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Technology use and academic performance

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ABSTRACT

As technology use continues its steady growth among college students, both within and outside of the classroom, its effect on academic performance becomes an increasingly important question to address. Cognitive theory and multitasking research strongly support a negative effect while other studies have found little to no effect. Using a large sample of students, this study attempted to address these opposing results and help find clarity. We explored the relationship of the frequency of students' use of technologies and their academic performance as measured by GPA, SAT scores, study hours, and predicted course grade. In order to help understand our findings, we also examined the role of gender and employment status in this relationship. Our hypotheses were partially supported, with frequency of technology use negatively related to academic performance. We discuss our findings and limitations of the research.

1. Introduction

Students are among the most active and enthusiastic users of contemporary digital communication technologies. Recent large scale surveys by Educause, Pew Research and others indicate that almost all college students access the internet, connect wirelessly, use social networking sites, own computers and cell phones and use the internet or email on their cell phones (Hakoama & Hakoyama, 2011; Smith, 2012; Smith & Caruso, 2010; Smith, Rainie, & Zickhur, 2011). Social media usage in particular has soared among traditional college-aged students. Eighty six percent of those ages 18–29 use social networking sites, a significantly higher usage rate than any other age group (Brenner, 2012.) Facebook alone currently has more than a billion users worldwide, with those in the U.S. 18–24 years of age the largest percent of all U.S. users (24%.) (Checkfacebook.com, 2013; Goldman, 2012; Internet World Stats, 2012.)

Scholarly study of these profound changes in rapid and heavy communication technology use on students' academic performance has just begun. Surprisingly, the results are mixed with some researchers finding technology use having little to no effect while others have found negative effects on academic performance. The purpose of this study was to add greater clarity to the research and examine the relationship between students' use of both computers and cell phones and their academic performance using a large sample of American students.

A variety of studies have found a negative effect of technology on performance. Chou (2001), in a qualitative study with Taiwanese students as its sample, reported sleep deprivation due to heavy internet use which, in turn, was correlated with poor academic performance. Also examining Taiwanese students, this time via quantitative methods and a large sampling (over 26,000), Chen and Peng (2008) found that students considered to be heavy users of the internet (identified by more than 34 h per week) had lower grades and lower learning satisfaction than non-heavy users. A similar type of study conducted by Kubey, Lavin, and Barrows (2001) in the U.S. found comparable results. Anand (2007) focused on the relationship between video game usage and grade point average (GPA). He reported “an inverse trend in GPA and daily video game usage; as the total time increased, GPA decreased” (p. 555) in his sample of U.S. college students.

Karpinski and Duberstein (cited in Ohio State University, 2009) found that while Facebook users reported spending less time studying than nonusers, 79% of these students did not believe that Facebook interfered with their academic performance. However, the authors' statistical analysis, not using students' subjective self-reporting, found a negative correlation between time spent on Facebook and grades. ul

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Haq and Chand (2012), using a sample of Pakistani students, reported that 61% of their sample believed that Facebook use adversely affected their academic performance, with men reporting this adverse effect to a greater extent than women.

Yet Pasek, More, and Hargittai (2009) found no negative correlation between Facebook use and students' grades when demographic variables were controlled while Kolek and Saunders (2008) suggested that Facebook usage may be correlated with higher grades. Rouis (2012) examined cognitive absorption in Facebook usage in relation to Tunisian students' polychronicity skills, engagement with their university and their satisfaction with friends and family. Although there was no direct negative effect of Facebook usage on academic performance as measured by GPA, her results found two moderators (student interest in her/his university and polychronicity skills) of this relationship.

Thus, surveying the literature suggests that there is no clear current agreement on the effects of technology use on academic performance.

1.1. Effects of multitasking

A number of researchers have explored the effects of using technology while engaged in academic endeavors to determine whether multitasking affects academic performance. In this study, we have adopted Junco and Cotten's (2012) definition of multitasking: "divided attention and non-sequential task switching for ill-defined tasks as they are performed in learning situations." (pp. 505–506) This definition was chosen because it was derived from the extensive cognitive psychology literature on attention to task as reviewed by Chun, Golomb, and Turk-Browne (2011). Numerous researchers have found that successful multitasking is impossible; our brains are not designed to concurrently attend to multiple incoming information sources effectively (Marois & Ivanoff, 2005; Monsell, 2003; Ophir, Nass, & Wagner, 2009.) The studies discussed in the following paragraphs have all found that humans cannot effectively attend to two or more tasks at the same time.

