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This study examines faculty perceptions of the impact of wireless laptops in the higher education classroom. A survey comprising Likert-scale and open-ended questions was administered to faculty members at a large public university. Survey questions focused on faculty perceptions of the impact of wireless laptops on the classroom atmosphere and their teaching. Depending on the context of use, respondents pointed to numerous ways in which laptops have enabled them to incorporate new information sources, engage students, and add activities to enhance classroom learning. A majority of respondents, however, indicated that students are likely to become distracted when using wireless laptops and that student participation in discussions can be negatively impacted. A majority also indicated that they would make use of an option to turn off Internet access in their classrooms.

Headings:

Classroom dynamics

Wireless laptops

Multitasking

Millennial students

Faculty perceptions

IT in education

FACULTY PERCEPTIONS OF THE IMPACT OF STUDENT LAPTOP USE IN A
WIRELESS INTERNET ENVIRONMENT ON THE CLASSROOM LEARNING
ENVIRONMENT AND TEACHING

by
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INTRODUCTION TO STUDY

Although the professor did not say anything humorous, a broad smile appears on the face of a student in the third row. Peering at her laptop, she quickly types a reply to the instant message she just received from a friend. Behind her, another student is shopping online for an external hard drive for his computer. A few desks away, a third student toggles between the class's PowerPoint presentation, his OneNote note-taking software, and his open email client.

This scene plays out daily in classrooms nationwide at universities that have embraced laptops and campus-wide wireless internet access. As universities continue to expand their wireless networks, many institutions, such as the University of North Carolina at Chapel Hill, have made laptop ownership required for all students. Anecdotal information suggest that there are important benefits to laptop use and Internet access in the classroom, such as the ability to conduct a quick fact check or immediately supplement class information with an online reference. Likewise, new note-taking software allows students to quickly and easily include class PowerPoint slides, audio recordings, drawings, and annotations in notes typed into a laptop. What is more, full-text searching of those notes can aid in later studying for exams.

Enthusiasm for wireless laptops in the classrooms has been tempered recently by a growing concern that wireless laptops distract students' attention, diverting their focus away from class. As wireless technologies are more widely deployed in campus classrooms, some educators have reported decreases in student participation and

engagement due to laptop use. Recent media reports describe faculty members who have banned laptops from their classrooms or departments that have installed Internet “kill switches” in classrooms in an effort to wrestle students’ attention away from the Internet and back to the instructor (Cohen, 2006; McWilliams, 2005).

In an effort to understand the impact of laptops in the higher education classroom setting, this study investigates faculty reactions to students’ use of laptops and the impact of laptops on their teaching and the classroom dynamic. An online survey consisting of multiple choice and open-ended questions was issued to all faculty at the University of North Carolina at Chapel Hill (UNC-CH). A total of 244 responses were received. The purpose of this survey was to gauge faculty reactions to and perceptions of this issue. Feedback was solicited from instructors, as their day-to-day work gives them a unique and proximal perspective on the impact of laptop use in the classroom. By focusing in on the classroom environment, this study seeks to better understand how the growing presence of wireless laptops impacts and mediates student-instructor relationships, teaching and learning practices, and overall classroom dynamics. Results from this study may benefit administrators, staff, and faculty at other institutions considering laptop initiatives or the expansion of their wireless infrastructures.

This study focuses on the use of mobile wireless laptops in the college classroom. Mobile wireless computers, commonly called wireless laptops, are the most popular mobile wireless technologies used in higher education (Kim, Mims & Holmes, 2006). Unlike wired laptops that use an Ethernet card and cable, wireless laptops use a wireless network interface card to connect to a network. These cards typically use a low frequency radio signal to connect to a shared wireless access point (WAP) installed in

classrooms. The WAPs are connected to the campus wired-network. While WAPs typically transmit data at a slower speeds than wired networks, they are able to support many simultaneously users (Kim et al., 2006).

Despite the technology push on campuses nation-wide, and the near universal support of laptop programs, the impact of wireless laptops in the classroom is under-investigated. A number of scholars have cited the need for further research on computer use in educational settings (Jones, 2002; Kim et al., 2006; Shim & Shim, 2001; Tao, 2003; Zucker, 2004). No published studies have specifically investigated faculty perceptions of the impact of students' laptop use in the university classroom. In particular, the issue of student distraction caused by laptop use requires further examination. This study begins to fill this gap by gathering and reporting on faculty opinions and perspectives.

To provide a backdrop for this study, the literature review will examine the current state of laptop use on U.S. university campuses and at UNC-CH particular. Recent studies examining how students make use of computer technology will be reviewed along with previous research on the impact of laptops on academic performance. Because there is relatively little research investigating laptop use in the college and university classroom, this study will also discuss research on related subjects, including multitasking and Millennial student learning styles.

Multitasking and its associated distraction and inattention have been investigated from many angles, but researchers have only just begun to understand how wireless laptop use impacts students' academic performance. Furthermore, much remains to be learned about the learning styles and preferences of today's college students. These

students, known alternatively as “Millennials”, “Digital Natives” (Prensky, 2001a) or members of the “Net Generation” (Tapscott, 1998), have grown up in technology-rich environments and exhibit different technology use and information seeking behaviors as compared to previous generations. The literature review will also provide a brief description of the laptop program at the University of North Carolina at Chapel Hill. Finally, recent firsthand accounts from faculty members nation-wide regarding their reactions to students’ use of laptops in their classroom are also examined.

Following the literature review, the study’s data collection and analysis methodology will be discussed. Results and conclusions are then presented. From the collection and analysis of faculty responses, this study exposes important concerns to be addressed and helps paint a clearer picture of current classroom practices and perceptions of how laptops can help or hinder the educational pursuits of today’s college and university students. Ultimately, this study hopes to propel forward the discussion of the most appropriate and effective use of educational technology in the classroom, in an effort to make today’s powerful technology tools useful for students and instructors alike.

LITERATURE REVIEW

Over the last decade, advances in technology have brought significant changes to higher education classrooms. Tools used by instructors, such as overhead transparency machines and chalkboards, have largely been replaced by computers and projectors. Students who have traditionally brought pens, pencils, and notebooks are increasingly bringing their own wireless laptops to class. Whereas instructors previously had control over all of the technology in the classroom, the presence of student laptops adds a new element to the mix of classroom focal points. Expanding wireless networks and laptop ownership are changing the nature of work, study, communication, recreation, collaboration, and knowledge sharing on college and university campuses. As the boundaries of where students can learn, research, and collaborate are dissolving, college students have quickly come to expect wireless Internet access in classrooms, dormitories, and open spaces.

This review of the literature will cover a) current trends in computer and Internet use, b) the effects of multitasking, c) characteristics of today's Millennial students, d) a brief history of the laptop program at the University of North Carolina at Chapel Hill, and e) recent reports on the reaction of U.S. higher education faculty and administrators to students' use of wireless laptops in the classroom.

Backdrop: Internet use by students in higher education

According to the Campus Computing Project (Green, 2006), wireless computing networks are quickly expanding across college and university campuses. More than two-

thirds (68.8%) of campuses surveyed had a strategic plan for deploying wireless networks as of fall of 2006. That figure is up from 64% in 2005, 55.5% in 2004, and 24.3% in 2001. Over one-fourth (28.9%) of campuses reported “full-campus” wireless services in 2005 (Green, 2005), up from 19.8% in 2004. In 2006 wireless networks reached 51.2% of college classrooms, up from 42.7% in 2005 and 31.1% in 2004 (Green, 2006). Private universities lead other institutions with 58.0% of classrooms equipped with wireless service. Public universities have covered approximately 56% of their classrooms with wireless access and community colleges follow at 31.7% (Green, 2006). This trend reflects a concerted effort by institutions of higher education to make their campuses competitive, and their students technology-savvy. Wireless networks save money on cabling costs and are easier than wired networks to install, operate, and maintain (Tao, 2003). Furthermore, by requiring students to purchase laptops, colleges and universities are able to save money on fixed computer labs and multimedia classrooms (Olsen, 2001). According to some counts, there are over 200 colleges and universities with some form of laptop initiative (Brown, 2005).

The Pew Internet & American Life Project’s report, “The Internet Goes to College” (Jones, 2002), presents a snapshot of Internet use among U.S. undergraduate and graduate college students in the U.S. This report provides a backdrop for current Internet use on college and university campuses, and helps illustrate the pervasive presence of information technology in student’s daily lives. Today’s students are heavy users of the Internet and have made it an integral part of their communication habits. For example, college Internet users are twice as likely to use instant messaging (IM) on any given day compared to the average Internet user (Jones, 2002). In many ways, the online

environment appears to be a staple of a student's educational experience, using the Internet to research, gather information, and communicate with others. Some of the Pew study's key findings are as follows:

- Nearly four-fifths of college students (79%) agree that Internet use has had a positive impact on their college academic experience.
- Almost half (46%) of college students agree that email enables them to express ideas to a professor that they would not have expressed in class, but, some interactions are still primarily face-to-face: Only 19% of students said they communicate more with their professors via email than they do face-to-face.
- Nearly three-quarters (73%) of college students say they use the Internet more than the library, while only 9% said they use the library more than the Internet for information searching.
- About half of all college students (48%) are required to use the Internet to contact other students in at least some of their classes.
- Two-thirds (68%) of college students reported subscribing to one of more academic-oriented mailing lists that relate to their studies. They use these lists to carry on email discussions about topics covered in their classes.
- More than half (58%) of college students have used email to discuss or find out a grade from an instructor.
- Nearly two-thirds (65%) of college students who email professors say they report absences via email.
- Three-quarters (74%) of college students use the Internet four or more hours per week, while about one-fifth (19%) uses it 12 or more hours per week. This is somewhat higher than the amount of time most students devote to studying (Jones, p. 2).

Taken together, these figures paint a picture of college student life in which computers are common place and utilizing online sources and services is almost second nature.

A 2001 study (Crook & Barrowcliff) hoped to gain a clearer understanding of student Internet use by investigating dormitory computer use. The researchers installed a system to monitor the software on 36 students' dormitory computers. All computer

activity was continually monitored and time stamped for a period of seven to nine days and the resulting log files were collated for analysis. The researchers found that across the period from midday until late evening there is, on average, almost a 60% chance that students will be making use of their computer. Using the system log files, the study authors identified significant multitasking and estimated that actual work-to-recreational use ratio for computer use was 20% to 80%. Referring to the university's intention to increase student access to academic resources by supplying broadband Internet access, the study noted:

...the good intention may be upset by the student being too susceptible to powerful alternative pathways-once the working environment of the computer is active. It would seem that any hijacking of the study agenda has more to do with the strongly interactive affordances of those applications that overlap with or that occupy the same working space as the tools needed for studying. (Crook & Barrowcliff, 2001, p. 254)

Computer games are another common pastime for many of today's students. Jones (2003) found that college students comprise an active gaming community. A survey of 1,162 traditional college students at 27 colleges and universities found that among self-identified computer gamers, almost half (48%) agreed that gaming keeps them from studying "some" or "a lot." Nine percent admitted that their motivation for playing a game was to avoid studying. College student gamers, however, reported approximately the same amount of time spent studying per week as college students in general. Almost a third of students surveyed admitted to playing games that were not part of the instructional activities during classes.

Additional studies have investigated current laptop and Internet use in higher education from other angles including occurrence of Internet dependency. For a small number of college and university students, Internet dependency has arisen as a

problematic and unintended consequence of the wide-spread provision of Internet access. Kubey, Lavin & Barrows (2001) examined recreational-only Internet use by 576 college students at Rutgers University. The self-report study found 9.23% of the sample agreed that they might have become “a little psychologically dependent on the Internet” (p. 370). Within that group, Internet use was over twice as high as that of the total sample. In response to the question “About how often has your schoolwork been hurt because of the time you spend on the Internet,” 14% of students reported that their schoolwork *had* been hurt “occasionally, frequently, or very frequently due to Internet use” (p. 374). The study authors point out, however, that “it is not entirely clear whether these students might have experienced similar or related problems without the Internet” (p. 390). Twenty percent reported that they had occasionally, frequently, or very frequently missed class because of their Internet use. Other studies on Internet dependency cited similar results with the percentage of students fitting the criteria for dependence ranging from 8% (Welsh, 1999) to 9.8% (Anderson, 2001) to 13% (Scherer, 1997).

In an effort to understand the larger impact of mobile computing on academic performance, researchers at Cornell University conducted a study (Grace-Martin & Gay, 2001) to correlate students’ semester-long use of wireless laptops with their academic performance. Students in two different courses were given laptop computers with wireless Internet access for the course of a semester. All Web browsing including URLs, dates and times, was recorded through a proxy server 24 hours a day, 7 days a week for 15 weeks. In this manner, the researchers were able to investigate how students’ actual browsing behavior with a wireless laptop inside and outside of the classroom impacted their individual academic performance. Using final course grade as the dependent

variable, the researchers found relatively few statistically significant correlations between browsing behavior and final grade for the two courses. The one statistically significant correlation that did emerge, however, was between students' in-class browsing sessions and their final grade. Longer browsing sessions led to decreased academic performance (correlation coefficient = -0.284, $p = .029$), suggesting that prolonged inattention to the class content may lead to lower grades. A closer examination of the data also suggested that shorter and more numerous browsing sessions led to higher grades. Although this second finding was statistically less significant (correlation coefficient +0.234, $p = .074$), it was an early indicator that more study on laptop use was needed to better gauge the impact of laptop use on academic performance.

Multitasking

It is clear that the further adoption of wireless networking and laptop computers has intensified multitasking. With myriad computer programs and Web sites at their fingertips, students' attention can easily become diverted away from the class content. While previous generations of students engaged in note-passing, day-dreaming, and doodling, today's faculty must compete against laptops with new and engaging forms of online content, social networks, email, instant messaging, notification systems, RSS feeds, computer games, downloadable television shows, and online shopping for students' attention. Today's students use their laptops to easily move between these applications and others, balancing tasks and attention. The formerly isolated computer is made into a communications hub for students in an educational environment formerly devoid of intense distractions. The following section examines recent literature on the

effects of multitasking in a variety of environments including the higher education classroom.

The act of multitasking may take many forms, but is commonly understood as engaging in multiple tasks simultaneously. Multitasking normally occurs when multiple demands are placed on us or when we choose to engage in multiple tasks at the same time, such as driving, listening to the radio, and conversing with a passenger or sending email during a meeting. Kenyon & Lyons (2005) estimates that through multitasking, people save nearly seven hours of activity each day. While time savings are a valuable aspect of multitasking, a broader set of studies suggest that some multitasking behaviors decrease specific task performance (Armstrong & Sopory, 1997; Hewlett-Packard, 2005a; Lang, 2001; Naveh-Benjamin, Craik, Perretta & Tonev, 2000; Pool, Koolstra & Van Der Voort, 2003; Rubinstein, Meyer & Evans, 2001). Information communication technologies (ICTs), such as laptops, can dramatically increase the opportunity for multitasking and raise the potential for distraction.

While there have been numerous studies on multitasking under intense workload demands (Karwowski, 2001), there are few that extend to computer use or multitasking behaviors in everyday situations. Only a very small number of studies have investigated the impacts on academic performance resulting from laptop use in the context of the higher education classroom. Hembrooke & Gay (2003) is one such study that sought to learn more about the effects of multitasking with laptops in the classroom environment. To study these effects, the researchers investigated two groups of students in an upper level communications course. Both groups heard exactly the same lecture and were tested immediately afterwards on their recall and recollection of the lecture content. One

group was allowed to use laptop computers with wireless Internet access to engage in browsing, search, or social computing behaviors. Students in the second group were asked to keep their laptops closed for the entire lecture. All laptop computing activities were carefully monitored through a proxy server. Through the use of Web metrics, researchers were able to gain a detailed picture of the student's laptop use, including type of application (e-mail, discussion board, browsers etc.), URL, number of site visits, and duration of each action. Use of the proxy server to log laptop use was essential to the study and afforded a richer view of the multitasking behavior than would have been possible with in-person observations or surveys. Using these log files, researchers found that the students used their laptops to explore lecture topics in more depth, as well as for emailing and instant messaging, and browsing unrelated to class content.

The findings from the study's post-class exam of the lecture content showed that the students who used the laptop computers suffered significantly poorer results on total recognition and recall test score measures by students with the laptop condition. Scores from the recognition questions showed decrements which approached significance for the laptop group. What is more, the content of material accessed on the laptops was coded to determine whether it was related or unrelated to class content and log data was used to calculate time students spent on and off-topic. After reviewing these log files, the researchers arrived at a more nuanced view of the effects of laptop use and multitasking behavior on academic performance. They showed, for instance, that not all types of multitasking behaviors appear to have equal impact on recall and recognition. Students who spent more time browsing class related pages scored lower in recall scores. To further explore these results, the researchers examined the amount of time students spend

on on-task material versus off-task material. The results suggest that spending a majority of time on class related content did not produce better test results. Rather the performance decrement on the memory test was more a result of the proportion of time drawn off task or off class focus. In other words, longer browsing sessions during a class resulted in lower memory scores. Shorter browsing sessions, regardless of whether the content access was class related or not, appeared to lead to higher test scores. This study thus suggests that students need to balance their browsing behavior, regardless of topics, to avoid spending too much time away from the primary task, which should be focus on classroom content.

Problems related to multitasking, distraction, and interruptions are certainly not restricted to the classroom. These issues have also caught the attention of large corporations seeking to improve employee productivity. While studies on the impacts of multitasking in the classroom are just beginning, there have been a number of studies by companies and researchers aimed at understanding the potential for distraction enabled by modern computing in the work place.

A survey by information technology research firm Basex in January 2006 found that interruptions take up an average of 2.1 hours of the working day for a typical employee. It was estimated that the cost of these breaches to the US economy is \$US 588 billion a year. The lost time for productivity included not only unimportant interruptions and distractions, but also the recovery time associated with getting back on the original task..

