Revisiting the Technology and Student Learning Debates: Critical Issues and Multiple Perspectives

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Abstract:

Technology is both extolled as an amazing educational tool and disliked as a pestilence that severely impairs learning. While in reality the impact of technology probably lies somewhere in between these two extreme views, it is helpful to consider the arguments from both sides to guide incorporation of technology in classrooms of the future. Five debates about the impact of technology in classrooms are discussed: whether technology enhances or diminishes academic performance, whether multi- or mono-tasking is optimal for tech-savvy students, whether technology isolates or brings people together, whether it is better to ban or train students on classroom technology use, and whether or not old teaching practices need to be updated to incorporate technology.

Key Words:

Technology, Technology Pedagogy, Classroom Policy, Isolation in learning, Multitasking.

Introduction

Technology in classrooms is a controversial topic. It is seen as a step forward in advancing education and also a distraction that prevents real learning. The following discussions will outline five debates that are found in the literature on technology in classrooms. They include the impact of technology on student performance, collaboration on learning tasks, and a sense of community. Also discussed are classroom technology policies and restrictions, as well as expectations of faculty to create more active learning environments utilizing technology.

Given, the complexity of the issue, the scope of this article is to recognize, explain and unpack the dichotomies prominent in the literature to allow us to see the rationale for different sides of the debates. We believe that this format will challenge educators to contemplate and reflect on how the technology they incorporate enhances or distracts learning, from a more nuanced and multidimensional perspective. We believe there is a need to move beyond these reductive and limiting binary discourses and develop frameworks informed by fruitful dialogues and supported by perspectives from all sides.

Debate 1: Enhanced versus Decreased Academic Performance

Most educators agree that wireless technology is significantly impacting primary, secondary, and college-level learning environments. However, while some educators praise technology for enhancing students' ability to engage with information presented in the classroom, others claim that technology is a distraction that negatively impacts students' classroom performance. There are studies that support the arguments of both sides.

Those embracing technology in the classroom argue that the short, self-directed breaks that occur when students stop working to browse online or engage with social media can facilitate important mental rest periods leading to greater productivity. A recent study by Ariga and Lleras (2011) reverses conventional wisdom that lack of attention is correlated to poor performance. Their study demonstrates that even short distractions from a task replenishes your brain encouraging greater creativity and productivity. Similar research conducted in the work context shows that personal internet use during work can enhance work-related innovation (Garrett & Danziger, 2008).

Others tout social media sites like Twitter for their role in helping professors efficiently address student questions during a lecture (via students tweeting questions to the teacher). These social media users point out that this real-time interaction enables professors to more accurately gauge student comprehension of lecture material. West (2011) argues that digital technologies enable faculty to move beyond traditional methods of assessment such as annual standardized tests and experiment with more frequent and multifaceted ways to measure student performance. In fact, many argue that technology opens up numerous prospects for educators to develop active learning approaches in classrooms that can enhance student learning and performance. (Crossgrove & Curran, 2008; Fitch 2004; Smith, Wood, Adams, Wieman, Knight, Guild, & Su, 2009; Stephens 2005).

Another positive effect reported by several studies is that technology not only facilitates learning but takes student engagement and participation to an entirely new level (Deslauriers, Schelew, & Wieman, 2011; Edwards, 2013; Gauci, Dantas, Williams, & Kemm, 2009; Hoekstra, 2008; Wardlow, 2014;). For introverted and extroverted students alike, technology enables more open communication with professors. A study by Jones (2002) found that that "46% of students report that email allows them to express ideas to professors they otherwise would not express in person, [and] 19% say they communicate more with professors via email than in person." Additionally, polling tools (apps, clickers, & online polls) enable students to answer questions anonymously, leading to much higher student participation in comprehension-testing questions (Young, 2010). For introverted students who find it too intimidating to speak in class, SMS, email, Twitter, or instant messaging provide ways for them to engage in classroom discussion alongside their more vocal peers. It also opens opportunities for "peer instruction" to use time in the classroom in collaborative learning with peers (Mazur, 1997).

