No A 4 U: The relationship between multitasking and academic performance

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ABSTRACT

The proliferation and ease of access to information and communication technologies (ICTs) such as Facebook, text messaging, and instant messaging has resulted in ICT users being presented with more real-time streaming data than ever before. Unfortunately, this has also resulted in individuals increasingly engaging in multitasking as an information management strategy. The purpose of this study was to examine how college students multitask with ICTs and to determine the impacts of this multitasking on their college grade point average (GPA). Using web survey data from a large sample of college students at one university ($N = 1839$), we found that students reported spending a large amount of time using ICTs on a daily basis. Students reported frequently searching for content not related to courses, using Facebook, emailing, talking on their cell phones, and texting while doing schoolwork. Hierarchical (blocked) linear regression analyses revealed that using Facebook and texting while doing schoolwork were negatively associated with overall college GPA. Engaging in Facebook use or texting while trying to complete schoolwork may tax students' capacity for cognitive processing and preclude deeper learning. Our research indicates that the type and purpose of ICT use matters in terms of the educational impacts of multitasking.

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1. Introduction

The last decade has seen the advent of new technologies used by individuals to share and communicate with each other. These social technologies, such as Facebook and text messaging, have seen growth in adoption rates over the last ten years. A decade ago, Facebook did not yet exist having been first introduced in 2004 and becoming widely available to everyone in 2006. Pew Internet and American Life data show that teen cell phone ownership has increased from 45% in 2004 to 75% in 2010 (Lenhart, Ling, Campbell, & Purcell, 2010) and that 51% of teens reported text messaging in 2006 which increased to 72% in 2009. The latest Pew report focusing on college students found that 96% of all undergraduates owned cell phones (Smith, Rainie, & Zickuhr, 2011). The popularity of text messaging has also increased exponentially. Data from Nielsen show that the average number of text messages sent each month grew from 65 in the first quarter of 2006 to 357 in the second quarter of 2008 (Nielsen, 2008).

Compared to ten years ago, Internet users are presented with more data (in the form of news stories, friend requests, wall posts, tweets, etc.) than ever. Unfortunately, humans are unable to take in and process all of this information and turn to engaging in multitasking as an information management strategy (Chun, Golomb, & Turk-Browne, 2011). Add to that the ubiquitous nature of cell phones and text messaging and you have a society of people that are surrounded by real-time digital information that is constantly placing demands on their attention. A necessary byproduct of the fast pace of our digital lives is the ability to filter data in order to manage our attention—we must be particular about what we pay attention to, for if we try to pay attention to every byte crossing out monitors, we would most surely fail. As Chun et al. (2011) aptly state, "people attend to all kinds of information every day, but they do not encode or remember all the things that they have attended." (p. 84).

For the purposes of this paper, we use the term multitasking with the understanding that it is often used in the vernacular to describe the phenomena of divided attention or task switching, concepts from the cognitive psychology literature that are more representative of how humans attend to and process information (Chun et al., 2011). Therefore, we define multitasking as divided attention and non-sequential

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task switching for ill-defined tasks as they are performed in learning situations; for example, when a student is text messaging a friend while studying for an examination.

The last decade of research on multitasking has uncovered clear evidence that human information processing is insufficient for attending to multiple input streams and for performing simultaneous tasks (Chun et al., 2011; Koch, Lawo, Fels, & Vorländer, 2011; Marois & Ivanoff, 2005; Rosen, Lim, Carrier, & Cheever, 2011; Tombu et al., 2011; Wood & Cowan, 1995; Wood et al., 2012). Almost all of the research on multitasking is conducted in the cognitive sciences and focuses on simple tasks such as attending to a stream of words presented to one ear while a distractor stream is presented to the other. However, it is clear that the information processing difficulties humans experience when attempting to focus on simple stimuli transfers to more complex tasks. For instance, research shows that driving while talking and/or texting on a cell phone is associated with increased reaction times and higher rates of accidents (Drews, Pasupathi, & Strayer, 2008; Drews, Yazdani, Godfrey, Cooper, & Strayer, 2009; Strayer & Drews, 2004). Recent studies also show that talking on the phone is associated with worse pedestrian safety among college students (Stavrinos, Byington, & Schwebel, 2011).

Researchers are beginning to examine how today's college students multitask and how this affects their ability to learn material and engage in the learning process (Junco & Cotten, 2011; Mayer & Moreno, 2003; Rosen et al., 2011; and Wood et al., 2012). The purpose of this paper is to expand the research focusing on the effects of multitasking on educational outcomes among a large sample of college students.

