom may seem like a minor inconvenience, students with dyslexia, ADHD, or visual impairments use computers to take notes and to access cloud-based assistive technologies. People with invisible disabilities are enrolling in higher education settings in increasing numbers, and require access to technologies that assist with their learning. Allowing all students access to a device in class avoids singling out students who have important reasons for using one.

When you do use technology in the classroom, check to see if the digital tools you use are accessible to different students. Consider using sans serif fonts, providing materials for lecture in advance of class for review, and using files that can be read aloud via text to voice software (avoid scanned pictures of text). A Boston Globe article entitled "**Digital education shouldn't bypass disabled**" highlights and personalizes these issues.

To allow or not allow devices?

Faculty are often hesitant to allow students to use devices in the classroom due to the potential for distraction. However, we note that the challenge with digital devices is not the device per se, but off-topic usage. We can decrease the temptation by ensuring that the class itself is interactive and engaging, and that any use of technology is relevant.

We recommend being intentional, transparent, and flexible about use of digital devices in the classroom.

- Start by thinking carefully about your **learning objectives**, and identify activities that align with your objectives and enhance learning. Sometimes the most appropriate activity might not involve technology, but instead might include students talking to a neighbor, drawing a diagram on paper, or solving a problem on a white board. In other cases, you might see an ideal use case for electronic devices. For example, you might incorporate online tools that provide insight into student understanding (such as polls) or that allow collaborative work.
- During some portions of a class, you might encourage students not to use their devices, but to instead maintain their attention on the conversation, for example. (You may wish to apply these directions flexibility, with the understanding that some students rely on digital tools for learning.)
- Communicate clearly—and frequently—about when and why to use a device, as well as why not to use a device. Share the research about how off-topic device usage impedes learning.
- Include a technology policy on your syllabus. In addition to letting students know what they can and cannot use, it is important to let them know why.

- Share advice about good practices for using digital devices. Guidance about turning off extraneous applications and notifications, and closing the device when an activity is completed, will help students not only in your class, but also in their future work environments.

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