Correspondingly, it has been suggested that technology facilitate what business organizations refer to as "Knowledge Management." Laptops and note taking software help students summarize, systematize, and utilize the information they receive in the classroom, which can be effortlessly communicated and retrieved anywhere (Schepman, Rodway, Beattie, & Lambert, 2012).

Other researchers highlight the benefits of technology for students with disabilities. (Hasselbring, 2000; Israel, Marino, Delisio, & Serianni, 2014; Kirk, Gallagher, Coleman, & Anastasiow, 2008,). For instance, assistive technology such as electronic readers that allow students to change the number of words per line of text that they have to read is a boon for students struggling with learning disabilities, particularly those with dyslexia. While some students with dyslexia might struggle with reversing words and letters while reading a traditional book, reducing the number of words per line can reduce word and letter reversal, leading to higher reading speed and comprehension (Shmulsky, 2013). In other words, several educators are of the opinion that assistive technological devices have the potential to reach these students like never before.

Finally, one teacher notes that while her economically disadvantaged students may not own computers, they do typically have mobile devices, so integrating mobile technology into her lectures "can level the playing field in my classroom, and give children from families of all economic backgrounds an opportunity to learn in the same way and compete on a more even level" (Restauri, 2013).

On the other side of the debate, several studies point to lower student outcomes resulting from the distraction provided by always-present, hard to ignore, mobile devices like cell phones and laptops (Biggs & Tang, 2007; Bligh, 2000; Chickering & Gannon, 1987; Fried, 2008; Grace-Martin & Gay, 2001; Kladko, 2005; McWilliams, 2005; Szaniszlo, 2006; Young, 2006).

First, several argue that instant access to information has led to a decline in critical thinking skills. Porter (2014) refers to the "Wikipedia syndrome," which he argues has "created an expectation of easy access to information and instantaneous answers."

Greenfield (2009) believes that a decline in analytical skills can be attributed to people spending more time with real time media as opposed to reading.

Others (Carr, 2010; Ciarcia, 2012; Hiawatha, 2012; Friedman & Heafner, 2012; Lowry, 2010) believe that technology has contributed to increased dependence on answers from the internet hindering the cognitive ability of people to think deeply, retain, comprehend and analyze information.

Second, researchers also establish a direct correlation between uses of digital devices and lower GPA. Recent experimental studies found that students who brought laptops and cell phones to class scored noticeably lower on tests than their peers and even admitted that their laptops distracted them from learning as much as their laptop-free peers (Duncan, Hoekstra, & Wilcox, 2012; Junco & Cotton, 2012; Lepp, Barkley, & Karpinski, 2014; McCoy, 2013; Rosen, Lim, Carrier, & Cheever, 2011; Smutko & Broaders, 2013; Wood, Zivcakova, Gentile, Archer, De Pasquale, & Nosko, 2012). Walsh (2013) correspondingly showed that students who spent their time reading a newspaper and listening to music as opposed to texting and surfing the internet had positive academic outcomes.

Finally, some contend that electronic devices are more than just a distraction—they signify a dark age. According to Jackson (2008) "we are losing our ability to create and preserve wisdom and slipping toward a time of ignorance that is paradoxically born amid an abundance of information and connectivity. (p.100)" Similarly, Bauerlein (2008) warns that the digital age has generated access to immense information at the expense of making us 'dumber'. He worries that the younger generation is increasingly disconnected from culture, history, politics and context contributing to ignorance and apathy.

Debate 2: Multitasking versus Monotasking

In recent years, a growing number of academics have expressed concerns about the physical and cognitive barriers created by technological devices. These academics assert that the presence of these devices is disrupting the very essence of the classroom experience. First, several studies point out that technology users can distract not only the student but other students in the vicinity. Yamamoto (2008) notes that the glowing color and the light of a laptop or an IPad can distract the person behind and next to user. Gounder (2014) highlights that cellphone ringing, portable media devices playing loud music and network computer games being played in the classroom all serve to disrupt other students. These technologies are immediate distractions to the people in the vicinity and, thus, one person can effectively distract a significant number of people in the class. Recent research (Sana, Weston, & Cepeda, 2013) supported this idea by showing that those who were simply in view of someone using off-task technology suffered on tests.