In a much publicized, report commissioned on behalf of Hewlett-Packard in 2005, researchers at the University of London's Institute of Psychiatry showed that office

workers who over-juggled and constantly interrupt their work to respond to incoming messages experienced a 10-point decrease in IQ. Using the term “info-mania” to describe this condition, researcher Dr. Glenn Wilson said “This is a very real and widespread phenomenon. [...] We have found that this obsession with looking at messages, if unchecked, will damage a worker’s performance by reducing their mental sharpness” (Hewlett-Packard, 2005a, para. 4).

In response to the study, Hewlett-Packard released its “Guide to Avoiding Info-Mania.” The publication presents workers with tips on increasing their productivity through appropriate use of technology. Their recommendations have sections on acting proactively, appropriate email and meeting behavior, and tips on dealing with coworkers (Hewlett-Packard, 2005b). The report reminds employees that “mobile technology offers massive productivity benefits when used responsibly, but inappropriate use can be negative” (Hewlett-Packard, 2005b, para. 1).

University of California Irvine Professor Gloria Mark channeled her frustration over “trying to do 30 things at once” into the design of a study on distractions in the office environment (Thompson, 2005, para. 1). A member of her research team spent more than 1,000 hours observing and looking over the shoulders of various office employees noting how often employees were interrupted and how long it took them to get back on task. The results were worse than she expected. Each employee spent only 11 minutes on any given project before being interrupted and whisked off to do something else. Each 11-minute project was itself fragmented into even shorter three-minute tasks and each time a worker was distracted from a task it would take an average of 25 minutes to return to the original task. Mark also found that people in open-cubicles suffer more

interruptions than those who work remotely. But because co-workers have a social sense of what their neighbor is doing, they interrupt them accordingly.

Instant messaging (IM) which is designed for synchronous communications has also been the focus of research on distraction and interruptions. Microsoft engineer Mary Czerwinski has conducted research to measure the impact of IM on employee's work rhythms and practices. Findings from her studies on work place interruptions (Cutrell, Czerwinski & Horvitz, 2001; Czerwinski, Cutrell & Horvitz, 2000) demonstrated the disruptive effects of IM notification delivery on memory for the prior task and on the worker's current task. Czerwinski and her research team hope that their findings will aid future software designers in creating more effective notifications systems. Part of the solution may be the creation of such systems that would include the use of graphical and linguistic summaries of the interrupted task. Such tools could remind the user of what they were doing prior to the interruption and help put them back on track more quickly after their interruption. The drive to improve employee productivity may indeed be advanced by such applications if they are written with a better understanding of the effects of interruption and multitasking on a worker's productivity.

Scholars and practitioners in the Information Sciences have also examined the effects of mobile and ubiquitous computing technology on people's interactions and task completion. Particular attention has been paid to the mediating effect of technology on communication and community level. New communication devices such as cell phones, laptops, and personal digital assistants (PDAs) can have a disruptive effect on traditional patterns of interaction and communication.

Gergen (2002) and Kleinman (2004) use the term “absent presence” to describe instances in which the individual removes him or herself from the context of a group to become focused on an individual virtual environment through the use of technology. This individual use of technology and the switching back and forth between real and virtual worlds impacts group interaction and relationships. Kleinman suggests the use of “community level” as a measure to investigate how individual technology use impacts a group. Proposed research would begin with the idea that communication richness is greatest in face-to-face communications and would examine whether this richness was maintained when individuals were connected to separate virtual environments. It is hypothesized that the overall community level will decrease as people engage in individual technology use. However, in certain circumstances the use of technology may improve decision-making and enhance learning when it is used with activities such as note taking. Further empirical evidence is necessary to assess impacts of the intervening technology on social trust, and examine the implications for collocated and virtual groups.

Former Apple and Microsoft software executive Linda Stone coined the term “continuous partial attention” (Thompson, 2005, para. 11) to describe how people cope with the modern day barrage of communications they receive by scanning their environments for the best or most important piece of information at any given moment. Instead of trying to do multiple things at once, continuous partial attention sees us scanning for one thing to focus on and perpetually switching our focus. For Stone, there are clear positives and negatives to our technology-infused work and private lives. On the one hand, people can become overwhelmed and drained by continuous interruptions

and distractions which require their attention. On the other hand many of these interruptions and notifications tie people into relationships, and processing and responding to such interruptions may bring a feeling of accomplishment or satisfaction when they successfully deal with the incoming barrage of messages (Thompson, 2005).

The wide-spread scope of the issue of multitasking and disruption suggests that higher education may have an important role to play in helping students be more effective computer users. Recognizing situations in which computer use may be detrimental to the task at hand may be a first step.

Millennial students

Born in the 1980s and later, “Millennials” have never known life without the Internet and make up the majority of today’s college students. They have grown up with the Internet, home computers, e-mail, cell phones, video games, instant messaging, and are accustomed to rapid technological change.

Oblinger (2005) notes that more than any other generation, Millennials are highly mobile and connected to online environments. They are used to receiving information quickly and have come to expect a certain level of immediacy in responses. Most prefer to learn by doing as opposed to being told what to do. They are participatory learners who assemble a variety of resources, often digital, to construct their own learning.

Their K-12 educations have often required group work and taught team approaches to problem solving. As a result, Millennials often have a preference for social interaction, and learning and working in teams. As they work in teams or with peers, they will move seamlessly between their physical interactions and virtual environments.

Even in close proximity “it is not uncommon to find students working together and still sending IMs—even though they are a few feet away” (Oblinger, 2005, p. 2.11).

Millennials are also one of the busiest and most scheduled generations yet, facing increased opportunities for involvement and time pressures. As such, they often prefer structure over ambiguity. They tend to focus more on visual sources and image-rich environments over large amounts of text. In comparison with previous generations, they are often seen as impatient and are thought to have short attention spans. Moreover, Prensky (2001b) notes that their generation craves interactivity. The rapid pace at which they are accustomed to receive information means that they often choose not to pay attention if a class is unengaging or too slow (Oblinger, 2005).

In some respects, Millennial students’ preference for interaction may be beneficial to their learning. Oblinger (2005) states that “learning science has consistently demonstrated that students learn more when they interact—with material, with each other, and with faculty. The ‘talk, text, test’ approach to teaching is not highly effective with most learners” (p. 2.13). Ramaley & Zia (2005) suggest “for all learners, research points to the importance of learning environments which are active, social, and learner-centered. These environments might be described as interactive” (p. 8.7). Brown (2005) further emphasizes the importance of learning as an active process. Drawing from the constructivist theory of learning, Brown argues that Millennial preferences for group activity dovetails well “with research indicating that learning is encouraged when it includes social components such as debate or direct engagement with peers and experts. Learning is strengthened through social interactions, interpersonal relations, and communication with others” (p. 12.6).

This generation is also recognized for its propensity for multitasking. In this area it may be reasonable to assume that practice and experience with such tasks and settings may indeed improve their multitasking ability and performance. This is an area where more situational and age group specific studies are needed.

Teachers, scholars, and writers are divided on how and whether educational techniques should adjust for this new generation. On the one hand, Prensky sees an important disconnect between students, which he terms “digital natives” and instructors who are “digital immigrants” (2001a). Prensky contends that cognitive differences in current students require new approaches to education. He believes that many students are bored by most of today’s education, and that the new skills that these digital natives exhibit (parallel processing, graphics awareness and random access) are largely ignored by educators. Current teachers, he contends are digital immigrants “who speak an outdated language (that of the pre-digital age), are struggling to teach a population that speaks an entirely new language” (p. 2).

Richard Sweeney, university librarian at the New Jersey Institute of Technology believes that Millennial students will alter the way professor teach, the way classrooms are constructed, and the manner in which institutions of higher education deliver degrees. They expect to choose the kind of education they buy, and what, where, and how they learn. Sweeney contends that professors should try to understand that Millennials learn from a wide variety of media, often simultaneously and will take new avenues to get what they want out of education (Carlson, 2005).

Conversely, many educators challenge the idea that major changes must be made to accommodate Millennial students in higher education. American University

Linguistics professor Naomi Baron, says that “students have a very short attention span, in part because of the media that we as teachers and parents have encouraged them to spend time with, and in part because we haven’t taught them to have longer attention spans” (Carlson, 2005, para. 43). Baron worries that as colleges increasingly cater to Millennial students, they will give up the core lesson of teaching students how to think on their own and be contemplative. Instead of overhauling educational practices, Barons feels that teachers should work with Millennials and “mold how they learn” (para. 67). Moreover, Baron contends that while students may be whizzes with their communications devices, their communication skills, both in writing and in person, have a long way to go. “We have these new technologies coming down the pike, and we’re told, Use them! Nobody has thought through which ones work and which ones don’t” (para. 47). Former American Library Association president holds similar views on accommodating the new crop of students. “This sort of end-of-history approach is dubious to me. [...] This idea that we have reached a watershed and we have to throw everything aside and come in with new approaches” (para. 7).

A study by the Educause Center for Applied Research (Kvavik, 2005) surveyed 4,374 college students from thirteen institutions in five states on the types of technology they use, their skill level with these technologies, the technology’s contribution to their undergraduate experience, and the value added by technology in terms of learning gains. Researchers had expected that Net Generation students would demand greater use of technology in classroom teaching and learning. They also expected that it would be increasingly necessary for faculty to use technology in order to appeal to this generation of students. Contrary to these expectations, the researchers found that the majority of

students preferred a moderate amount of information technology in their classes. Moreover, Oblinger (2005) notes that Millennial students are comfortable using technology although their understanding of the technology may be shallow. Kvakik found a “significant need for further training in the use of information technology in support of learning and problem-solving skills” (p. 7.17).

Oblinger (2005) remarks that it is almost instinctive to believe that Millennials want to use information technology in their education as heavily as they do in their personal lives. However, “they don’t think in terms of technology: they think in terms of the activity technology enables” (p. 2.10). Furthermore, students’ definitions of technology focused on the most recent advances. “For example, a cell phone with a new feature was considered technology; a cell phone with standard features was not. What we might consider “new technology,” such as blogs and wikis, are not thought of as technology by students” (p. 2.10). These types of distinctions certainly can impact cross-generational interactions and are important considerations for “digital native” students and their “digital immigrant” instructors.

Wireless laptops at the University of North Carolina at Chapel Hill

UNC-CH is a large, highly ranked public university which offers 71 bachelor’s, 110 master’s, and 77 doctorate degree programs (News Services, 2006). In August 2000, the university became the nation's largest university and major research campus to require undergraduates to own laptop computers. This program, known as the Carolina Computing Initiative (CCI) made UNC-CH a leader among its peers in student technology. During the phased implementation, the 2000 freshman class and each subsequent freshman class was required to own a laptop computer that met university

specifications. The university negotiated a contract with a major hardware vendor to supply the laptops at a discounted price. Students could choose between the university-sponsored laptop models and purchasing from another outside vendor whose laptop met the university's hardware specification. Students who chose to purchase the university-sponsored laptop models were offered two choices ranging in price between \$2000 and \$3000, marking a substantial increase in students' first year costs. Grant funding and monies from central university sources provided assistance in covering the cost of new laptops for ten to twenty percent of incoming freshman. Other students were offered help in acquiring student loans to cover the cost of the laptops (Newby, 2002). At the same time, the university was pushing to expand its wireless Internet coverage across campus. Wireless networking was available in some parts of campus, but most classrooms were not covered (Newby, 2002).

In taking an early lead in public institutions, the University sought both to produce graduates with the high-tech savvy required for the 21st century by making technology more accessible (Carolina uses wireless technology to transform learning, 2001) and to reduce spending on information technology (Olsen, 2001). Anticipating generalized benefits to students, faculty, and staff UNC-CH Chancellor James Moeser remarked,

Rather than just having a classroom with four walls or a faculty member's office or a laboratory or a studio, the green spaces are equally a learning environment, as are the coffee shops [...] so students can be sipping coffee on Franklin Street, but also be engaged in conversation on the Internet with each other. It makes the entire campus part of the learning environment. There's no question, in the conversations I have had with students, that their experiences on this campus are deeper and more meaningful because of their ability to be connected with each other and with faculty. I think that what we are seeing here will be the norm on American college campuses within the very short term; three to five years (Carolina uses wireless technology to transform learning, 2001, p. 66).

As more and more students purchase their own laptops, University administrators hoped to realize cost saving on fixed assets such as the computers currently in laboratories, dormitories, and classrooms. Then vice chancellor for information technology Marian Moore envisioned important cost savings that could be realized by having students bring their laptops to a wireless-enabled class as opposed to having to purchase, wire, and maintain a computerized classroom (Olsen, 2001). Moreover, faculty no longer needed to schedule computer lab access for their classes. The laptop mandate did not specifically address any curricular or teaching initiative or specific pedagogical goal. Instead, proponents expected and assisted faculty with creating new ways to use laptops and wireless Internet access in the classroom.

Like most new initiatives, the wide-spread deployment of wireless access points and the simultaneous spread of laptop computers represent an experiment in higher education. Of particular interest to this study is the impact that wide-spread wireless networking and laptops are having in the classroom. UNC-CH is now entering the sixth year of its laptop requirement program. This marks an opportune time to reflect on the experience of UNC-CH faculty as a way of better understanding the perceived role and impact laptop computers are having on classroom dynamics and teaching.

Wireless backlash: Faculty objections, institutional reactions

Despite the positive aspects of classroom laptop use, the combined proliferation of laptops and wireless Internet access has created a new, and potentially negative, dynamic in the college classroom. With myriad computer programs and Web sites at students' fingertips, their attention can easily become diverted away from the class content. Today's faculty must compete with laptops which have new and engaging forms

of online content including social networks and contacts, email, instant messaging, notification systems computer games, RSS feeds, downloadable television shows and online shopping. Indeed, with new technologies, services, and communication channels, the Internet has changed and continues to evolve in important ways. The new abundance of online tools and options is supplanting many traditional forms of communication. Moreover, these new technologies can introduce an unprecedented and enticing pull away from the classroom and the instructor, which can lead to disengagement, distraction, and potentially negatively impact student learning.

Dismayed at students' level of distraction and reduced participation, some professors are objecting to the availability of wireless internet in their classroom.

Anecdotal evidence of an emerging problem has been reported on various campuses.

Professor Dennis Adams of the University of Houston remarks, "You can be in the front of the classroom and your hair could catch on fire and they'll never see it because their eyes are glued to the 14-inch screen at the end of their nose" (McWilliams, 2005, para.

3). Adams, who advocates the ability to turn off Internet access to students in classrooms says,

There may be times when access is appropriate for a particular exercise, but there are also times when I need to decrease or eliminate the number of electronic distractions. While classroom access to the Internet may be a wonderful teaching tool, it can also be a barrier to learning (Adams, 2006, p. 25).

Dr. Don Herzog, a law professor at the University of Michigan, says "One of my jokes is that I'm willing to compete with Minesweeper, but not with the entire Internet" (Cohen, 2006, para. 13). Dr. Herzog continues with this comment:

At any given moment in a law school class, literally 85 to 90 percent of the students were online, [...] and what were they doing online? They were reading The New York Times; they were shopping for clothes at Eddie Bauer; they were

looking for an apartment to rent in San Francisco when their new job started.... And I was just stunned (Ridberg, 2006, para. 3).

Professor Ian Ayres of Yale Law School is another critic of the laptops and Internet's introduction to the classroom. Ayres sees laptop and Internet use as negatively impacting students themselves. Unless law students are fully engaged in the class, he says, they miss out on the give and take of ideas in class discussion and do not develop the critical thinking skills that emerge from "deeply tearing apart a case" (Schwartz, 2003, p. 11). Dr. Ken Brown, Associate Professor of Business at the University of Iowa recently requested the ability to turn off Internet access in his classes, "I would never suggest we ban laptops, because we are interested in technology," he said. "But we need to keep in mind that [technology] is just a tool" (Cropp, 2006, para. 5). Carnegie Mellon University history professor John Soluri says "The problem I have is not with the *laptops*, per se, [...] The problem is that I know that some people use laptops to e-mail, to watch movies, to do whatever, and they're not really using them to take notes" (Sostek, 2005, para. 6).

Some faculty members have taken their own steps to reduce students' use of laptops and wireless Internet access. June Entman, a law professor at the University of Memphis forbade students from bringing laptops to her civil-procedure class in the spring of 2005. In an email to her class she explained her rationale for the ban "The wall hampers the flow of discussion between me and the class and among the students. Also, by giving students a sense of anonymity, many are encouraged to feel that they are present merely to listen in" (Young, 2006, para. 11). This ban did not go over well with her students. In protest against the ban, some of her law students signed a petition against her policy and filed a complaint with the American Bar Association, contending that they

were being denied an up-to-date education. This complaint was dismissed, but the case gained wide-spread coverage in media.

After spending sizable sums to spread wireless Internet access to classrooms, some colleges, universities and departments have setup systems that allow professors to switch off classroom internet access at their discretion. At the University of Virginia's Darden Business School, wireless Internet access is disabled in classrooms and auditoriums during class time. Former Darden Dean Elliot Weiss said they "came to realize that having Internet access was like placing a big bowl of candy in front of students" and that "they'd eat, whether they were hungry or not" (Mangan, 2001, para. 9).

The University of Michigan's law school implemented a system that allows instructors to control wireless access during class time. According to stated policy, "The decision as to how much Web access a student will have during each class session or exam is made by the professor teaching that class" (University of Michigan Law School, 2006, para. 5). Likewise, Harvard Business School has had similar control measures in place since 2001. Harvard's implementation disables Internet access when students are in class because their individual course schedules are linked to their wireless access (Bhayani, 2006).

In the spring of 2006, two Harvard Law School groups hosted a wide-ranging discussion on whether the school should consider limited Internet access in the classroom. A panel of four faculty members and an audience of about 50 students debated the relative merits of Internet access in the classroom. At issue was whether the Law School should choose to follow the model of the Harvard Business School in

disabling wireless Internet access in classrooms. The debate focused on whether Internet access aids in classroom learning and highlighted disagreements among faculty and among students on the most effective and appropriate use Internet access in the classroom. Harvard Law School professor Bruce Hay banned laptops from his classroom citing the distraction laptops can cause to the user and others in class. “Frankly, if I was in their position, I would be tempted to check my e-mail. I understand it. But when a lot of people do it, it becomes demoralizing and distracting. [...] My sense is that the quality of classroom discussion has gone down in the past five or six years. I think that more or less corresponds with the widespread introduction of laptops” (Cohen, 2006, para. 20).

