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iSpy: seeing what students really do online

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Numerous studies have shown that college students use computers, the internet, and social networking websites (SNS) at high rates; however, all of these studies have relied on self-report measures of technology use. Research in other areas of human behavior has shown that self-report measures are considerably inaccurate when compared to actual behaviors. This study produces more effective estimates of the time that college students spend on computer and internet activities by using logging software to collect data on actual use. A sample of 45 students installed a computer monitor for two months. The results show that social networking was the most popular computer activity, with *Facebook* being the most popular SNS. Furthermore, the results also suggest that students may be able to somewhat regulate their computer use in ways that could benefit them academically. For instance, students spent significantly more time using the university's learning management system when classes were in session and less time watching videos. Although there are some limitations of monitoring computer usage, such monitoring is an effective method of evaluating frequency of use.

Keywords: internet; social networking sites; learning; students; computer logging

Introduction

Research has shown that college students use technologies like computers, the internet, and social networking websites (SNS) at high rates. Indeed, the most recent large-scale study of a stratified random sample of 3000 undergraduate college students found that 87% owned a laptop computer, 53% owned a desktop computer, and 11% owned a netbook (Dahlstrom et al. 2011). The most recent Pew Internet and American Life Project dataset on teen use of technology (Pew Internet and American Life Project 2011) corroborate the findings by Dahlstrom et al. (2011). The Pew data showed that 86% of households with a teenager owned a computer and 94% of teens reported using the internet. Youth use the internet at higher rates than people from other age groups: 95% of those 18–33 years old go online, 86% of those 34–45 go online, and 81% of those 46–55 go online (Zickuhr 2010).

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Because of their popularity, most of the research on what students do online has focussed on examining SNS use (Mesch and Talmud 2010; Palfrey and Gasser 2010). Of all SNS users, 92% use *Facebook* (Hampton et al. 2011). In contrast, the next most popular SNS, *Myspace* is only used by 29% of all SNS users (Hampton et al. 2011). Just like in the general population of SNS users, the most popular SNS is *Facebook* with research finding that around 90% of college students use the site (Dahlstrom et al. 2011; Junco 2012a). Junco (2012a) found that 92% of undergraduates used *Facebook* and spent an average of over 1 h and 40 min on the site per day. Ross et al. (2009) found that 79% of their sample reported spending between '10 and 60 min on *Facebook* daily' (581). Additionally, Pempek, Yermolayeva, and Calvert (2009) found that students reported spending an average of 27.93 min per day on weekdays and 28.44 min per day on weekends on *Facebook*. Lastly, Rideout, Foehr, and Roberts (2010) found that youth 15–18 years old, spent 26 min per day on SNS. These disparate figures of *Facebook* use are possible because of how frequency of use was assessed: through a self-report continuous measure (Junco 2012), a self-report categorical measure (Ross et al. 2009), or a self-reported daily diary (Pempek, Yermolayeva, and Calvert 2009; Rideout, Foehr, and Roberts 2010).

Beyond SNS use, there is limited data on how much time college students spend on computer-based activities. Data from 2007 (Junco and Mastrodicasa 2007) show that students who used instant messaging (IM) typically spent over 1 h and 20 min actively chatting each day. However, IM use has declined in popularity since. More recent data by Rideout, Foehr, and Roberts (2010) found that 15–18 year olds, spent an average of 1 h and 39 min on their computers, 14 min playing games, 14 min IM, 16 min on video websites, and 6 min on *email* 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, and Hitlin 2005) and prefer it for official university communications (Salaway, Caruso, and Nelson 2007).

Because of its popularity with students, there has been a great deal of interest in studying outcomes of *Facebook* use in university populations. Researchers have examined how *Facebook* is related to various aspects of the college student experience including learning (Junco 2012a; Kirschner and Karpinski 2010; Kolek and Saunders 2008; Pasek, More, and Hargittai 2009), student engagement (Junco 2012b), multitasking (Junco 2012c; Junco and Cotten 2012), political activity (Vitak et al. 2011), life satisfaction, social trust, civic engagement, political participation (Valenzuela, Park, and Kee 2009), development of identity and peer relationships (Pempek, Yermolayeva, and Calvert 2009), and relationship building and maintenance (Ellison, Steinfield, and Lampe 2007, 2011; Valenzuela et al. 2009). Additionally, researchers have examined how *Facebook* use relates to personality variables, such as scores on the big five personality dimensions of openness, conscientiousness,

extraversion, agreeableness, and neuroticism (Back et al. 2010; Ong et al. 2011; Ross et al. 2009).

While not as popular as *Facebook*, researchers have also studied how *Twitter* use is related to student educational outcomes. For instance, investigators have examined how *Twitter* use is related to student engagement and learning (Junco, Elavsky, and Heiberger 2012; Junco, Heiberger, and Loken 2011), developing social presence in a learning community (Dunlap and Lowenthal 2009), large-lecture classroom course dynamics (Elavsky, Mislan, and Elavsky 2011), student communication (Ebner et al. 2010), and how *Twitter* posts affect instructor credibility (Johnson 2011). While there has been some interest in student use of other SNS like *Pinterest* (Thornton 2012) and *Tumblr* (Yunus and Salehi 2012), little to no research has been conducted on their popularity among students.