Second, research (see Barak, et.al 2006; Fried, 2008; Hembrooke & Gray, 2003; McCoy, 2013; Ravizza, Hambrick, & Fenn, 2014) also highlights that students who use technological devices in the classroom spend considerable time multi-tasking and engaging in non-classroom and non-academic related activities. These studies suggest that students who used laptops in class did so for checking email, instant messaging,

surfing the web, and playing video games, making it harder for students to pay attention in class. Faculty are particularly concerned about multitasking. Largely, research in the area of Cognitive Psychology shows that dividing attention generally hurts performance. This is especially true if both tasks use the same sensory modality (e.g., both sets of items are presented visually; Allport, Antonis, & Reynolds, 1972), but even holds true when the tasks use different modalities (Strayer & Drews, 2007). Thus, for complex activities, such as listening to a detailed lecture, people will likely have memory and attention deficits if they are dividing their attention between the classroom activities and their digital devices, even if the information is presented in different modalities.

This has been also echoed by educational research. Experiments by Grace-Martin and Gay (2001), Stanford University, found a negative correlation between grades and time spent surfing the Web during class. Gergen (2002) and Kleinman (2004) employ the expression "absent presence" to describe instances in which the individual disengages from group interactions and shifts back and forth between the real and the virtual worlds. Along the same lines, Carr (2010) argues that with increased multitasking we find ourselves struggling to concentrate on one task for an extended period of time. He is of the opinion that multitasking prevents us from reflection and deep thinking and is making us superficial human beings.

On the other hand, Cathy Davidson (2011) calls for the need to debunk the myth of monotasking. She argues that in the digital world multitasking is the norm and the human brain is rightly suited for it. In her view the small pauses we take to check email or Facebook relax and stimulate the brain. According to Davison, we need to move beyond blaming technology but invest in restructuring our schools and workplaces to make it more suitable for the digital age we live in. In 2003, during her tenure as the Provost of Duke University, Davidson made the controversial decision of giving both students and professors iPods. This experiment, she highlights, led to fruitful collaborations between students and professors resulting in innovative learning and teaching applications in ways she had not anticipated. Accordingly she says, "Distraction is really another word for saying that something is new, strange or different. We should pay attention to that feeling… Distraction is one of the best tools for innovation we have at our disposal—for changing patterns of attention and beginning the process of learning new patterns."

Debate 3: Isolation versus Interaction

Many educators view technology as a tool that encourages interaction by providing more ways for students to contribute and by allowing instructors the ability to enable 'lecture' outside of class time and dedicate class time for interaction.

Technology is used by students to connect with fellow students, faculty, and others from across the globe (Prensky, 2010), and enriches those collaborations (Hewege & Perera, 2013; Dunleavy, Dexter, & Heinecke, 2007). Utilizing virtual lectures and assessments can free up class time for more interaction and discussion (Topp, 2011; Alvarez, 2011; Mazur, 1997). Thus, the use of technology outside of class can increase interaction both outside of and in class.

Raths (2012) argues that the use of classroom response systems (CRS) during class allows students to interact more frequently throughout lecture by anonymously and silently answering questions that are posed electronically, thus encouraging students to be active participants in their learning.

In addition, there is strong evidence that technology is an effective technique among groups for whom participation might be inherently difficult. Introverted students are more likely to participate in a class discussion if they have access to a CRS (Finley, 2014). Similarly, teachers of students with special needs report that these students feel more like a part of the community when everyone else has technology as well (Maninger & Holden, 2009). Finally, many studies indicate that individuals who do not know the language well can participate in their learning more and communicate more easily with the aid of technology (Hewege & Perera, 2013; Warschauer, 1996; Webb, 2006).

Other research looks more generally at the influence of technology on all learners. Dong and Hwang (2012), in a study of a system called "Pause Lecture, Instant Tutor-Tutee Match, and Attention Zone," found that students who sat further from the teacher utilized the technology more often than those who sat closer. Although sitting further away usually decreases interactions between students and teachers, the use of technology allowed them increased interactions with the teacher. Finally, comparing an implementation site with a control site, Mabry and Snow (2006) found that an instructional technology program implemented for high-risk students resulted in an increase in the amount of 'spontaneous collaboration' and sharing.