In an April 2006 survey of 1,057 students at Harvard University, a 64.6% majority did not support a wireless ban. When asked how a ban on wireless in the classroom would affect their level of attention, the modal response of 38.7% stated that they would pay more attention. Almost a third (30%) stated there would be no effect because, “I usually pay close attention anyway,” and 25.9% stated there would be no effect because “I would find other ways to distract myself” (Harvard Law School Council, 2006).

Five years ago Bentley College in Waltham MA, set up an on/off switch for wired Ethernet connections in each classroom. Known as the “classroom network control system,” it lets professors select from one of five settings: allow all access, shut off all access, disable Internet and e-mail access but allow computers to reach campus Web pages, disable e-mail but allow Internet access, and disable Internet access but allow e-mail access. In the fall of 2005 the college managed to implement this same service on their wireless classroom installations. Now, about half of the professors use the system to

block Internet access which is controlled by a PC at the instructor's podium (Mangan, 2001; Silva, 2006). Attaining this blocking mechanism for wireless access, however, proved to be much harder than the wired network. Bentley's principle network engineer Todd Marsh manages the system by manipulating the signal strength and antenna configuration of each wireless access point to keep the signal confined within each room. Although the system is not 100% effective, Marsh reports "from the most recent feedback it's working fairly well" (Young, 2006, para. 54).

Adding to the technical challenges of prohibiting Internet access are private Internet service providers such as Verizon wireless. Such services could not be interrupted by existing wireless infrastructure techniques. Moreover, college and university classrooms which are adjacent to non-campus building may bleed wireless signals into classrooms, allowing students continued Internet access. Director of Academic Technology at Bentley College, Phillip Knutel said that kill switches "would never be without their loopholes," adding that "If a student has a commercial service, the kill switch would not affect it" (Cropp, 2006, para. 7). Alternative plans could attempt to side-step the issue of wireless signal bleed by restricting Internet access based on student identification. Such a system, however, would require an additional layer of complexity to dynamically enable and disable access to resources based on student ID, location, and time.

Some professors and administrators counter the idea of banning wireless Internet access. Dan Weiss, associate director of instructional technology at Loyola Marymount University's law school says, "It's teachers who refuse to engage students well enough and who don't set proper boundaries as to what is and isn't acceptable in the classroom"

(Young, 2006, para. 21). Randy Picker at the University of Chicago Law School echoes this same sentiment. “Obviously the Web is something of a distraction, but there are a lot of distractions. My job is to make them want to pay more attention to me than what is on the screen” (Cohen, 2006, para. 22).

Brian Voss, chief information officer at Louisiana State University also counters the laptop ban argument stating “I’d say banning laptops or shutting off wireless on demand is like throwing the baby out with the bathwater. Both are draconian solutions to a problem that requires something a bit more diplomatic” (Young, 2006, para. 43).

Rudy McDaniel, assistant professor of digital media and English at the University of Central Florida, compares banning wireless computer from the classroom with banning pens and paper.

Much like a professional speaker will adapt her speech in response to cues from the audience and environment, so should a lecturer acknowledge those clues in the classroom. Numerous computers open to dating services and sports blogs should indicate that the lecture is not as successful as it could be. Instead of immediate disciplining, why not gather information and improve the situation for both parties? Find out what students are engaging with and assess the problem using that new data. If there is too much chat, ban only instant messaging or suggest periodic random “sharing” of screens with the class. If feckless browsing is the problem, direct students to a few of your own favorite sources and ask them to find some of their own. [...] There always will be students who take advantage of technology to escape from academic engagement. The next time you spot students with glazed eyes peering into a laptop during your lecture, consider a new approach: Ask them to find an online example of a topic you’re discussing and share it with the class. Repeat as necessary with new offenders. That “distracting laptop in class” problem might just take care of itself (McDaniel, 2006, para. 5).

Weaver and Nilson (2005) acknowledge a dearth of evidence that laptops enhance learning, but advise that skeptics take another look at the good things that can and do happen with laptops in university classrooms. Emphasizing pedagogically sound use of

laptops and proper faculty development, Weaver and Nilson contend that “student behavior problems as Web surfing and e-mailing almost disappear when the laptop activities truly engage the class” (p. 4). Each chapter in their recent edited volume highlights success stories across disciplines and courses at Clemson University. Faculty workshops at Clemson continue to explore and develop more student-centered approaches to teaching which rely on interaction, participation, collaboration and hands-on experience. Weaver and Nilson believe that benefits from laptop use can be achieved without sacrificing the quality of student-instructor interaction. Specifically, they see laptops as an opportunity for instructors to make their classes more student-active and engaging through active participation in both technology and pedagogical training.

Willingness to change aspects of their teaching style and formats-in particular, to move toward a studio, master-apprentice, interactive, hands-on, discovery-based, experimental, or collaborative model of teaching and learning (obviously more challenging in a large class) [...] Willingness and ability to invest considerable time in developing pedagogically sound and student-engaging laptop assignments, exercises, and projects (p. 12).

The continued deployment of wireless networks, combined with an increasing number of students with laptops has brought issues of distraction and participation to the forefront. The questions and concerns that have been raised at these colleges and universities build a case for further research into the complex issue of wireless laptops in the classroom setting.

METHODOLOGY

This study solicited the opinions and perceptions of faculty and adjunct instructors on the impact of students' wireless laptops on their teaching and classroom dynamics. In order to best obtain and gauge these views, an online survey was developed to assess the perceptions of a broad range of instructors including full, associate and assistant professors, adjunct and clinical instructors, and graduate fellows. To ensure that the sampled population had experience with student laptop use in their classrooms, the survey was sent to instructors at the University of North Carolina at Chapel Hill (UNC-CH), a university that has required student laptop ownership for six years. Likert-scale questions were designed to provide quantitative measures of instructor demographics, teaching experience, and broad views on the impact of wireless laptops in instructor's classrooms. Open-ended questions were designed to allow respondents to express their viewpoints with more precision, subtlety, and depth. The responses to this combination of questions will assist in characterizing broad views and capturing nuanced feelings and opinions. The following section details the procedure and methods used to conduct this study. It describes the study's design, implementation, respondents, and summarizes the steps used to collect and analyze the data.

Data Collection

On September 26, 2006 an email invitation was sent to all UNC-CH faculty and staff requesting their participation in the study. The text of the email invited all faculty and adjunct instructors to follow a link to the survey. The survey instrument was

developed using the SurveyMonkey.com online software application. The survey was approved by the Institutional Review Board of the University of North Carolina at Chapel Hill (09/22/2006), and all responses were kept completely confidential. No personal information was collected. The survey consisted of 24 questions, was open for a period of one week and received 244 responses. Possible bias may have been introduced into the survey through the sample collected. It is possible that instructors and faculty members who agreed to participate in the survey had stronger opinions and viewpoints than those who did not participate.

The survey (see Appendix A) was composed of several sections including demographics, current teaching practices, and perceptions. The first demographic section queried instructors' rank, school, department, sex, age, and number of years of teaching experience. Section two solicited information on respondents' current teaching practices in relation to wireless laptop computers, including any formal policies instructors had, and the use and incorporation of laptops in their classroom. The third section sought instructors' perceptions on a range of questions related to the impact of wireless laptops in their classrooms. These questions sought to gauge instructors' views on the impact of wireless laptops on classroom dynamics and on students' level of engagement in the class, instructor's opinions on the use of classroom Internet blocking mechanisms.

Data Analysis

When the survey closed, the quantitative data was exported from SurveyMonkey, converted into a Microsoft Excel spreadsheet and imported into SPSS for further analysis. Both quantitative and qualitative data were collected to address faculty perceptions. Five-point Likert-scale questions were combined with open-ended questions

to elicit more comprehensive responses. Questions of an interval and ratio nature were examined using descriptive statistics. The open-ended quantitative survey responses were also exported from SurveyMonkey into Microsoft Excel and then brought into Microsoft Word for further analysis. Over 1600 responses to the nine qualitative questions were examined using an iterative process. Coding began with an initial reading of the responses to each open-ended question. Rough descriptions, labels, and codes were written based on the respondents' answers. Notes were also taken on patterns, deviations, contradictions, relationships, and respondent stories and ideas for further investigation. Using the initial categories and notes, a second focused coding of the data was conducted concentrating on identifying similarities and differences between responses and on simplifying the data. Themes and sub-themes were further refined as categories were eliminated, combined or further subdivided as necessary in relation to their prevalence and pertinence to the question. A third reading of data was conducted to delimit the emergent themes and label responses in a line-by-line fashion. Responses were group into categories and analyzed in terms of their frequency.

RESULTS

This section presents the results of the study, outlining the quantitative and then the qualitative results. The online survey was available for a period of one week and had 244 participants.

Quantitative Data Analysis

Questions 1-6 solicited basic demographic information. Not every question was answered by each respondent. Therefore, the number of respondents is listed for each question.

Data (n=236) displayed in figure 1 showed female participants outnumbering male participants 58.1% to 41.9%.

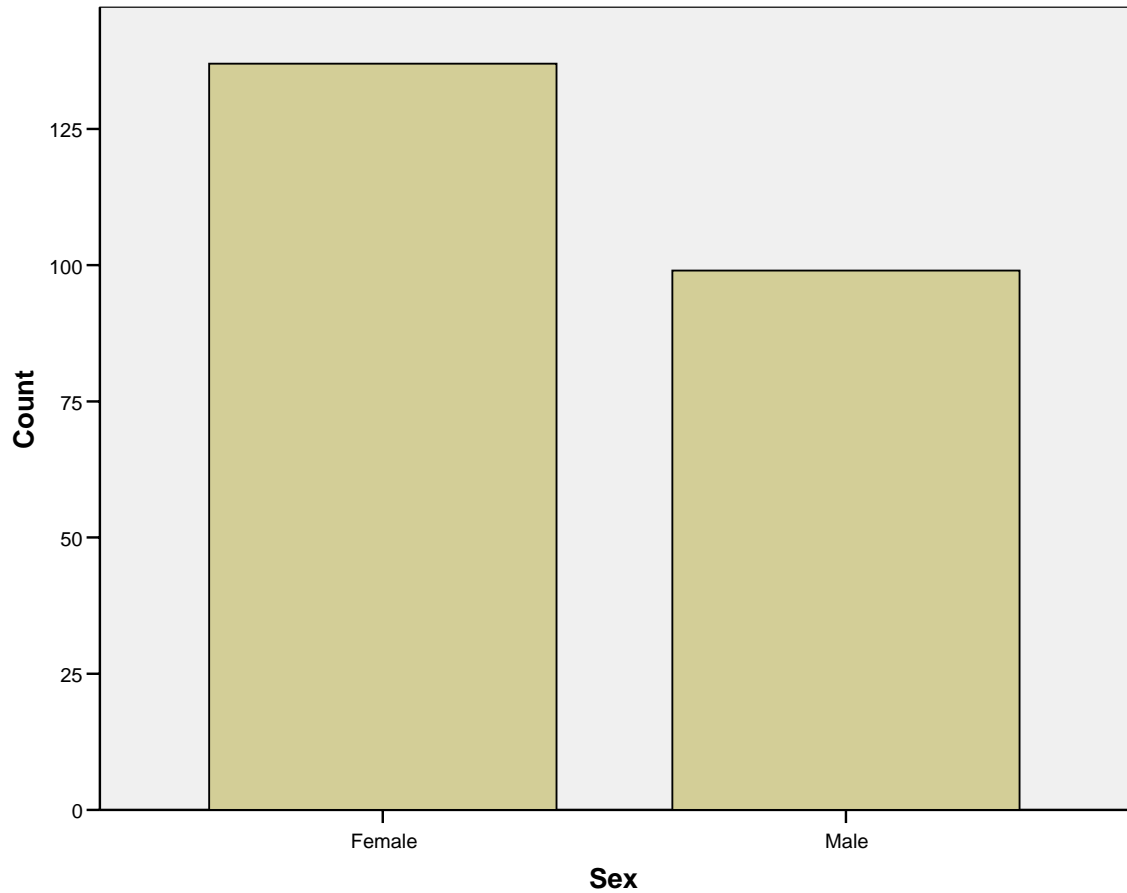


Figure 1. Sex of participant

Figure 2 shows that participants ($n=243$) were roughly equally divided among full professors (24.3%), associate professors (17.7%), assistant professors (25.5%) and others (22.6%). Fewer adjunct instructors (9.9%) participated in the survey.

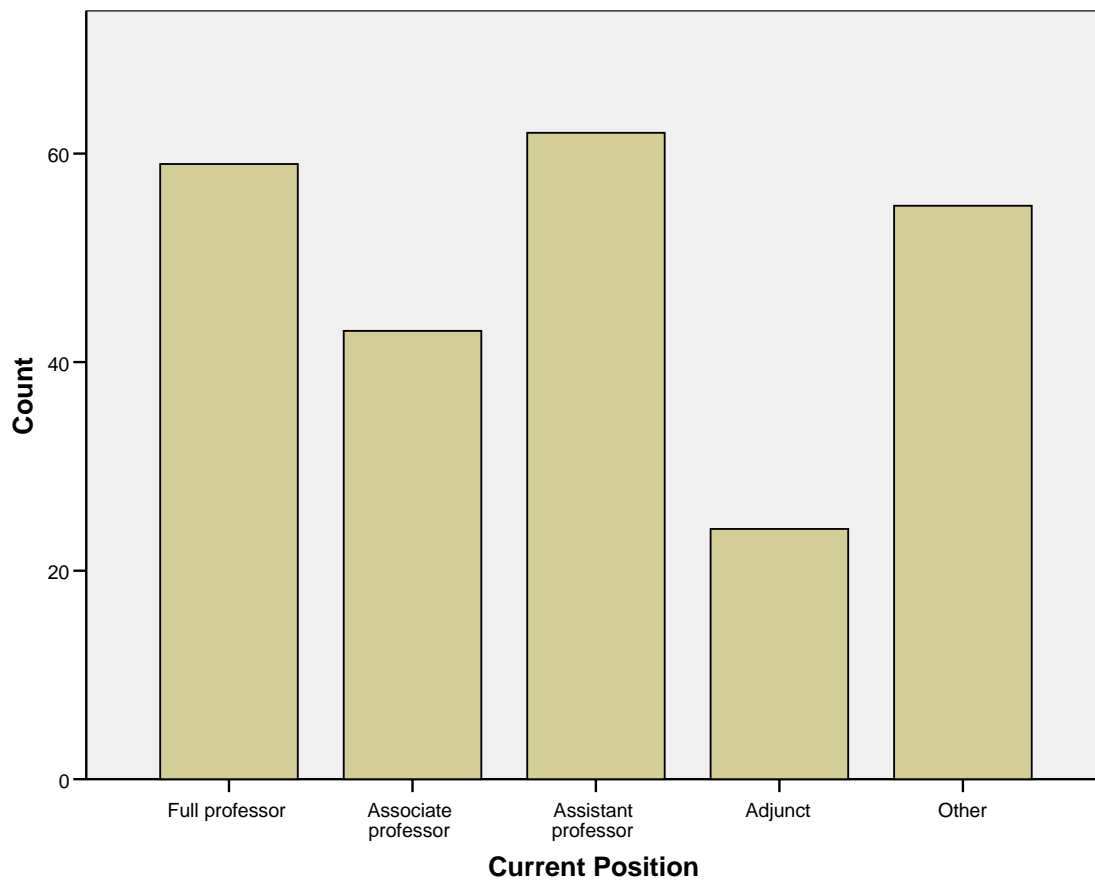


Figure 2. Current teaching position

A total of thirteen different schools and colleges within UNC-CH were represented (n=233). Responses by age (n=237) were roughly bell-shaped as seen in figure 3.

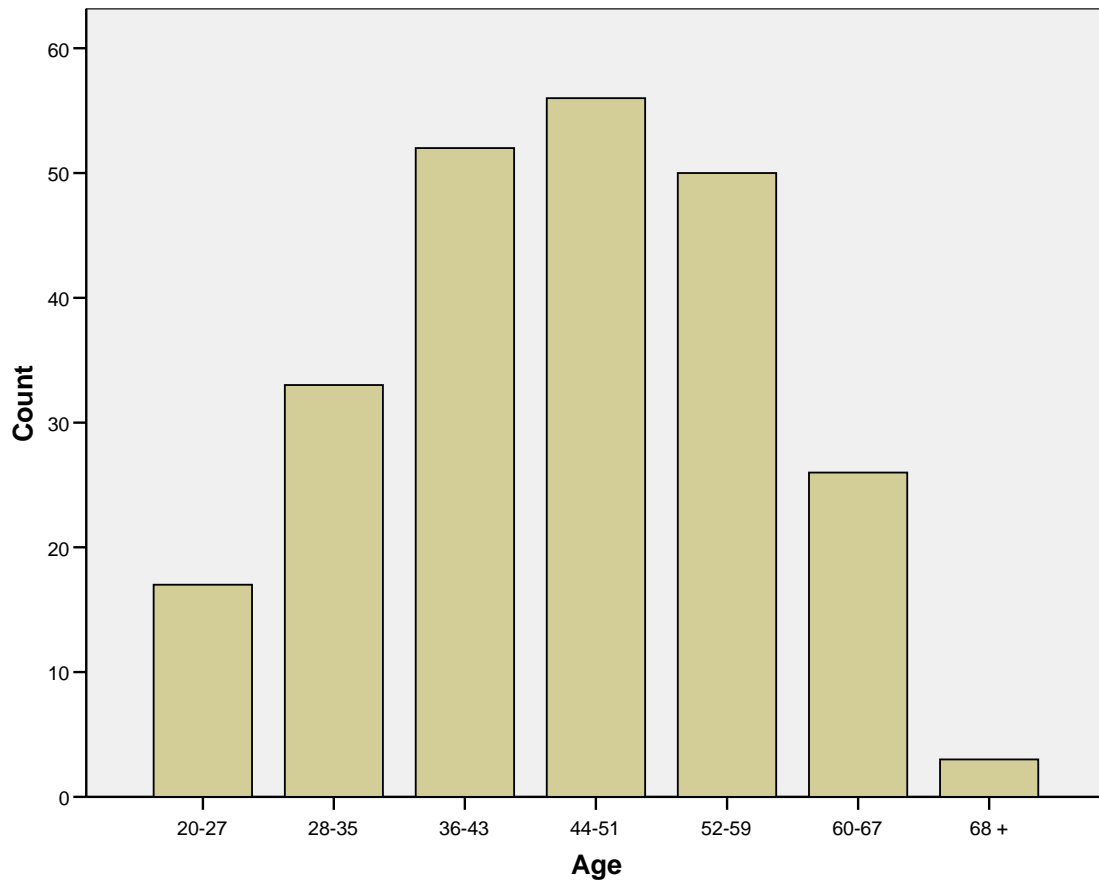


Figure 3. Age of respondents

Approximately one half of respondents (n=239) had 10 years or more teaching experience in higher education as shown in figure 4.