Mayer and Moreno (2003) provide a cognitive theory of multimedia learning that is relevant in examining multitasking and academic performance. They argue that human memory is both limited in its ability to process information coming from multiple channels and that meaningful learning requires substantial cognitive processing. They suggest that when processing demands exceed processing capacities, a situation of cognitive overload results, which diminishes meaningful learning. Thus, multitaskers cannot perform effectively due to the multiple cognitive demands simultaneously placed upon them.

Ellis, Daniels, and Jauregui (2010) conducted an experiment comparing accounting students who were required to text during a class lecture to those for whom texting was forbidden. Performance on a subsequent exam administered to both groups revealed that the texting group received significantly lower scores than the non-texters.

Fried (2008) reported a negative effect of in-class laptop use in both level of distraction and overall course performance while controlling for other possible explanatory variables such as academic preparation and aptitude as measured by high school rank and ACT scores. Kraushaar and Novak (2010) also reported a negative effect of in-class laptop use. With student consent, these researchers tracked the type of software running during a fifteen-week management information systems class. Those who had "distractive" software open during class had significantly lower scores on homework, projects, quizzes, final exams and final course averages than students who mainly used "productive" software. Additionally, they found that students' self-reports of multitasking were greatly underreported when compared to their actual behavior.

However, Hembrooke and Gay (2003) found the opposite; overall course performance was not affected by in-class laptop use and subsequent multitasking. Similarly, Hargittai and Hsieh (2010) reported no negative effect of social network use on academic performance.

A related issue, the impact of cell phone rings in the classroom setting has been studied. Both End, Worthman, Mathews, and Wetterau (2010) and Shelton, Elliott, Eaves, and Exner (2009) found that students exposed to ringing cell phones during a lecture exhibited low accuracy rates on test items based on material presented when compared to students who were not exposed to a ringing cell phone. Students also were less likely to include the interrupted lecture material in their notes. Campbell (2006) surveyed students and faculty and found that both groups indicated ringing phones in the classroom were a problem. Both groups supported policies banning them from the classroom.

Instant messaging during classroom time has also been a target for study. Fox, Rosen, and Crawford (2009) reported that the more time students spent instant messaging, the lower their self-reported GPA. Junco and Cotten (2011) reported negative effects of instant messaging on homework completion. In another study examining the effects of instant messaging, Levine, Waite, and Bowman (2007) found that distractibility and amount of time spent instant messaging were positively related while distractibility and amount of time spent reading books were negatively related. Bowman, Levine, Waite, and Gendron (2010) examined the effects of instant messaging during class time. When comparing groups that instant messaged before, during, or not at all while reading a long passage via their laptops while in class, the group that received instant messages while reading the passage fared the worst. When time spent reading the actual instant messages was subtracted, this group still required a much longer time (22–59%) to read the passage, an indication that multitasking was not working for these students.

A study conducted by Junco and Cotten (2012) investigated the effects of multitasking while studying. Using hierarchical regression analyses, they found that using Facebook and texting while completing class work were negatively associated with overall grade point average. Kirschner and Karpinski (2010) also found negative effects of Facebook use on grade point average and number of weekly hours spent studying. Yet, in Junco and Cotton's (2012) study, using email, instant messaging, talking on a phone, and information searching were not related to GPA.

Wood et al. (2011) conducted an in-class experimental study including several control groups and found detrimental effects of technology use on academic performance. Their results showed that students who used technologies during class time underperformed those who did not on a content-based exam. When these students were asked if they complied with the instructions on whether to use technology or not, only 57% reported compliance, suggesting that for a large percentage of students, the availability of technology was irresistible.

Frequency of cell phone use was negatively correlated with grade point average in research conducted by Harman and Sato (2011). Jacobsen and Forste (2011) included all types of electronic media in their research and found a negative correlation with grades.