On the other hand, when students' attention is directed at a piece of technology rather than other people, it may serve to isolate those individuals. One law professor banned laptops in his class, calling them a "picket fence between you and the students" (Associated Press, 2006). He argues that this 'wall' inhibits body language and even if technology does increase the number of interactions, it can't match the quality of active classroom discussions.

CRS, which are designed specifically to allow more frequent participation from all students, have been shown to create an individualistic, disengaged experience (Bowden, 2011). In contrast, non-tech-enhanced classrooms were associated with stronger social connection and even loyalty. Laptops, in particular, have been shown to have an isolating effect. They are associated with increased off-task behavior, less communication with fellow students and the instructor, and social isolation (Fisher, Lucas, & Galstyan, 2013; McGrail, 2007).

Lastly certain technologies are more or less likely to isolate. Liu, Chung, Chen and Liu (2009) found that handheld devices that have a shared display (an additional peripheral screen that can be accessed and used by the group) are described as more public, and encourage more collaboration than more traditional handheld devices that are private and have no shared screen. In the same vein, some types of students collaborate more with technology while others collaborate less. Technology may be especially beneficial for students who deal with an obstacle to interaction such as being a non-native speaker of the language (Hewege & Perera, 2013; Warschauer, 1996; Webb, 2006) or having a disability (Maninger & Holden, 2009).

Debate 4: Banning versus Training

While viewed by some as an extreme measure, some academics have turned to banning laptops from the classroom as a viable solution (Yamamoto, 2008; Maxwell, 2007). Clay Shirky (2014), a social media professor and an outspoken enthusiast of technology explained his decision to ban laptops in his NYU classrooms as he was concerned about the growing level of distraction. According to Shirky the fundamental perils of technology in the classroom include the intense tendency of students to gravitate towards emotionally laden content as well as second-hand distraction. Along the same lines, Dan Rockmore (2014) explains that the rationale behind banning laptops in his classroom was because the costs, such as distraction and multitasking, outweighed the benefits of laptops for students.

Second, several faculty argue that typing on a laptop is far more detrimental for learning than taking hand written notes. According to Loeffler (2013), typing leads to a mechanical transcription of the lecture with students focused more on capturing every spoken word. On the other hand, since we write slower than we type, students are required to comprehend and conceptualize the lecture prior to summarizing the content. Similarly, Mueller and Oppenheimer (2014) in a recent study demonstrated that students who took handwritten notes performed much better on conceptual questions than students who took notes on the laptop.

Finally, several academics in the humanities and social sciences call for the need to restrict laptop usage as it creates a tangible block between peers in their classrooms, which thrive on group interactions and critical thinking. (Sierra, 2012). Synder, a History Professor claims "...we are losing the long tradition of people learning from other people. The lecture course, in one form or another, has been around for more than 2,000 years. The ability of one human being to reach another by speech is an irreplaceable part of what it means to be human. In seminars, laptops are still more harmful, serving as physical barriers that prevent a group of students from becoming a class (2010)."

On the other hand, numerous arguments have been put forth against the ban of laptops in the classroom. Schuman (2014) highlights that in several universities laptops are covered by financial aid making it more affordable for students. Second, many argue that college students should be regarded as adults who are responsible for their own education. In the words of Schuman (2014), "Policing the behavior of college students infantilizes them. They are adults who are old enough to decide for themselves whether they want to pay attention in class- and to face consequences if they do not." Others like Miller Fox (2014) call for the need to embrace the consumer paradigm and treat them like consumers of higher education, which is an expensive commodity. She emphasizes that students should be reminded that under this paradigm there should be equitable investment from both the students and the professor.

Finally, the literature (Bhave, 2002; Borja, 2006; Bugeja, 2007; Jaschik, 2008) also suggests that often the problem lies with the lack of training for students on the use of technology in the classroom. Young (2006) notes that the onus lies on the professors to educate students about the appropriate and inappropriate use of technology. Programs

such as 'digital citizenship' and "Digital Etiquette," which have become popular among educators, ensure that students don't abuse or misuse their digital privileges.