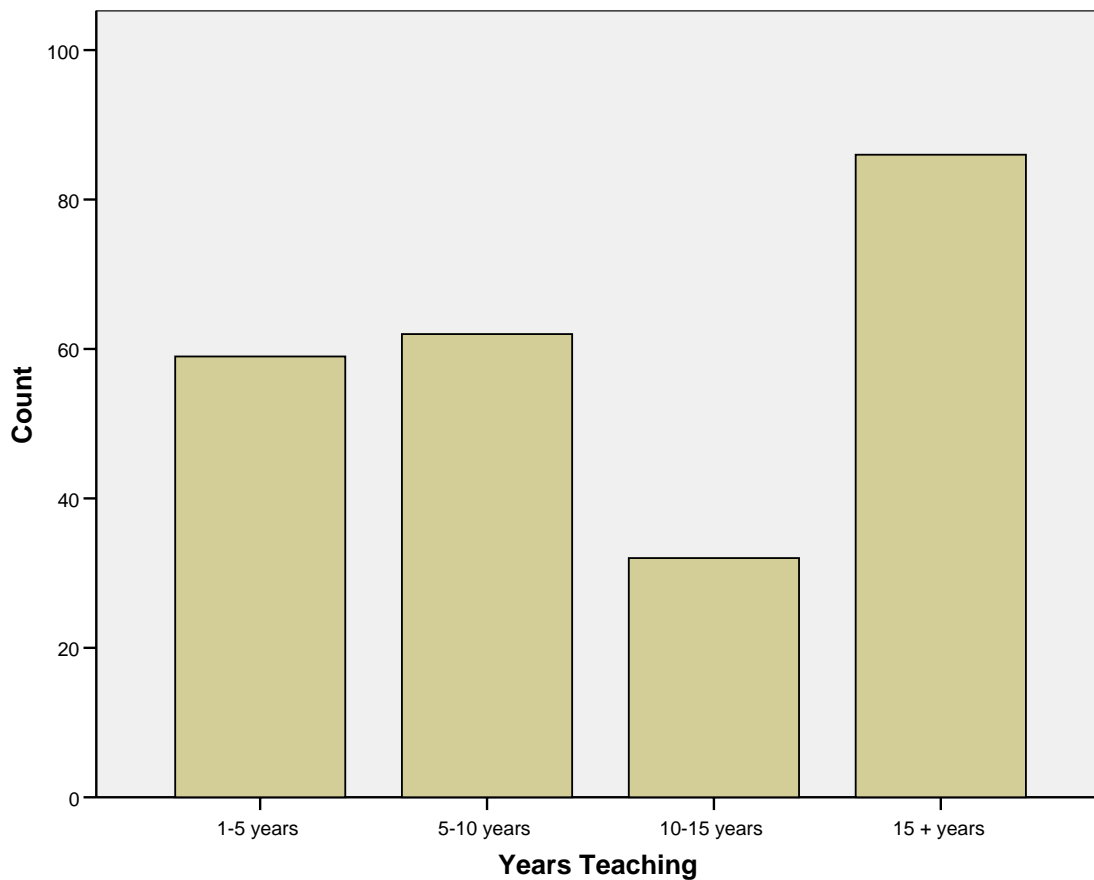


Figure 4. Years teaching in higher education

In response to question 7 (n=224), “Do you _____ student use of laptops in your classes?” 53.1% of respondents answered that they “allow” student use of laptops.

Almost nine percent (8.9%) said they “require” laptops, 11.6% “encourage”, 21.4%

“tolerate” and 4.9% “prohibit” student use of laptops in their classrooms (figure 5).

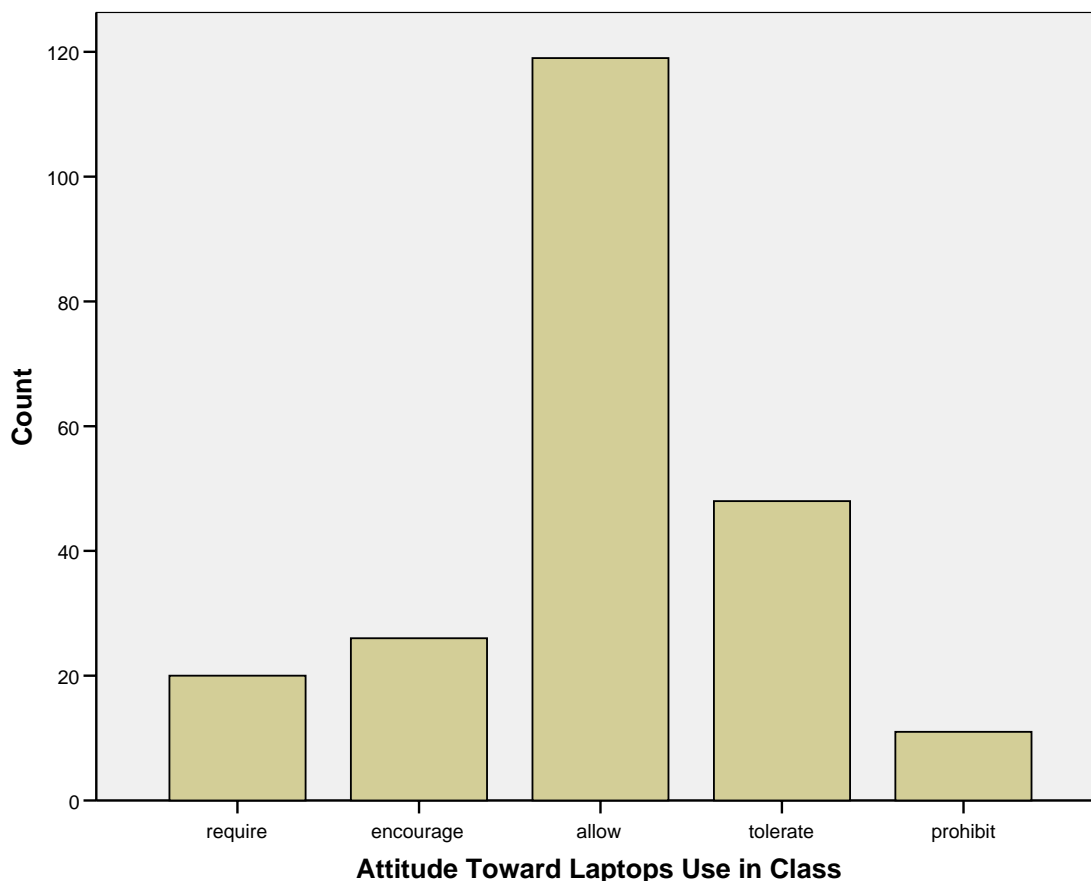


Figure 5. Approach to student use of laptops

Figure 6 shows that a wide margin of respondents (n=206) agreed that students are more likely to become distracted when using laptops with wireless Internet access in class. Over three-quarters of respondents (77.1%) indicated that they “agree” or “strongly agree” with the statement, “Students are more likely to become distracted when using laptops with wireless Internet access in class.” Just 13.1% said “disagree or “strongly disagree.” Approximately 10% (9.7%) did not know.

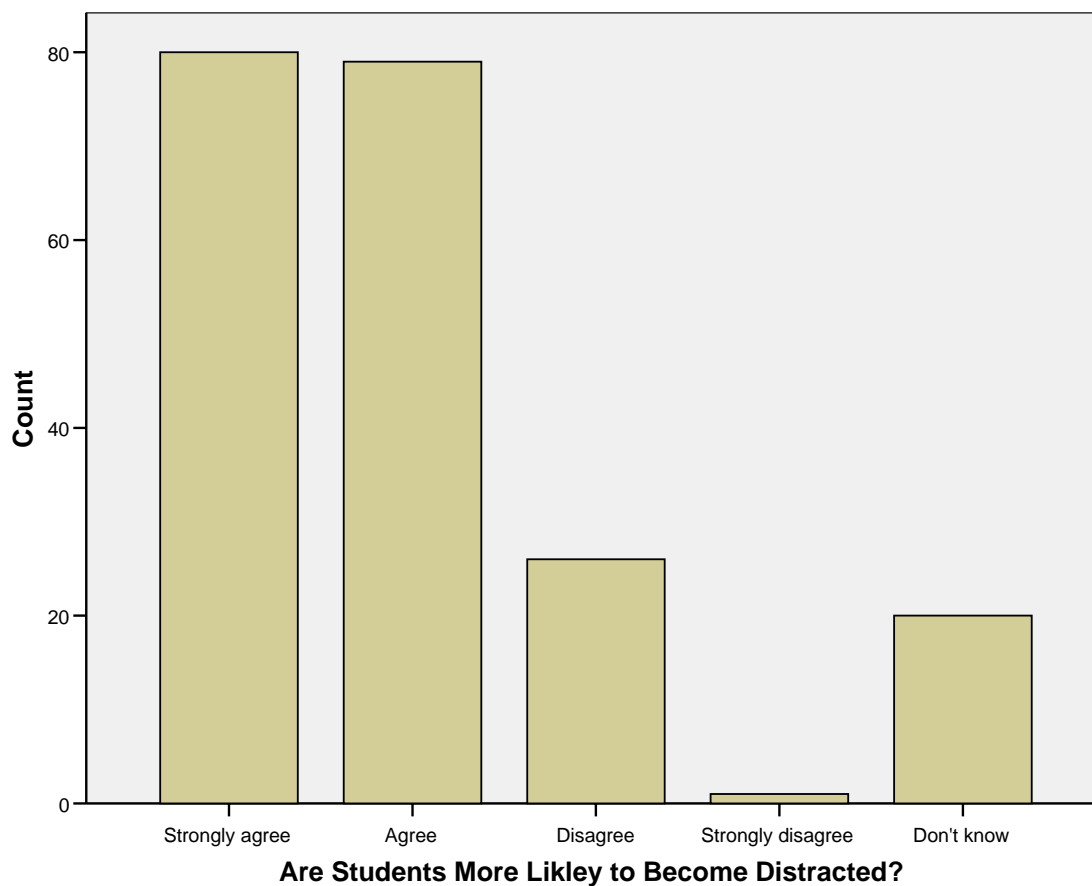


Figure 6. Are students more likely to become distracted?

Figure 7 shows the modal response (37.2%) to question 11 (n=207), indicating that respondents *did* have a good idea of what their students were doing with their laptops during class. However, a closer look revealed an even split between those who agreed or strongly agreed and those who disagreed or strongly disagreed. Slightly more than 10% did not know, adding some weight to idea that instructors often do not know what their students are doing with their laptops.

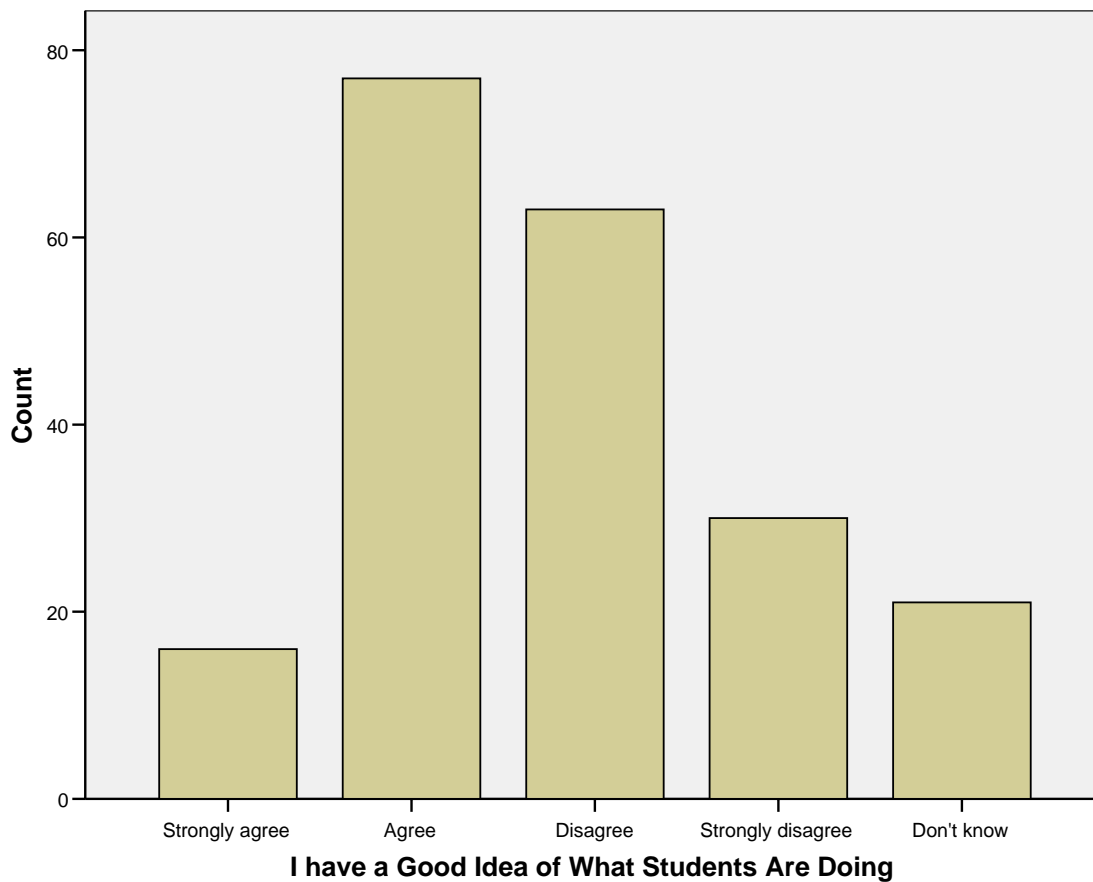


Figure 7. I have a good idea what students are doing

On question 12 (n=206), regarding students' participation in class, most disagreed that participation increases because students use laptops. Over 70% disagreed or strongly disagreed, while over 18% did not know, as shown in figure 8.

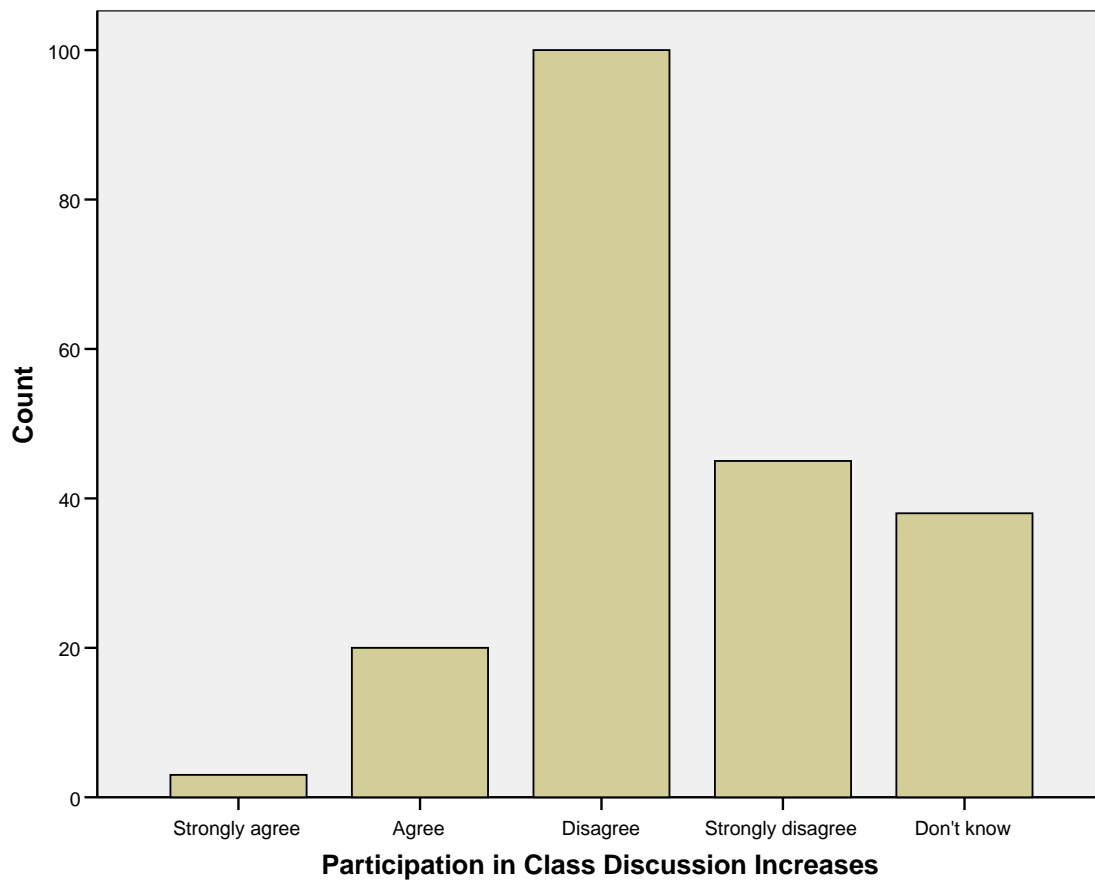


Figure 8. Participation in class discussion increases

On question 13 (n=203), respondents agreed that instructors should have the option to prohibit laptop use in their classrooms. An overwhelming 90.6% either agreed or strongly agreed, as see in figure 9.