1.1. College student technology use and the potential for multitasking

Nowhere is the penetration of social technologies and potential for multitasking more apparent than on college campuses. College students are part of a digital generation, born during a time when information and communication technologies (ICTs) were pervasive in our society; they have never known a time when it was not normal to use ICTs to perform daily activities (Cotten, McCullough, & Adams, 2011). They use ICTs at extremely high rates and also have to juggle classes, homework, work, and recreational activities.

A large EDUCAUSE Center for Applied Research (ECAR) study of college student ownership and use of technology ($N = 36,950$ students and 127 universities) found that over 73% text message daily, 99% own a computer (with 84% owning laptops), and 90% use social networking websites. The most popular social networking website is Facebook, with 97% of students saying they use the site (Smith & Caruso, 2010). Junco (2012) found that 92% of undergraduates used Facebook and spent an average of over 1 h and 40 min on the site per day. Ninety-six percent of young adult Internet users use search engines to find information and search engine use is the most popular Internet activity after email (Fallows, 2008; Purcell, 2011). Cell phones are also very popular with college students. A higher proportion of undergraduate college students own cell phones compared to same-aged non-students (Smith, Rainie, & Zickuhr, 2011). Eighty-eight percent of teenage cell phone owners send text messages, with those 14–17 years old typically sending 123 text messages a day (Lenhart et al., 2010).

Other technologies have decreased in popularity with college students. Data from 2007 (Junco & Mastrodicasa, 2007) show that students who used instant messaging (IM) typically spent over 1 h and 20 min actively chatting each day; more recent data using a younger sample (Rideout, Foehr, & Roberts 2010) found a steep decline with 15–18 year olds reporting using IM only 14 min per day. College students have shifted from using email for communicating with friends to using email for communicating with their professors (Carnevale, 2006; Lenhart, Madden, & Hitlin, 2005) and prefer it for official university communications (Salaway, Caruso, & Nelson, 2007).

1.2. Digital inequalities

While research shows that there is a high adoption rate of social technologies among college students, digital inequalities still persist. Technological ownership, adoption and use within the overall population and within the population of college students vary according to gender, race, and socioeconomic status (Cooper & Weaver, 2003; DiMaggo, Hargittai, Celeste, & Shafer, 2004; Hargittai, 2008a; Junco, Merson, & Salter, 2010; Kaiser Family Foundation, 2004; Rideout et al., 2010). Junco et al. (2010) found that female and white college students were over twice as likely to own a cell phone as male and African American students and more affluent students were over three times as likely to own a cell phone. African American students were more likely to send text messages than Whites (Horrigan, 2009), send more text messages and spend more time talking on cell phones than others (Junco et al., 2010). Women typically send more text messages than men (Junco et al., 2010; Rideout et al., 2010). Hargittai (2010) found that women, students from lower socioeconomic backgrounds, and African American and Latino students reported knowing less about the Internet even when controlling for online experience. She also found that Latino students were less likely to use Facebook than Caucasians, and that students whose parents had a college degree were more likely to use Facebook than students whose parents did not have a college degree (Hargittai, 2008b).

1.3. Multitasking and educational outcomes

Much research has examined the effects of multitasking on human information processing. Koch et al. (2011) found that there were significant performance costs (in both accuracy and reaction time) when switching between two auditory stimuli and that these costs were not reduced by advance preparation of participant's attention. Tombu et al. (2011) found that participants responded more slowly on dual task trials than on single task trials (for both auditory-vocal and visual-manual tasks) and had poorer accuracy. Additionally, using time-resolved fMRI, they found that an information processing bottleneck seems to be located in the prefrontal regions of the brain (Tombu et al., 2011). Attempting to either attend to or process more than one task at a time overloads the capacity of the human information processing system (Koch et al., 2011; Marois & Ivanoff, 2005; Strayer & Drews, 2004; Tombu et al., 2011; Wood & Cowan, 1995), which results in real-world consequences due to the costs of task switching (Koch et al., 2011; Tombu et al., 2011). The consequences of task switching extend to more complex tasks like driving and learning.

Research on distracted driving shows that drivers who talked on a hands-free cell phone had 18% slower brake onset times, took 17% longer to recover the speed that was lost after braking, and were involved in twice as many rear-end collision as those not talking on a phone (Strayer & Drews, 2004). Talking on a hands-free cell phone caused drivers to make more driving errors than when talking to a passenger (Drews, Pasupathi, & Strayer, 2008). Drivers who engaged in text messaging had longer brake onset times, longer following