Debate 5: New versus outdated teaching practices

Some argue that digital distraction in classrooms is a symptom of outdated teaching methods. Today's students are described as "digital natives" who have grown up in a world that is constantly connected and online. They are visual and kinesthetic learners (Skipton, Matulich, Papp, & Stepro, 2006) who like to experiment and explore. However, our education system has not kept pace with the radical transformations in technology. Many argue that educators continue to resist new educational technologies (Roberts, 2008) and it is the archaic lecture model of teaching that needs to be overhauled (Khan, 2012). In fact, a recent study by Kim Novak Morse (2011) indicates that the tendency to use laptops in the classroom among law students increased when students were not interested in the instructor's lecture. Overall, there is considerable support in the literature (Oblinger, 2003; Prensky, 2010) for the view that educators need to transform their teaching strategies in order to retain the interest of 21st century students. They highlight that the limited use of technology in the classroom adds minimal value to the curriculum (Frand, 2000) and leads to the perception of faculty incompetence among students (Taylor, 2003).

However, placing the blame on outdated teaching practices in the era of technological transformation has been critiqued. First, there is little institutional recognition for faculty who use technology for instructional purposes. Many educators (Green, 2015) argue that University tenure review boards tend to favor scholarship and research over instructional excellence. Junior and untenured faculty often find it hard to justify the learning and implementing of new technologies in the classroom as they are both expensive and time-consuming and therefore, these individuals tend to focus more on research, which is perceived as more beneficial for their tenure and promotion (Flaherty, 2011).

Second, the integration of innovative technology in the classroom also requires support in the form of training. A new survey from the Bill & Melinda Gates Foundation (Fabris, 2015) has found that, out of the 40% of faculty surveyed who either use or are drawn toward using innovate technologies in the classroom, only 20% have essentially employed them. Many argue that faculty, especially older faculty, are reluctant to incorporate technology due to competence issues. Prensky (2001) described the older generation as 'digital immigrants' "who speak an outdated language and struggle to teach a population that speaks an entirely new language" (p.2). They feel they are less proficient with technology because their early academic training occurred before the advent of the technological revolution. In fact, Dean and Levine (2013) describe these digital immigrants as "abstract and reflective" learners themselves who tend to use technology as a supplement to their teaching rather than the core of their pedagogy.

Accordingly there is sufficient support in the literature for the need of more training for faculty at universities. Some educators (Georgina & Hosford, 2009; Spotts, 1999,) call for faculty training programs that move beyond mechanics of using the tools and software and instead focus on how technology can make them better teachers and enhance student learning. Specifically, faculty need to be taught *how* to add technology

to their learning design, only doing so when it enhances rather than distracts. Others (Allen & Seaman, 2008; Brown, Benson, & Uhde, 2004; Osika, 2006,) suggest that the successful integration of technology into teaching will only happen with the strategic backing and support of the university administration. Successful technology programs require support from the entire institution in the form of long-term planning, faculty surveys that facilitate communication of technical needs, more funding and reduced course loads for faculty implementing new technologically-driven curriculum.

Conclusion

In sum, it seems that while technology can have some positive outcomes in classrooms, its usefulness and acceptance are far from ubiquitous. Visiting these debates should help educators to think more critically about when and how to incorporate technology into their learning design. For example, future studies might want to consider ways of maintaining the benefits of technology for those who have difficulty interacting without it, while avoiding the distractions experienced by more traditional students. Further, much of the research on this topic considers the technology-enhanced learning environment without a control group (i.e., traditional classroom). Future studies could actively compare the technology-enhanced experience to a traditional experience. This type of research design might help justify money spent on classroom technology in times of tight budgets and competition for funding. However, it should also be noted that a lack of significant differences in such designs would not necessarily mean the technology has no impact (Kock, Verville, & Garza, 2007). For example, even if learning outcomes are the same, technology-enhanced learning opens the doors to individuals who might otherwise be unable to enroll. Most importantly, though, when faculty are designing their pedagogy, rather than adding technology for technology's sake, meaningful consideration should be given to whether it will enhance or distract from the ultimate learning goals for the class at hand. Including technology in such a thoughtful way, will increase the likelihood of enhancing rather than distracting learning.

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