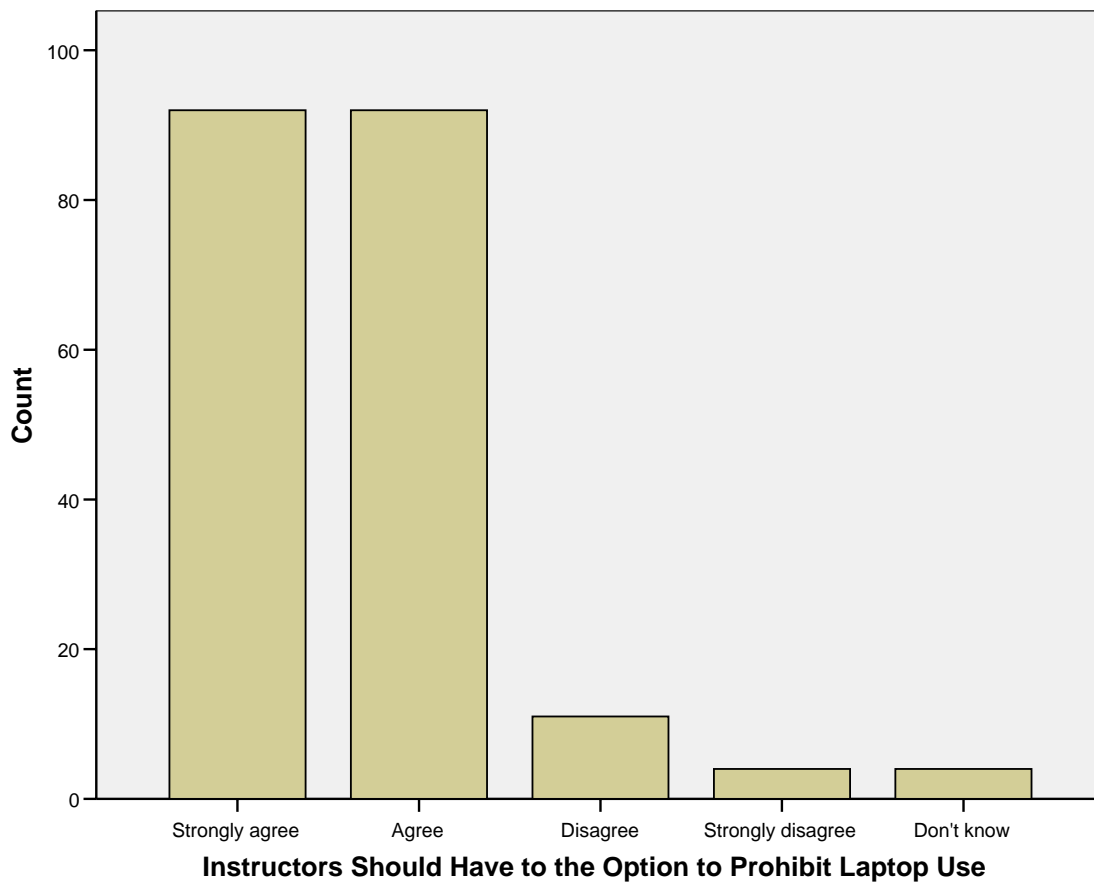


Figure 9. Instructors should have the option to prohibit laptop use

On Question 14 (n=205), a clear majority (73.7%) indicated that they would make use of the ability to turn off Internet access at their discretion during class if that feature were available (figure 10).

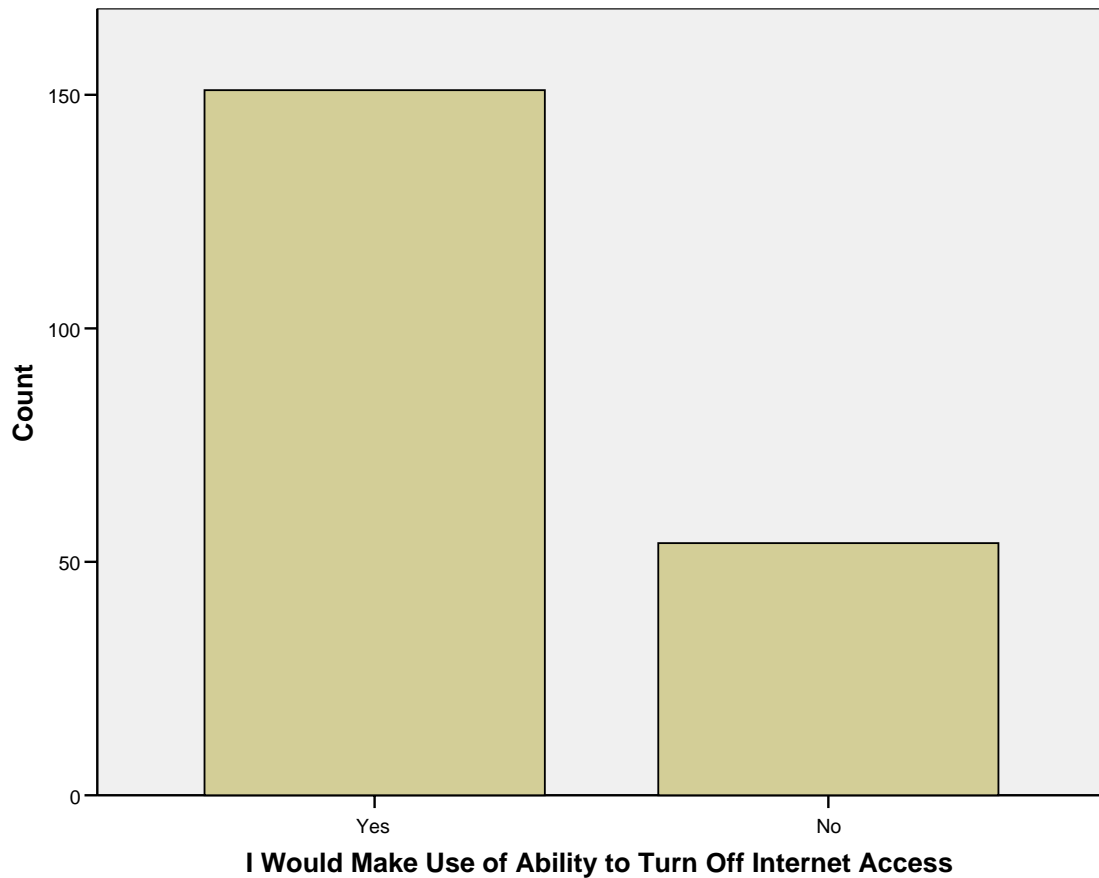


Figure 10. I would make use of the ability to turn off Internet access

Question 15 (n=182) asked, “If it were possible, in which situations would you turn off or restrict Internet access in your classroom? Select all that apply.” Answers were almost equally divided between discussion, lecture, and presentation, with group work and other trailing (figure 11).

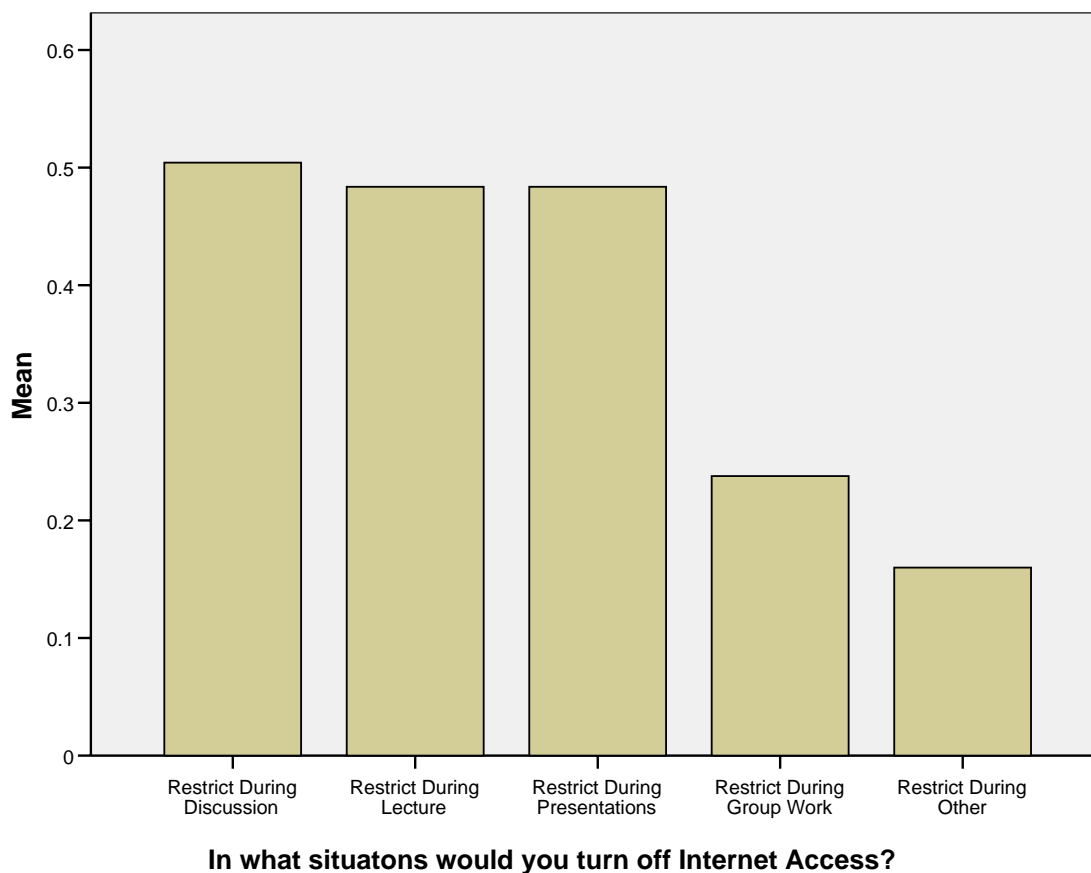


Figure 11. In which situations would you turn off or restrict Internet access?

Respondents generally agreed with the statement in question 16 (n=205), “The ability to turn off Internet access at my discretion would improve participation in my classes.” Figure 12 shows that nearly half (48.3%) agreed or strongly agreed that turning off the Internet would improve class participation. Approximately one-fifth (22.4%) disagreed or strongly disagreed and 29.3% did not know.

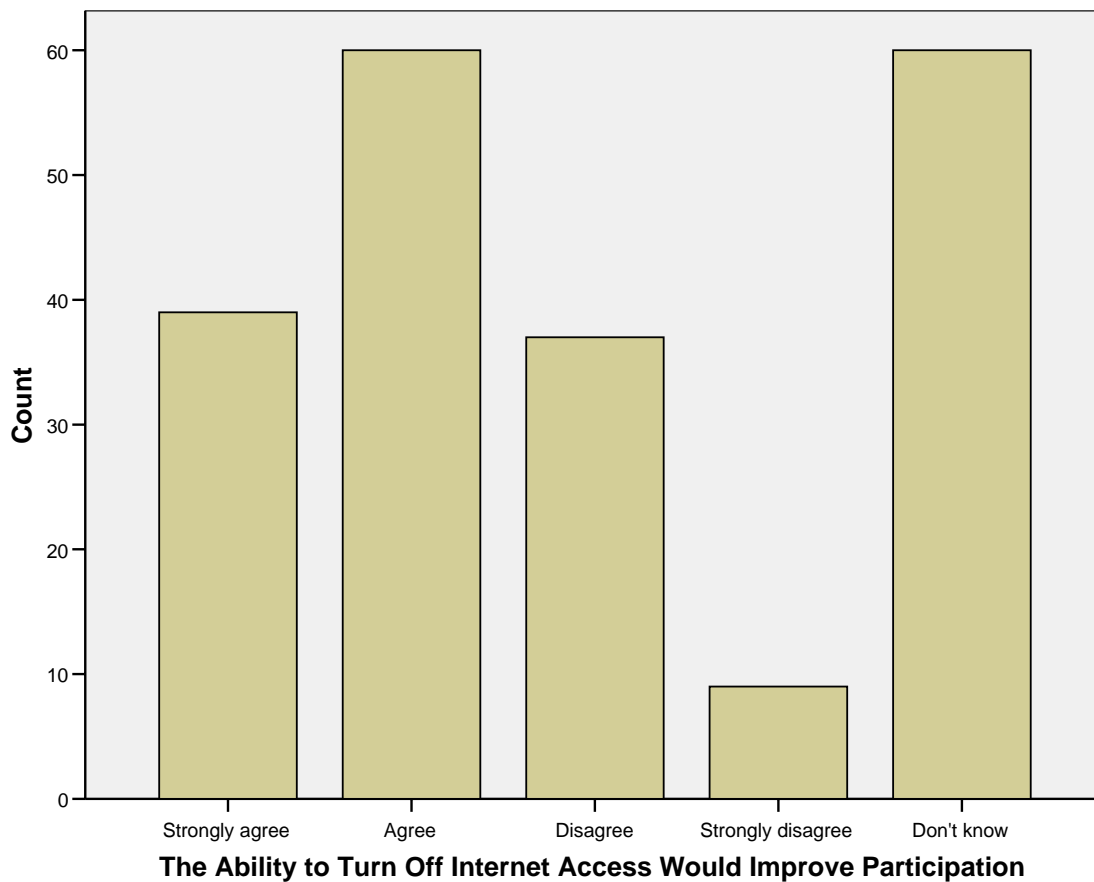


Figure 12. The ability to turn off Internet access would improve participation
Figure 13 shows that by almost a seven to three margin, respondents (n=198) thought that today's Millennial students need to be taught differently than students 10 years ago.

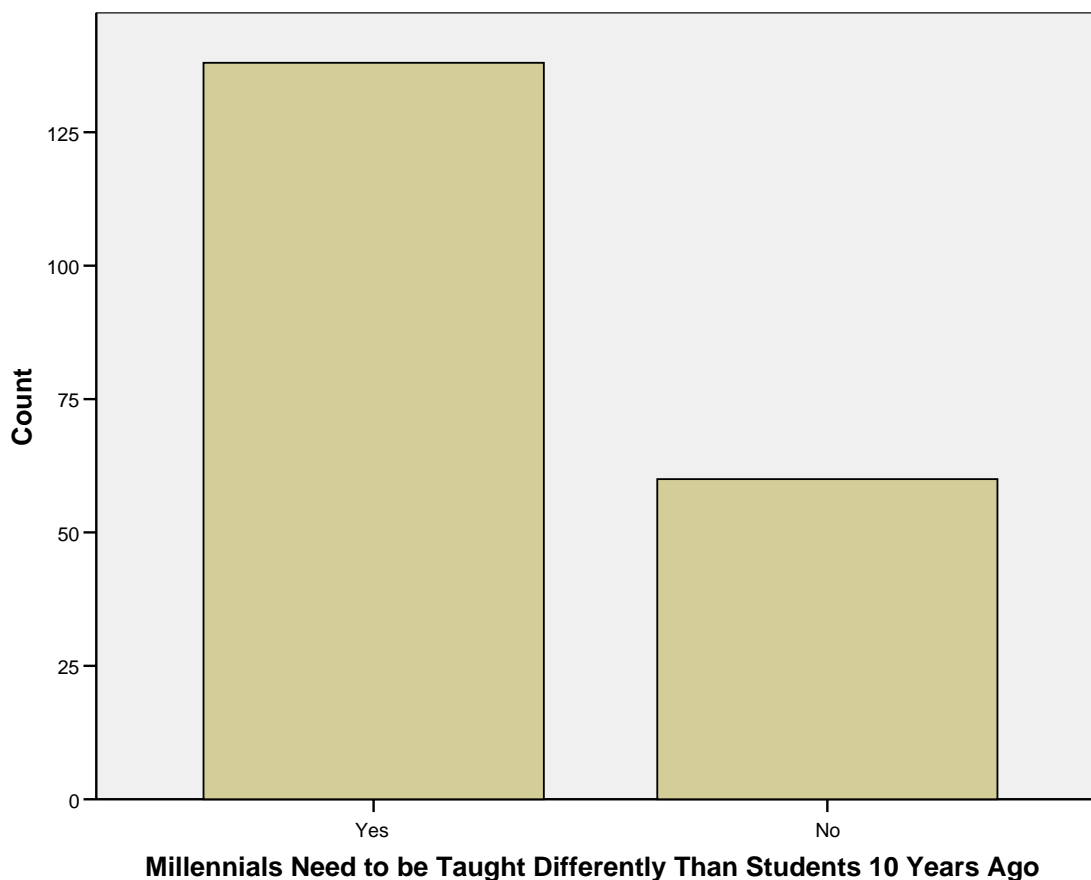


Figure 13. Millennials need to be taught differently than students 10 years ago

Qualitative Data Analysis

The narrative responses to the open-ended questions provided a deeper, more personalized understanding of faculty perceptions in relation to classroom laptop use.

The following section details the most important themes, types of responses, and issues expressed by faculty in response to the nine open-ended questions.

Question 8: Please explain any formal policies you have regarding student use of laptops during class. (181 responses out of 244 participants)

Instructor responses varied from having no policy, some type of policy, “heading towards” a policy, and having an explicit policy. The most common response was to

report no formal policy. Many other respondents either had a formal policy or had some aspects of a policy. The remaining respondents referred to existing school policies that they followed or indicated that they had no policy but were headed in the direction of creating one for their classrooms.

Respondents with some elements of a formal policy characterized their approaches as requests, suggestions, warnings, discouragements or expectations. They cited numerous ways in which students are and are not allowed to use their laptops. For example, instructors cited the following ways in which students were allowed to use laptops during class:

- note-taking
- looking up past assignments
- looking up information
- multi-media use and oral presentation
- in some lab classes
- when using specific software
- during breaks
- after asking permission
- when seated in a seat with no one behind them
- while sitting in the back, with the sound muted
- when using the schools' software
- when the desks are arranged so that the instructor can see all of the screens

Conversely, students were variously discouraged, forbidden or otherwise not allowed to

do the following:

- surf the Internet
- play computer games
- take excessive notes
- do research
- instant message
- listen to music
- watch videos

Responses also pointed to specific contexts in which students were not allowed to use their laptops, such as during discussions, in-class exams, experiments, specific activities, in honors sections, in small groups, at the end of class when the instructor is summarizing the lesson, during a lecture, and when students otherwise go “off-topic.” In response to students who disobey classroom laptop policies or guidelines, instructors noted that they deal with such indiscretions by counting the student absent, confiscating their laptop for the day, revoking their privileges or requiring that the laptop be turned off if they are found checking emails or surfing the Internet, or by “calling them out” and asking them “not to do it again.”

Respondents with a formal policy generally fell into two categories: a) laptops are required as part of school policy or b) laptops are entirely banned in their classroom. In the instances when a respondent had a formal policy, they taught in the School of Medicine or the School of Law, as these schools have existing laptop policies and requirements. Respondents stated that laptops were required of medical students so they can take part in the Audience Response System (an electronic polling system). A School of Dentistry respondent noted that student use of computers in the classroom is now at the discretion of the instructor. The respondent added that they ask students to keep their laptops closed during class.

Regardless of the existence of a laptop policy, many respondents specified that laptops were “only meant to be used for classroom purposes” and that their use should not cause the student to become distracted or stray off-topic. Many indicated that a student’s laptop use should be used for classroom purposes, and that students should avoid “behaviors that are distracting to classmates and instructors.”

Question 9: In which classroom contexts (besides exams) do you ask students to close or turn off their laptops? Please explain. (188 responses out of 244 participants)

Most respondents stated that they do not ask students to close their laptops or have not experienced a need to ask students to do so. Respondents typically made statements like, “A few students use laptops for notes or to check email during breaks – I haven’t noticed at all that this causes any problem in group interaction or activities.” Another noted “I didn’t think I could ask them to turn them off, since the university encourages the use of laptops so strongly. Therefore, the only situation that laptops are forbidden is during tests.”

The minority of respondents who had already prohibited laptop use in their classroom indicated so on this question. One respondent explained his stance this way:

Laptops not allowed in any situation. They only serve to distract the students. From my experience sitting in on undergraduate classes where I can see their screens, I know that 50% or more of the students are checking email and chatting on IM during class.

For the remaining respondents, the most common situations for asking students to close their laptops included during group work, discussions, interactive activities, videos, lectures, demonstrations, presentations, guest speakers, student presentations, with patients, during field trips, in “larger” classes, in seminars, when giving instructions, if students are causing too much noise, and during “lectures and seminars that require thinking together.”

Broadly speaking, several respondents stated that they would ask students to close their laptops if they felt students were becoming “overly distracted.” One instructor stated, “I usually don’t [ask students to close their laptops] unless I feel we are having a

problem in a particular class with people doing other things (emailing, IMing, Facebooking) during class.” Similarly, another respondent stated that they had no occasion to have students close their laptops, “unless the student is disturbing other students with what is on his/her laptop.”

Instructors in the School of Medicine noted that laptops are even in use during exams. Special software installed on laptops blocks both Internet access and access to users’ local files during exams. Additional school software known as the “Audience Response System” is also used to solicit feedback by polling students’ responses periodically during regular class time.

Question 17: How do you think students' classroom use of laptops benefits students? Please explain. (189 responses out of 244 participants)

This question elicited more in-depth responses. A large majority cited note-taking as the chief benefit provided by laptops. The advantages of laptop note-taking were described in many facets, including the following:

- saves transcription time and effort
- students can type faster than they can write
- counteracts bad handwriting
- many students seem to be more comfortable taking notes on laptops
- will not lose notes
- saves ink and paper
- more legible
- searchable
- organized
- digital notes are more easily manipulated and modified

Respondents further explained that students have reduced printing costs, do not have to copy things over, can interact with digital presentations, study more efficiently, and that students can be better able to pay attention in class.

Paying attention to the PowerPoint presentations or taking notes directly in PowerPoint was commonly seen as another benefit. Additionally, respondents also identified conducting research or using Google as another advantage of laptop use in class. A host of other benefits cited included reading classmates' blogs, conducting impromptu or instant research, finding and sharing current news and information, and accessing class source material.

Numerous benefits related to specific activities and situations were also mentioned. These included in-class writing exercises, "enabling lab exercises," computer programming activities, lab courses where the laptop is the primary data collection vehicle, ability to "try things live," running statistical applications, using Blackboard, with interactive software related to course content, answering questions, conducting in-class peer-reviews of their papers, audio or video taping the lecture for later replay, for those with poor eyesight, and use during group projects. Discussing in-class writing assignments, one instructor said,

There is also a perceptible improvement in students' writing, probably because use of the laptop allows for/encourages even minor revisions. There have been instances in class where students who were curious about something I said found some relevant information on the internet and shared it with the class. Their finds added some interest and color, but not substantially so. I have also found pairs of students with their heads together over a laptop screen during a lecture. At times this is unnerving, but when I have questioned the students involved about it, they informed me that they were checking the internet for things related to the topic of the lecture or discussion. Mainly I learned that things are not always what they appear to be, and that what I as a lecturer can construe as distracted behavior actually may be behavior motivated by interest in the subject.

While note-taking and numerous other possible benefits were cited, several important caveats to laptop use were raised. Besides note taking, respondents expressed their "skepticism at other uses" or indicated that benefits came only if the laptops were

somehow incorporated into the lesson. Another response noted that students have different levels of sophistication and focus with laptops and that benefits only extend to those who stay “on task” during class. Referring to the use of PowerPoint, a respondent added, “I worry that students are spending more time on the form of their content presentation - how many features of PowerPoint can they let loose - than on the substance.” Likewise, another respondent noted that “I still like for students to take notes [handwritten] because I feel that it is one more active way to interact with the material.”

Faculty members also expressed concerns about the effectiveness of laptops as an information gathering tool and the types of sources students tend to reference:

I think it is just another way of facilitating learning. Honestly, I think it probably deters profound contemplation of questions and produces mediocre at best undergraduate research, at least in my field. I do not allow materials gathered from the net as legitimate sources, except for graphics. We have too many excellent data bases through the library system here to even consider accepting 'googled' information [sic] or that extracted from Wikipedia.

The following comment that was raised by another respondent reflects on how the tenor of a discussion can change when laptops are used to quote verbatim from an online source:

Sometimes students can look up additional info in class that can add to the discussion, but I have also seen it used to 'upstage' a presenter by quoting verbatim from something on the internet. It seems that we are mixing mediums inappropriately in those situations. In discussions we are not usually quoting sources verbatim, rather we are discussion ideas at a more general level.

Interestingly, a number of respondents stated that laptops did not provide any benefit to students in the classroom setting. This minority opinion stated either that laptops do not benefit students, benefit them only on rare occasions, hinder interaction or note taking, or that laptops “do not offset distraction.” Some also stated that students

become proficient at video games, IM, Facebook, email, and solitaire or visit inappropriate sites. One respondent said “I think they use them to send email and ‘goof off’.” Another respondent stated, “On the whole, classroom use [of] laptops need[s] to be controlled. Reading mail, IM-ing, word-processing on papers for other classes, and the like are absolutely not desirable during class.” Similarly, another respondent said, “I don’t think it benefits them at all. It is a distraction and supports short attention spans, which is not a good preparation for the workforce.” Two other objections were expressed in this way:

- I think that the use of laptops makes the classroom experience more passive for the student. Also, sometimes I sit in on my colleagues’ lectures, and I can see what is on the students’ screens – I am astonished by how many students are not even following the lecture online.
- I think that it hinders their interactions- before students might have a conversation before class, but now lots of students are online as soon as they sit down and can’t spend a moment talking with someone else or daydreaming :O) Seems to be a general trend in society.

Answers in this section of the survey brought up three other important issues which reappear in subsequent responses. The first issue involves the determination of who is responsible for the perceived improper use of laptops. One respondent touched briefly on this issue in this way:

It is another tool that places the student in control of their learning. This survey is spun to place the responsibility of learning on the shoulders of the faculty member and not in the hands of the student. As a faculty member, I cannot control the student behavior if they do not take the responsibility to learn. If they use the computer to surf instead of participating, cutting the computer off is like not allowing my 10 year old son to watch TV. Higher education students should be adults and act accordingly.

The second issue concerned a perceived difference in classroom behaviors with regard to laptops between undergraduate, graduate, and professional students. Speaking of graduate and professional students, one respondent said,

My students seem a good deal more comfortable taking notes by typing than by writing. They may also manufacture notes that are more usable to them by putting them on their laptops. Since I want to encourage notetaking [sic] -- I don't want them just sitting there -- I am willing to have laptop use in the room if that helps me reach that goal. Given my students (highly motivated professional and graduate students), I think they are using the laptops appropriately, but I do not go around checking their screens.

Likewise, a similar comment was made by another respondent,

I teach graduate students. Those who use laptops are taking notes. At this point students are taking classes because they want to. If they choose not to pay attention and don't get the material it is their problem, but I honestly don't see it happening (and classes are small enough that I would probably know).

The third issue is the notion that the laptop can be as distracting an influence as any other distractive influence, such as day-dreaming or doodling. Speaking of the laptop's impact, this respondent said, "In reality, students can be distracted by any number of internal and external factors...the laptop or PDA is simply a physical representation of the potential for distraction." All three of these issues return in subsequent responses.

Question 18: How do you think the classroom dynamic changes when students use laptops with Internet access during class? (185 responses out of 244 participants)

The overwhelming majority of respondents to this question felt that laptops impacted the classroom dynamic negatively and changed the classroom atmosphere by causing students to become disengaged, distracted or inattentive. For many, the side effects of laptop use included a lack of eye contact and withdrawal from participation in class discussions. This distraction and disengagement was described in multiple ways:

- Students seem more distracted, closed-off, from classroom participation when using laptops. Students read the PowerPoints [sic] rather than listening and engaging with the lecturer.
- Too easy for them to go surfing, ‘multitask,’ distract themselves much more thoroughly than just doodling or writing notes.
- Many students use laptops to check email or surf the web during classtime [sic]. That obviously destroys the classroom dynamic.
- Students do not maintain eye contact with others in the class as frequently. They seem distracted and preoccupied. I think that laptop use is addictive for some people.
- Students are less likely to make eye contact with each other or the instructor. Students are more likely to withdraw from participation. Students are more likely to find something else to do, like IM, view web sites, work on assignments.

One instructor felt that students who browsed the Internet during lectures were “rude.” Others’ negative reactions to these types of situations were variously worded as “annoying”, “frustrating”, “distracting”, and “disappointing.”

Several respondents remarked that even those students who were technically “on task” were not getting maximum benefits out of class because of their laptop use. The laptop as a tool was overshadowing the importance of the content of the class.

Students focus less on what's being said -- even the ones that are paying attention -- because they are distracted by trying to type the notes into their laptops. Learning becomes a much less active process. They learn to think of taking notes as the process of learning, the goal of the class, and the demonstration of what they learned/did that day. 2) They pay much less attention to one another, and less attention to me, because they are always at least half alert to email and often reading messages or web-surfing. 3) I've seen students web surfing on the subject we're discussing/that I'm lecturing on. I think this gives them a sense that they don't have to pay as much attention because 'the information' is out there; certainly it distracts them from what's actually happening in the class even though they might think that they are participating because they're thinking about the class topic.

Others remarked on students' constant typing stating, "They become stenographers rather than participants," and that students "stay too focused on typing and not thinking." One respondent described that "In 'the old days', students actively took notes during the lecture. Now most of them sit completely immobile, treating the lecture as a totalling [sic] passive experience." Another worried that laptops let "students check out of lectures, and for those sitting toward the back it undermines the professor's authority to see how many students are not paying attention - it leads to a class full of solitaire players and AIMers."

Many of these same respondents who noted serious distraction with their students also pointed further to the negative effects that laptop use can have on interaction between students. Instructors pointed to a reduction in student to student interaction, noting that students rarely look at each other. One respondent said that students sometimes engage with friends online, but not with classmates in the same room.

Concerns about laptops' impact on fellow classmates were also raised. One respondent said that "some students have reported that they are distracted by the use of computers by their classmates and dislike it." The impact on other students in close proximity is further described in these quotes:

- I sometimes worry that if a student sees another student using a laptop inappropriately that it erodes the integrity of the class. It also probably sends the message that it is okay to do this. If I notice someone constantly using a laptop inappropriately, it annoys me (although not as much as usual) and this probably impacts my interactions with everyone. One student's bad behavior can impact everyone's classroom experience (instructor included) in a negative way
- I think that students sometimes surf the web and email/IM in class instead of listening/participating. This means that some students are actively NOT PAYING ATTENTION/PARTICIPATING in class. This is distracting for me/other students (when it is obvious/when they are sitting [sic] next to laptop-users), and also allows a larger group of students to take class less seriously.

Many respondents described both positive and negative ways in which laptops impact classroom dynamics. Most depended on the particular setting or context of use. As one respondent put it, laptops “can enhance participation with relevant information however can also distract with use of IM etc.” Another explains,

It depends on the class and how students are using the internet. It can be distracting and counterproductive during large lecture/discussion classes if student opt to 'surf the web' rather than paying attention to and participating in class. However, I don't typically find any more distracting, as an instructor, than the time-honored practice of reading the paper or chatting during class. In more interactive teaching / learning situations, however, it can be a useful tool for finding, manipulating, presenting and storing information that is relative to the class.

Focusing again on the importance of context, another respondent said “In some instances it can increase discussion when students can access material. In other instances, it has the potential to discourage participation if they are using the internet for other activities...such as checking email.”

A smaller number of respondents focused their answers on the positive impacts that laptops had on their classroom dynamics. The following responses were typical of positive impacts:

- It would make the learning environment more interactive. The use of laptops may prove to be a way to engage the learner in the subject matter.
- In some instances it can increase discussion when students can access material.

The School of Medicine’s Audience Response System was also mentioned as having a positive impact by making lecture more interactive. One respondent remarked that “when you ask questions of the 160 students during class it is usually only a small minority of students who raise their hands and participate.

With the audience response system, the majority of students are actively participating simultaneously.”

In comparison with previous questions, more respondents pointed to the importance of the type of student in terms of the laptop’s impact. In particular, many stated that distraction and inattention was lower among their masters, PhD, and professional students. Instructors also cited motivation and maturity level as having positive affects on appropriate laptop behavior. Typical responses were as follows:

- The less motivated students tend to sit on the edges of class or in the back and surf the web instead of participating in class. Generally - these are the same students who are not paying attention anyway, so as long as they are quiet and do not bother other students I generally do not care.
- It depends upon the maturity of the students. In one class I teach I believe it really contributed to healthy discussion during group activities and actually stimulated discussion. In another class with younger and perhaps less motivated students, I think it distracts because I often see students at other sites or reading their email. The question is, would these students be more attentive and participatory without their laptop? Perhaps I'll try a 'no laptop week' and see
- I've not had difficulty with students appearing not to be paying attention. This may be because I'm teaching masters and doctoral students who are highly interested in the topics

Related to the distinction between different types of students, the theme of responsibility was raised again. Despite finding some in-class student behaviors frustrating, several respondents put the responsibility for paying attention and focusing on the class squarely on the students:

- If the students aren't paying attention in class, it is their loss.
- Our students are adults - we have to let them take responsibility for their own actions as long as they are not distracting someone else.

- Often they surf the internet during lectures. I think this is rude and frustrating, but they are adults, so I don't see much point in restricting it if they are able to learn the material.

Finally, the laptops were again identified on par with other sources of distraction.

The observation was made by several respondents that students do not need the Internet to become distracted.

- I think that if they didn't have the laptops, they'd find another way to avoid engaging in the class. In general, I think allowing students to use laptops during class can improve their learning, as long as they can be kept 'on task'."
- Sometimes they can be checking email or other things rather than paying attention, but if they did not have their computer then they would be reading the paper, so I don't think it adds more distraction.
- It's another distraction during lectures but students will always find distractions

Question 19: How do you think the quality of classroom discussion is affected by students' use of laptops with Internet access during class? Please explain. (n=173 responses out of 244 participants)

In many respects, this question was a more focused version of question 18 on classroom dynamics. As such, many respondents referenced or reinforced their previous answer. A clear majority pointed to detrimental effects that laptops have on class discussion. Addressing this impact, respondents described students with "lower concentration", "decreased attention", and "less focus." The resulting discussions were characterized as having "impaired professor-student interactions", "stifled discussion", and "lost spontaneity." Two respondents described the impact as follows:

- The quality of discussion is definitely affected because being disengaged there is no deep thinking, thus no flow of discussion. Partial attention allows for only superficial comments. Those who do use them cause distractions to those around them. They are hard to ignore.

- Can be helpful but I think that the cons outweigh the pros. I think classroom time should be different from other venues in which there is interaction. It should be a 'real time' space and I would hate to lose that designation.

In contrast to the previous responses, a number of respondents cited ways in which laptops can benefit classroom discussions. Most responses of this type mentioned the assistance provided by doing a quick online fact check or the retrieving information to enhance or augment class discussion. The immediate access to online sources was cited as helpful in clarifying points brought up in discussion and in bringing in outside information from electronic journals. One respondent wished that all students had laptops, because they felt it would improve their teaching flexibility in the classroom.

Another viewed the use of laptops as freeing students up for better participation:

If they're able to augment the PowerPoints with their own notetaking, [sic] they may have more braintime [sic] to think critically and contribute to class discussion. Students who type well may be able to take better/more complete notes. My hope is that it will improve note-taking, which seems to be a skill that isn't a strength of many students.

Some responses shifted the focus away from laptops as the sole factor in distraction. In these responses, laptop use was combined with a variety of student characteristics including their overall proclivity for participation to explain participation habits. For example, one respondent commented that “students who use the laptop to tune out are the ones who don’t have any interest in the class to begin with and would rarely participate anyway.” Another stated that “the students that are naturally apt to dominate classroom discussion take over even more than usual, while those students who usually have to be coaxed into discussion or who are easily distracted may stray away from the discussion and become involved in their screen.” Similarly, another respondent

remarked that “If the laptops are on, the discussion suffers, usually because the students most comfortable with discussion remain the ones who talk and the others go off in their own cyber-world, even if I stand over them.” One respondent reflected on the case of an avid multitasker, “On very rare occasions I have had particularly bright students who can manage to carry on two activities at once--think and carry on computer activities. However, their questions generally are of the type that asks for repetition of some comment just made in the class.” Students in graduate level courses were again mentioned as having superior levels of discussion.

Finally, class size was noted several times as another factor shaping how and when laptops are used. One faculty member who taught classes with over 400 students required little participation to begin with. Another believed that laptop distraction was more likely in large classes, and a third respondent noted that in their small class, they could reduce misuse of laptops because they could easily see what students were doing.

Question 20: Do you think that students effectively self-monitor their laptop and Internet use so as to not become disengaged from class? Please explain. (n=186 responses out of 244 participants)

A clear majority of respondents were of the opinion that students do not self-monitor their laptop and Internet use in class. The following comments exemplify this sentiment:

- The temptation to use the internet and all the social networks therein is too much for most students to keep their focus on class activities.
- no. i [sic] sit in the back while another teacher lectures and i [sic] see many students with games/email/facebook/etc up on their screens. only a handful actually have the powerpoints or pertinent activity on their screens.
- I think in general such use is viewed as an entitlement.

- They try to pay attention to what is going on - at least sometimes - but I'm not sure that they realize they don't remember things from one class to the next. That continuity is important and they don't realize what they are missing.

Several respondents spoke directly to students' multitasking efforts. Most comments reflected a strong skepticism toward the efficacy of multitasking.

- No, they think they can multitask and that all their [sic] job is in the class is to copy down what is on my powerpoints. they [sic] aren't thinking about the material and what it means because they are doing other things on their laptops. I know that's what I do when I have my laptop in a meeting/lecture.
- Hard to tell. Maybe they multitask better than I think they can. I know I would not be able to surf the internet and absorb a lecture simultaneously.
- No. They have grown up in a culture of perceived of multitasking in which they believe they are just as productive as if they were solely paying attention to what is going on in class.

In contrast, numerous respondents' affirmed that many students *were* able to self-monitor their laptop and Internet use. Many of those qualified their answers by explaining the types of students who self-monitor their laptop use. A range of student types or attributes emerged as generalizations in regard to self-monitoring. Undergraduates and first-year students in particular were most often cited as becoming disengaged through laptop use. Other student traits influencing laptop use were stated as follows:

- Distracted students surf the web and chat with others, good students do not let their laptops become a distraction.
- ...depends on the individual student and her/his own motivation.
- No. Undergraduates do not have the discipline to effectively manage their internet use. In graduate classes, laptops can be helpful.

- I'm not sure yet. As noted earlier, I have seen instances in which students get rather engrossed in their laptop activity. Whether the computer leads to that absorption or whether the students are introverts already is not clear to me.
- No, although some do. The current generation of students seem oblivious to certain classroom standards of respect and decorum.

Marking a final theme to this question, a handful of responses reflected on the ultimate responsibility for classroom disengagement due to laptop use. Responses were roughly equally divided between placing the onus on students, on instructors and on both parties.

- I don't feel it is the role of a college educator to monitor the activities of students on their laptops. The student is responsible for mastering the material presented. How the student does this is up to the individual.
- I try to make the classroom experience valuable enough that students realize they are missing something if they're not engaged. And I think most of them are mature enough to make such decisions for themselves [sic].
- depends on the student, and whether the teacher can keep the class engaged, redirecting non-productive computer use.
- They [first-years] don't seem to grasp: when to stop; that the teacher knows what you're doing even if he isn't standing behind you; and that if you miss things because you are lookign [sic] at Facebook pages, it's not your instructor's fault.
- It depends on the maturity intellectually of the student, a first year, first semester student is more likely to wander from the task and topic because they may not have learned how to use information access in a more scholarly way...that is why it is important for the teacher to set expectations and continue to development them in the context of the student group throughout the semester.

It seems apparent that the ultimate responsibility for a truly engaged and engaging classroom is a joint responsibility shared between student and instructor especially as laptops become a greater presence in the classroom.

Question 22: If you answered yes to the question above, how do you think that Millennial students need to be taught differently than students 10 years ago? (139 responses out of 244 participants)

When asked whether Millennial students need to be taught differently than students 10 years ago, almost 70% said “yes.” For those who answered “yes”, this question was a follow-up to elicit further opinions from instructors as to exactly how students should be taught differently. Answers were quite varied and revealed a number of themes and perspectives. Many began their responses describing the traits and strengths and weakness of their current Millennial students. In particular many pointed out students’ penchant for multitasking, visual orientation, and need for immediacy. Others indicated their disappointment with students’ decreased attention spans and underdeveloped critical thinking skills. The following responses were typical of these comments:

- Students seem to think less critically, on the average, than a decade ago. Their attention spans also seem to be shorter (as a general rule) and they seem to both use (and require) more visual input in what used to be the primarily verbal climate of the average classroom.
- Sorry to go all old fogey here, but I can see a real decrease in the writing abilities, reading comprehension, and concentration spans of current students vs. those ten years ago. They live in such a hyper-stimulated environment, one that caters immediately to their every whim, that they are significantly poorer students.
- They are incredibly efficient multitaskers and they have much shorter attention spans. Both teaching and classroom techniques should be adjusted accordingly.
- They tend to think less linearly than many other students and are much more visually oriented and active in their learning.

The notion that the classroom experiences needed to be more entertaining for Millennial students was brought up multiple times. One respondent said “I think it's very

important for the instructor to 'change media' at least every 20 minutes. Lecture, show a video tape, take a quiz, listen to an audio clip, discussion... not too much time on any one thing.” Others make the following remarks:

- Add entertainment value to the instructional content like MTV. Use a richer media besides lecture & PowerPoint slides.
- They need more stimulation to stay on focus. Also are less likely to be self-motivated to learn; must be entertained to be engaged.

The online environment was recognized as an important new resource giving students the “ability to answer a vast variety of curiosity questions easily (without hours of hunting and library work).” In this environment, students were recognized for their “resourceful” approaches to finding information. However, two important concerns of the Information Age were expressed repeatedly by instructors; a) the problems associated with “information overload” and b) the challenges of teaching students how to effectively evaluate the sources they have available to them. Many respondents cited students’ underdeveloped ability to “...distinguish accurate from inaccurate information” especially with online sources. These observations were typical of the responses:

- They are also able and willing to access material...but also need further guidance on evaluating the quality of materials available on the internet.
- Until they are well prepared and experienced, they do not have sufficient grounding to be able to distinguish between acceptable material and unacceptable. They must have studied and internalized whatever the subject matter may be--and be able to recognize good sources of information--before they should ever consider using web materials as sources. Prior to the 'cyber world' generation existed, that added responsibility did not exist. Ergo, the computer has not necessarily lightened the pedagogical load.
- It is important to teach them how to use and evaluate critically the information they find online rather to accept everything as fact.

- They also tend to trust the internet wholesale, so we have to talk about what makes a reliable source. Conversely, however, the info. science world is changing so rapidly that they often don't know how to use computers for academic research.

Furthermore, instructors also noted changes in the types of information sources used by students. “They obtain much more information from the Internet, much less from libraries, it seems,” said one respondent. Others added that today’s students were “less likely to read books and more likely to access on-line materials”, and that students “expect information to fit into popular culture in order to be relevant.”

Given the instructors’ views on Millennial students in the classroom, there were a variety of approaches suggested for teaching this generation. A large number pointed to the necessity of including technology in the classroom.

- Technology is more of a reality and fact of life - we should learn how to adapt classrooms to these new resources. Millennial students (interesting term) are used to such tools - we need to work with them to enhance learning.
- Adding technology to the classroom experience gives them more ways to participate and 'connect' with the material.
- Faculty need to accept teaching in more technically savvy [sic] ways, using computer-based and online information.
- I think laptop use in the classroom is inevitable. Therefore, as a professor, we need to change our teaching techniques to ensure that students are engaged and are using the laptop in an effective way to facilitate their learning.

Others also noted an important role for technology in the classroom, but expressed caveats to its use.

- It is important to keep up to date with technology, but it must be used wisely, not just for the sake of its existence.
- Using technology can be a real help. But we need to preserve interpersonal interactions.

- You also have to make an effective balance of new technologies in the classroom. Multimedia can work well to engage students who are used to constant visual/auditory stimulation, and I encourage its usage. But if overdone it feeds into their general passivity and causes them to shut off their 'thinking minds.'
- Certainly they should be taught to make the best use of technology, but technology creates its own opportunities for impolite or ineffective behavior.

Two respondents spoke about the best of the classroom time. Both suggested that the type of content accessible online is best processed by students outside of class time, freeing class time for problems solving and developing critical thinking skills.

- Low level, information (content) sharing can and should be 'off-loaded' from the classroom to electronic media for 'consumption' [sic] by students in their own style and environment, freeing 'class' time for application of knowledge to solving novel problems, true discussion, and interaction with faculty and peers. I would see large lectures all but disappear, to be replaced by more intimate, small group discussion.
- Students can access and learn content based material outside of lecture format. Classes can be used to develop thinking skills, experimental thinking and hypothesis driven basic research.

A minority reported that the fundamentals in education and learning have not changed.

While traditional teaching methods may need to be altered, the ways in which students learn and the skills they require have remained basically the same.

- All the material and information sources for my courses have changed, so they need to be taught differently because the material is different. However, there is nothing inherently different in the [sic] students themselves.
- Teaching styles may have to be adapted to this [Information age], but I feel that many skills that we should teach remain the same. These skills include critical analysis and thinking, problem solving, and communication. So I would say, some things have changed but many have not.

A number of respondents questioned the value of the traditional lectures for Millennials students. The following comments reflect their ideas on adaptation:

- Also I believe that students are less tolerant of lectures than they used to be, & demand more interaction & participation in the classroom.
- Less 'lecturing', more participatory learning and hands-on demonstrations.
- even more constructivist methods are needed. more engagement and less lecture. more challenging questions to encourage engagement.
- [...] the current evidence suggests that everyone learns best by being engaged in the thinking, feeling, doing activities that require the use of the data and information in a typical class...it is no longer sufficient to 'tell' a student about something...the optimal learning situation engages the student in the different learnign [sic] domains so that the content becomes a lived expereince [sic] that is structured at the appropriate level for the student's understanding.

Several other respondents suggested that students will benefit from occasionally disengaging from technology and focusing on the development of their intellect and critical thinking skills.

- In short: millennial students actually ned [sic] to disengage from their electronic media so that they can develop their shorter attention spans, so that they can actually interact with their professors and classmates. They use the laptops as a means of avoiding engagement and interaction.
- However, I think we as teachers of undergraduates need to take our students by the hand and help them develop more intellectual independence and critical thinking and to attend longer and more closely to the written and spoken word. I think this is quite reasonable and possible to achieve but university will and leadership will be essential to accomplish this.
- I think that we have definitely lost something from the past and I believe that more rules, respect and criticalness need to be integrated BACK into the classroom. These technologies (or maybe its the current generation) seem to have eroded some respect that people used to have for the university. Obviously, as instructors, we have to acknowledge that students use the Internet and technologies a lot and leverage that to our and their advantage.

Finally, one respondent reflected on the opportunity for students and instructors to learn from each other,

[...] it seems to me that there exists the possibility of a larger gap between traditional instructor and students who do not remember a world without multiple

PCs or laptops in their homes and schools. Rather than place the onus of adjustment on one or another of those constituencies, we should recognize that each group can and should learn from the experiences of the other.

Question 23: Please describe how you think students can make effective use of their laptops and the Internet in class. (169 responses out of 244 participants)

This questioned re-enforced question 17 regarding ways that students benefit from wireless laptops. As such, it received some similar responses. A majority again referred to the ability to take notes in class as a chief benefit of laptop use. Following closely behind was the ability to immediately access wide-ranging sources of online information in support of class content. The resources cited consisted of PowerPoint slides, course pages on Blackboard, course materials, Podcasts, diagrams, visuals, science videos, animations, wikis, blogs, topical Web sites, Internet search engines, Wikipedia, PubMed, PsycInfo, and other online databases.

Many cited specific activities and applications as effective ways of using laptops and the Internet. Beneficial activities enabled by wireless laptops included group work, sharing papers, fact checking, simulations, group projects, problem solving, collaboration on written assignments, in-class writing, creating presentations, with time-limited exercises, and on practice problems. A number of specific applications were also mentioned such as statistical programs, computer applications and programming, lab exercises, group calendars, Breeze courseware software, audience response systems, and note-taking programs.

Scattered through the responses was the notion that these applications should only be used in support of learning and connecting to the topic at hand. The challenge of keeping students focused and on-task was addressed in several responses.

- Assignments that involve laptops can be great-- but they should be monitored in a way that the teacher has control of what is going on. A teacher being able to see the screen of the student is almost always enough of a deterrent [sic] to keep them working on class material.
- Structured lab exercises. Some task that requires the students to focus on a task for class, rather than using the laptop for their own purposes.
- Greater interactivity with class - instead of simply attending, maybe we can require that they submit questions interactively, comment on other student comments. It is really the responsibility of faculty to help them.

Systems like the School of Medicine's Audience Response System were mentioned several times as aids to keeping students engaged through the use of real-time polling and feedback.

- Interactive response systems poll student answers to the educator's questions. Students then engage in a learning activity and then re-poll student responses.
- Computers could be very useful for evaluating the effectiveness of my lectures in real time. It would be great for students to have software to indicate their level of understanding during the lecture. I imagine having a simple graph on display all the time so that I, and the class, could monitor their self perception of how well they are understanding the lecture. Little 'pop' quizzes [sic] would be useful adjuncts to such a system.

Others saw either no effective ways or very limited effective ways in which students could make use of their wireless laptops. One important distinction made in these responses was between laptop use (primarily for note taking) and laptop used to access the Internet.

- I don't think laptops are needed. The fact that the University requires them to purchase the machines makes banning them outright very difficult.
- Aside from note-taking or making presentations, their use should be severely limited.

- I think the Internet should never be used in class, and thus that there is no effective use of it. It is always detrimental. I think that laptops can be effective in note-taking, though.
- in my class, not at all except for note taking. because it is a discussion based class, they need to be fully engaged with other students and with the books we are reading.
- Turn them off and listen to the material being presented.
- I honestly can't think of one single thing they could do to enhance their learning experience by being connected.

Interestingly, many respondents pointed out ways in which classroom discussion was enhanced or augmented by using laptops. These examples typically refer to students conducting a quick online fact check or Web search.

- You can ask them to search for and access information that can be used in a class discussion.
- They can use them to access material that is posted to Blackboard and that is available on various websites. This allows for a more free-ranging discussion at some times.

And finally, referring again to the perceived best use of class time, one respondent had this to say,

I don't waste valuable time having them do internet work in class. I prefer to make Internet assignments for them to complete outside of class so we can compare, discuss, and process their research in class. Class time is for critical thinking, and critical thinking requires debate and discussion.

Question 24: Please add any additional comments about the impact of students' use of laptops/the Internet on your teaching or the classroom environment here. (68 responses out of 244 participants)

The final question allowed instructors to finalize their thoughts and add any additional comments that they wished to make. Some took to opportunity to emphasize

the barriers that laptops present to learning and the detrimental effects they can have on the classroom experience. Several others saw laptops as providing students with the most benefit outside of the classroom. Many commented that the laptop's positive or negative impact often hinges on its particular context of use. Concerns about critical thinking skills and information literacy were also echoed in responses to this last question.

This is not just about classroom uses of laptops, but I feel that it is more critical than ever to teach our students the difference between data and information, between fact and fiction. There is an awful lot of data on the Internet. Much of it is good, a lot of it is misleading or false. And data without interpretation does not make for informed students. Internet literacy is of great importance, but reading student papers based on Internet sources, it is sometimes sorely lacking. Access to data is easier than it has ever been. Being an informed person may be more difficult than it has ever been before. With so many facts and fictions filling cyber space, sorting out truth from fiction and synthesizing facts into knowledge is a real challenge. I am not convinced we do enough at UNC to teach students about Internet literacy and it concerns me because I fear that there will be whole generation with lots of titbits [sic] of information but no real knowledge or understanding.

The issue the student entitlement was also raised by several respondents.

- I'd never had to deal with it en mass until this year and I am very concerned about the way it is impacting my classes. At the same time, the students' sense of entitlement to use them creates a situation where I don't feel comfortable banning the computers although I am 100% sure that, at least in the classes I'm teaching now, the laptops are creating obstacles to the students' learning.
- Laptops are here. The internet is here. Both are tools that should no more control the classroom than chalk does. Unfortunately, some teachers are as much enchanted by new technology as students are, and they let the teaching process get away from them. Meanwhile, students use laptops as an 'authority' to over-ride whatever the teacher is doing or saying. It's probably a losing battle to retrieve student minds from their cyberworld, [sic] but we should try.
- I think that it's a ridiculous [sic] entitlement that students assume they have the right to play solitaire and check their email in class now. I don't sit and read the newspaper while students give presentations.

- It is distracting for me to see a student looking at stock quotes [sic] instead of listening to a complex discussion of genetics/society. I warn them and then they get upset about being warned!

One respondent summarized the issue of distraction caused by laptops as student dependent “If the student is responsible, Internet shouldn't distract them. As I said before, if they are prone to get off track, it can happen any way, with or without internet or laptop use.” Another instructor reflected on the joint responsibility of the students “to self-monitor their use and the responsibility of the instructor to incorporate internet resources into the lecture in such a way that instruction is enhanced.”

DISCUSSION

This section discusses some of the important opinions gathered from the survey and highlights issues that remain open. Particular attention will be paid to laptop policies, determining on-task versus off-task laptop use, multitasking, Internet “kill switches”, laptop pros and cons, responsibility for effective laptop use, Millennials and technology, and finally, the importance of context.

Answers to the initial Likert-scale questions provided a snapshot of faculty and instructor views on the impact of wireless laptop on the classroom. Only a small minority (4.9%) of respondents prohibit laptop use in their classrooms. Underlying many of the open-ended responses was a majority opinion (77.1%), which agreed or strongly agreed, that students are more likely to become distracted when using laptops with wireless Internet access in class. In retrospect, a question about doodling or day-dreaming in the classroom perhaps would have elicited similar responses. However, it seems apparent that laptops introduce not only a new form of diversion, but a more enticing and difficult to monitor form of distraction and pull away from the classroom focus. Activities such as doodling and day-dreaming are surpassed by the tempting multitude of activities that laptops offer.

Laptops policies

When asked to describe any laptop policies they may have, respondents’ answers were diverse. In fact, taken as a whole, the responses show a dizzying and nuanced array of partial policies, mechanisms of control, exacting conditions, ambiguous suggestions,

and circumstances for appropriate use. Specific laptop uses and prohibitions were variously spelled out by respondents along with additional restrictions on context of use. Most of the approaches sought, in one form or another, to identify and define effective and appropriate laptop use for students in their classrooms. The changing nature of the technology and the types of activities it enables make the drafting of laptop use policies very difficult for faculty and administrators. Because of this difficulty, instructors often focus on creating very general policies which allow laptop use that is considered relevant to the class. This is because more specific policies can lead to impossible predicaments. How do we define the boundaries of “on-task” work and “appropriate use”? Moreover, how can these policies be fairly enforced and how much time and effort should be spent doing so? Most responses to question nine¹ indicated that instructors do not generally ask students to close or turn off their laptops except during exams.

The array of laptop policies can also bring challenges for the student. Millennial students are accustomed to being connected and having ready access to computers. Few restrictions are put on students’ technology use outside of the classroom. Given that laptops are variously banned, encouraged, despised, limited or required, students may justifiably wonder what the policy de jour is for their individual classes.

On-task/off-task

The issue of students being “on-task” or “off-task” is further complicated beyond the ways in which respondents alluded. Respondents often characterized the ability to look up information or do further research as a benefit to laptop use. Moreover, a characteristic of “good” students was their ability to stay on topic. But when it comes to

¹ In which classroom contexts (besides exams) do you ask students to close or turn off their laptops? Please explain.

academic performance in terms of measures of recall and recollection, there is more to the story. Regardless of whether the student is on- or off-topic, performance decrement has been identified more as a function of the amount of time spent browsing online content (Grace-Martin & Gay, 2001; Hembrooke & Gay, 2003). Therefore, even the seemingly engaged student who takes the initiative to search for further information can miss out on important class content.

Multitasking

The literature presented in this study points to limits on mental processing in a variety of multitasking scenarios. It is said, however, that practice makes perfect. Given Millennial students' full schedules and frequent use of digital devices, they have had more multitasking experience than previous generations. It may reasonably be argued that Millennials are indeed capable multitaskers; however, more research is needed to make this case. It could also be argued that college students are unaware of the extent or degree of their own distraction when using wireless laptops in the classroom. Most respondents felt that students do not effectively self-monitor their laptop and Internet use so as to not become disengaged from class. Many were skeptical of students' multitasking efforts. The minority who *did* see more effective laptop use primarily referred to upperclassmen and graduate students. More evidence is needed to draw further conclusions about how laptop use changes through the course of a student's college career.

Internet "kill switches"

Respondents to the survey agreed or strongly agreed (90.6%) that instructors should have the option to prohibit laptop use in their classrooms. This showed a strong

desire on the instructor's behalf to maintain control over this aspect of their classrooms. Almost three-quarters (73.7%) indicated that they would "make use of the ability to turn off Internet access" at their discretion during class.

The ability to turn off the Internet in any given classroom is rare, but some colleges in the U.S. have implemented such systems in response to faculty requests. In effect, this ability puts a certain amount of flexibility back in the hands of the instructor. This has not always played out successfully, however. A number of respondents to this survey pointed to laptop use as a perceived entitlement by students. It was this claim, over their technology, that led the of the University of Memphis School of Law students to object so vigorously to their professor's ban on laptops in class (Young, 2006).

Colleges, universities, schools and individuals who ban laptops or Internet access during classes may indeed experience the results they are looking for in their classes. However, by doing so, they have a further responsibility to not let the "off" setting become the unquestioned, de-facto standard for each and every class. In other words, specific classroom goals may be met by disabling Internet access, but ongoing opportunities to incorporate new approaches and online tools and services into their lessons should not be overlooked.

Laptops: A hindrance and a help

Responding to questions 18² and 19³, the majority of respondents felt that laptops impacted the classroom dynamic negatively and changed the classroom atmosphere by causing students to become disengaged, distracted, or inattentive. Respondents were also

² How do you think the classroom dynamic changes when students use laptops with Internet access during class? Please explain.

³ How do you think the quality of classroom discussion is affected by students' use of laptops with Internet access during class? Please explain.

dismayed at perceived detrimental effects of laptops on class discussion. While stories of students not paying attention were typical of the responses, there was still some inconsistency between and within respondents' answers and some bright spots for laptops. In particular, a handful of respondents found that, at times, having the ability to do a quick fact check or online lookup enhanced or augmented their in-class discussions. Furthermore, laptops enabled a host of activities that would otherwise be impossible to conduct without them.

Whose responsibility is this anyway?

A few respondents indicated that distraction and inattention in class was largely the student's prerogative, and any content that they missed amounted to their loss. In the classroom setting there is clearly a need for students to take personal responsibility for their learning and to make the most of the college careers. Likewise, there is a responsibility on the instructor's part to engage the class in learning. Barone (2005) further emphasizes the importance of the instructor's role in meeting and engaging today's students.

Students have daily encounters with technology and innovation in many areas of their lives; in fact, their social interactions may be organized around instant messaging, blogs, and other technology-based modes of communication. Students may use PDAs and wireless networks to stay in touch with each other, to get information, to vet their ideas and thought processes. Yet, they are not surprised by the mandate that they sit in classrooms and listen to lectures when they get to college—they just get bored and restless. Thus, it should be no surprise when they eventually—perhaps inevitably—begin to question the ways we ask them to learn, because those ways do not match with the interactive access to information and modes of communication by which they learn in other aspects of their lives (p 14.4).

The usual generational differences between students and faculty are compounded by a new technology intermediary in the form of the laptop. Clearly, the majority of the

instructors surveyed are witnessing the distractive affects of wireless laptops in their classrooms. The response should then focus simultaneously on effective technology use by students and successful student engagement by instructors. Indeed, the changing classroom dynamic introduced by wireless laptops marks another opportunity to re-examine and re-evaluate tools and approaches to classroom teaching. As one respondent stated, “Rather than place the onus of adjustment on one or another of those constituencies, we should recognize that each group can and should learn from the experiences of the other.”

Millennials and technology

There are a number of factors that make the student/instructor challenge so significant. One obstacle is differing views on what constitutes technology. As discussed in the literature review, Oblinger (2005) points out,

It is an almost instinctive assumption to believe that Net Gen students will want to use IT heavily in their education; they certainly do in their personal lives. However, if you ask Net Gen learners what technology they use, you will often get a blank stare. They don't think in terms of technology; they think in terms of the activity technology enables. In general, the Net Gen views the Internet as an access tool—a medium for distribution of resources rather than a resource with limitations. When asked about technology, students' definitions centered on new technologies. For example, a cell phone with a new feature was considered technology; a cell phone with standard features was not. What we might consider “new technology,” such as blogs or wikis, are not thought of as technology by students (p. 2.10).

Some respondents admitted puzzling over the best way to teach their Millennial students. Many suggestions (inline with expert opinions) suggested increased interaction, collaboration, visual display of information, and hands-on work. Other respondents who earlier saw little benefit to laptop use or detrimental effects, suggested, almost paradoxically, overall increases in technology to reach and engage with Millennials.

People who have studied Millennials have found that they are not so interested in using technology for technology's sake. Researchers found that the majority of students preferred a moderate amount of information technology in their classes (Kvavik, 2005). Oblinger (2005), remarks that it is almost instinctive to believe that Millennials want to use more information technology in their education, as they do in their personal lives. However, Millennials "don't think in terms of technology: they think in terms of the activity that technology enables. In general, the Net Gen views the Internet as an access tool—a medium for distribution of resources rather than a resource with limitations" (p. 2.10). The implication for higher education is that,

...colleges and universities should not assume that more technology is necessarily better. Technology that enables certain types of activities is likely to be appreciated. For example, wireless networking enables learner mobility and makes it possible to be constantly connected. The majority of wireless network use, however, may be outside the academic realm. Using technology to increase customization, convenience, and collaboration is well received; however, its integration into most courses or curricula is not as deep as into students' personal lives. [...]The activity enabled is more important to the Net Gen than the technology behind it. For example, instant messaging wasn't considered a technology; IMing is treated as a verb—it is an action, not a technology. Students often use the word "talk" when they describe text messaging or instant messaging (p. 2.10).

The debate remains open, however, about where, when, how, to what extent should faculty transform their pedagogy to engage Millennials. In the following quote, Oblinger (2005) suggests working with students and learning what activities are most engaging:

It isn't technology per se that makes learning engaging for the Net Gen; it is the learning activity. If today's students are experiential learners, lectures may not be an optimal learning environment. If they are community oriented, providing opportunities for peer-to-peer experiences or team projects may be preferable to individual activity. There are significant individual differences among learners, so no one-size-fits-all approach will be effective. Even so, learning science and the

habits of the Net Generation provide some clues as to how we can improve learning. Are there ways to use IT to make learning more successful? Learning science indicates that successful learning is often active, social, and learner-centered. However, with the multiple responsibilities of faculty, staff, and administrators, as well as the large numbers of students most campuses serve, ensuring successful learning without the support of IT may be impossible. Individualization and customization are laudable goals for instruction; they are also time intensive. With the appropriate use of technology, learning can be made more active, social, and learner centered—but the uses of IT are driven by pedagogy, not technology (p. 2.16).

Importance of context

Finally, any discussion of wireless Internet access in the classroom is incomplete without an appreciation of the variety and complexity found in classrooms. Respondents to this survey touched on many different factors that appeared to influence student behaviors. These factors included student age, maturity, personality type, interest in the course subject, class size, topic, classroom layout, faculty attitude, class structure, and student expertise with technology, to name but a few. A similar study soliciting student perceptions of laptop use would undoubtedly add more to this list. What is clear from this study is the need to continually evaluate laptops as learning tools, recognizing the contexts which make them effective and useful and accepting their limitations.

Further research

Based on the literature review and findings of this study, there are several ways in which further research could enhance the understanding of the impact of laptops in the higher education classroom. Additional research into the many ways that laptops positively and negatively impact the classroom could guide instructors, policy makers, and the development and implementation of new classroom practices.

A starting point for such research could be to gain a more solid understanding of the types of student behaviors, with regards to wireless laptops, that negatively impact classroom participation and academic performance. Hembrooke & Gay (2003), for example, suggest that future research focus on developing a taxonomy of situational variables that are associated with poor academic performance. The information produced by such studies could have a conscience-raising effect and encourage more people to recognize and reflect on the productive and non-productive ways they use their laptops. A study similar to the current one, focused on students instead of faculty, could gather feedback on the variety of factors that influence how, when, where, and why students choose to use their laptops and access online content in class.

There is also a need to better understand the differing opinions and viewpoints between Millennial students and their "digital immigrant" instructors, so that the current divide can be lessened. This could be accomplished, in part, by administering additional surveys to both students and instructors on a larger scale, and by combining in-depth interviews with classroom observation. It is likely that a survey eliciting opinions on appropriate and effective technology use in the classroom would yield different answers among students and instructors. Data gathered from such a study could go a long way toward dispelling myths, misinterpretations or wrong characterizations regarding students' and instructors' classroom behaviors and intentions. Indeed, respondents in the current study revealed a number of assumptions and suppositions that may or may not reflect actual student characteristics or intentions.

As technology continues to advance at such a rapid pace it is also important to continually seek to understand how to maximize its benefits for teaching and learning.

Instructors could benefit from sharing their individual stories of success and disappointments with their approaches to incorporating, or restricting, laptops or wireless Internet access into the classroom. Such a body of practical knowledge and techniques would be helpful for instructors at all levels.

Finally, additional studies could focus on the emerging technologies of audience response systems or follow up on the experiences in classrooms where faculty have the ability to limit or turn off Internet access. Further research in all of these areas will help identify where the teaching and learning experience could be helped or hindered by technology use.

CONCLUSION

This study gauged faculty perceptions of the impact of student use of wireless laptops in their classrooms. Results showed that many faculty members are witnessing the distractive effects of wireless laptops in the classroom in the form of decreased student attention and participation. In light of this issue, almost three-quarters of respondents said that they would make use of the ability to turn off Internet access in their classrooms.

At the same time, respondents saw important benefits for students who use their laptops for note-taking and other purposes. These benefits were seen, however, as contingent on the student's appropriate use of the laptop during class time. A concise characterization of "appropriate use" of laptops use would depend on myriad factors. Therefore, any sweeping assertions about the benefits or drawbacks of student laptop use must be tempered with a careful consideration of the context of laptop use. Class size, subject matter, faculty attitudes, physical classroom layout, student age, and pedagogical approaches, expertise with technology are among the many factors that can influence the classroom environment. Given the complexity and variety of teaching and learning environments, laptop and wireless prohibition, inclusion, and measured use are all viable classroom options. With no hard and fast rules, instructors will likely continue to experiment with different approaches ranging from laptop-free classes to laptop-enabled activities.

As college and university classrooms are increasingly equipped with wireless Internet access and more students own laptops, the impact of wireless laptops becomes more widely noticed. By examining current faculty perspectives on students' classroom use of laptops, this study exposes some of the challenges instructors face in this changing environment. This changing landscape provides not just an opportunity, but also an obligation to re-examine classroom teaching and learning. In this endeavor, institutions of higher education will benefit from engaging with students to better understand their learning styles and preferences. This is especially important given the confluence of wired classrooms and students who have never known life without the Internet.

Students will also likely benefit from further discussion of the appropriate and effective use of technology in the classroom. Given the research in academia and business, the current generation will continue to face issues of distraction and interruption as potential burdens on their productivity as they enter the work force.

Finally, the laptop debate provides the opportunity to reflect on how technology is changing our classrooms. The decisions made by schools, departments and individuals must consider the promise and limitations that technology has to offer in any given situation. Technology choices driven by pedagogical goals will help achieve a learning environment that enables students to deepen their understanding of important issues, better evaluate sources of information and sharpen critical thinking skills.

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APPENDIX A: SURVEY QUESTIONS

Part I – Demographics

1. What is your current position at UNC?
 - Full professor
 - Associate professor
 - Assistant professor
 - Adjunct
 - Other, please specify: _____

2. In which school do you teach? Please specify.
School: _____

3. In which department do you teach? Please specify.
Department: _____

4. What is your sex?
 - Female
 - Male

5. What is your age?
 - 20-27
 - 28-35
 - 36-43
 - 44-51
 - 52-59
 - 60-67
 - 68 and over

6. How long have you been teaching in higher education?
 - 1-5 years
 - 5-10 years
 - 10-15 years
 - 15 or more years

Part II – Current teaching practices

7. Do you ____ student use of laptops in your classes.

- require
- encourage
- allow
- tolerate
- prohibit

8. Please explain any formal policies you have regarding student use of laptops during class.

9. In which classroom contexts (besides exams) do you ask students to close or turn off their laptops? Please explain.

Part III – Perceptions

10. Students are more likely to become distracted when using laptops with wireless Internet access in class.

- Strongly agree
- Agree
- Disagree
- Strongly disagree
- Don't know

11. I have a good idea of what my students are doing with their laptops during class.

- Strongly agree
- Agree
- Disagree
- Strongly disagree
- Don't know

12. Students' participation in class discussions increases because they use laptops.

- Strongly agree
- Agree
- Disagree
- Strongly disagree
- Don't know

13. Instructors should have the option to prohibit laptop use in their classrooms.

- Strongly agree
- Agree
- Disagree
- Strongly disagree
- Don't know

14. I would make use of the ability to turn off Internet access at my discretion during class.

- Yes
- No

15. If it were possible, in which situations would you turn off or restrict Internet access in your classroom? Select all that apply.

- Discussion
- Lecture
- Presentations
- Group work
- Other: _____

16. The ability to turn off Internet access at my discretion would improve participation in my classes.

- Strongly agree
- Agree
- Disagree
- Strongly disagree
- Don't know

17. How do you think students' classroom use of laptops benefits students? Please explain.

18. How do you think the classroom dynamic changes when students use laptops with Internet access during class? Please explain.

19. How do you think the quality of classroom discussion is affected by students' use of laptops with Internet access during class? Please explain.

20. Do you think that students effectively self-monitor their laptop and Internet use so as to not become disengaged from class? Please explain.

21. Do you think that millennial students need to be taught differently than students 10 years ago?

- Yes
- No

22. If you answered yes to the question above, how do you think that millennial students need to be taught differently than students 10 years ago? Please explain.

23. Please describe how you think students can make effective use of their laptops and the Internet in class.

24. Please add any additional comments about the impact of students use of laptops/the Internet on your teaching or the classroom environment here.

APPENDIX B: TEXT OF THE EMAIL SOLICITING STUDY PARTICIPANTS

My name is Aaron Brubaker and I am conducting research for my Master's Paper on faculty perceptions of the impact of laptops with wireless Internet access on classroom dynamics and teaching.

In order to gain insight into UNC faculty perceptions, I have created a Survey. If you are a faculty member or adjunct, I'd like to request your input. The survey will take 10-15 minutes to complete.

This link:

<http://www.surveymonkey.com/s.asp?u=439922622940>

will take you to the survey hosted by SurveyMonkey.com. By following this link, you are consenting to participate in this study.

All responses are completely confidential, and no personal information will be collected. Your participation is voluntary and you may stop participating at any time. You may skip any question you choose not to answer for any reason.

If you have any questions about this study, please email brubaker@email.unc.edu. You may also contact my advisor, Dr. Deborah Barreau at 919-966-5042 or barreau@email.unc.edu.

Thank you,

Aaron Brubaker

brubaker@email.unc.edu

MSIS student, School of Information and Library Science

University of North Carolina at Chapel Hill

This email is sponsored by: School of Information and Library Science.

Approval IRB: Behavioral Institution Review Board

Date of Approval: 9/22/2006

Study Title: Faculty Perceptions of the Impact of Student Laptop Use in a Wireless Internet Environment on the Classroom Learning Environment and Teaching

IRB Study #: 06-0507

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