All of the previous research on how college students use computers, the internet, and SNS has relied on self-report measures. For instance, large-scale research studies by the Pew Internet and American Life Project (Hampton et al. 2011; Lenhart, Madden, and Hitlin 2005; Smith, Rainie, and Zickuhr 2011; Zickuhr 2010), the Kaiser Family Foundation (Rideout, Foehr, and Roberts 2010), and other academic researchers (Junco and Mastrodicasa 2007) rely solely on self-report; however, self-reported measures of behavior are problematic. Research in other areas of human behavior has found that there are significant differences between self-reported and actual behaviors. For example, up to 50% of head and neck cancer patients who reported being non-smokers were actually smoking as determined by measurement of carbon monoxide in expired air and of blood levels of a nicotine metabolite (Hald, Overgaard, and Grau 2003), self-reported measures of physical activity underestimated health risk biomarkers by as much as 50% when compared to accelerometer measurements (Celis-Morales et al. 2012), and self-reported TV viewing time was underestimated by an average of 4.3 h per week when compared to data from a TV monitor (Otten, Littenberg, and Harvey-Berino 2010).

In the only published study of its kind, Junco (2013) found that students significantly overestimated the amount of time they spent on SNS by a factor of five. Therefore, it is possible that the data from previous research on college student computer and internet use are inaccurate estimates of time actually spent using these technologies. Furthermore, little research has examined the academic and social ways in which students use their computers and the internet. There is evidence to suggest that social use of the internet and SNS leads to different outcomes than academic use (Junco 2012a, 2012b, 2012c; Junco and Cotten 2012). There is also limited evidence to suggest that students adjust their online behavior based on external stimuli. For instance, Kay and Lauricella (2011) found that faculty structured use of laptops in classrooms led to students engaging in more academic computer activities. Like other research, the Kay and Lauricella (2011) study relied on student self-report.

Purpose of the study and research questions

The purpose of this study is to produce more effective estimates of the time that college students spend on computer and internet activities. Self-report measures of time spent using computers, the internet, and SNS have varied widely (for instance, researchers have asked students to report time spent yesterday, in general, or over the past week; Junco 2012a; Pempek, Yermolayeva, and Calvert 2009; Rideout, Foehr, and Roberts 2010; Ross et al. 2009). Some of the variability might be associated with when the data were collected (for instance, *Facebook* use has grown substantially since 2009). Another possibility for the wide range in usage estimates is the use of self-report measures. Research in other fields suggests that these are imprecise ways to measure actual usage (Celis-Morales et al. 2012; Hald, Overgaard, and Grau 2003; Otten, Littenberg, and Harvey-Berino 2010). In a recent study, Junco (2013) found that students significantly overestimated their *Facebook*, *Twitter*, *email*, and *search engine* use. Therefore, previous research showing normative values for student technology use may be providing very high estimates of use.

This study uses a computer logging method to collect data on how much time students spend on computer-related activities. Since SNS are popular with college students, this study will pay particular attention to the actual amount of time students spend on these sites. The study was conducted over two months: one month during an academic semester and then continued through one month of a student break. It is hypothesized that students will impose a limited structure on their usage habits when classes are in session, much in the same way that they behaved differently in a classroom when laptop use was structured (Kay and Lauricella 2011).

The research questions examined were:

Question 1: How much time do students actually spend on various activities on their computers?
Question 2: Are there differences in the ways that students use their computers when classes are in session vs. when they aren't?

Methods

Participants

A random sample ($n = 640$) of all ($N = 1186$) of college students enrolled for summer courses at a medium, 4-year, public, primarily residential institution in the Northeast was obtained through the university's institutional research office. Students were contacted through their on-campus *email* accounts and sent a link to a survey hosted on *SurveyMonkey.com*, a commercial survey-hosting website. The survey included demographic questions and questions for forthcoming analyses. For students who had not completed the survey, a reminder

was sent a week after the first *email*. After completing the survey, students were asked to install software that monitors their computer activity. Student computer use was recorded for the month of July (when students were enrolled in summer courses) and for the month of August (when courses were not in session). Participants were offered a $10 *Amazon.com* gift card as an incentive. A total of 110 surveys were completed for an overall response rate of 17%. Of the 110 students who completed the survey, 49 installed the monitor for a 45% participation rate. Four students dropped out of the study before the end of the two-month data collection period for a final sample size of 45. The survey data were downloaded as an SPSS file directly from *SurveyMonkey*, combined with data from the monitoring software, screened for anomalies, and analyzed using SPSS Statistics Version 19.

Instrument and measures

Demographic information

Demographic information was obtained from the university's institutional research office. Parental education (a proxy for socioeconomic status) was evaluated by asking students 'What is the highest level of formal education obtained by your parents?' with prompts for 'Parent/Guardian 1' and 'Parent/Guardian 2'. Parental education items were coded using a five-point Likert scale with options for 'less than high school degree'; 'high school degree'; 'some college'; 'college graduate (for example: B.A., B.S., B.S.E.)'; and 'advanced graduate (for example: master's, professional, J.D., M.B.A., Ph.D., M.D., Ed.D.)'.

Monitoring software

Upon completing the survey, students were provided a link to download an application that monitored their computer use for two months. Once installed, the students were unable to remove the software from their computer until the end of the monitoring period. The monitoring software was developed in order to help employers evaluate how employees are using their computer time. The software ran in the background and measured which application, website, or document was being used. Specifically, it only measured active time spent on the current window. After 2 min of idle time (when no mouse movement or keyboard activity is detected), the software stops logging and does not add those 2 min to the active time count for that window. The data collected by the software were automatically uploaded to a central server where only the researcher had access to the monitoring data. The number of seconds each student spent on various computer activities were downloaded from the server and then converted to average minutes per day.

In addition to collecting time spent on each computer activity, the monitoring software categorizes activities for ease of initial analyses. For the purposes

of this study, the most popular categories for the entire monitoring period were used. These categories were

(1) Social networking: This category included all time spent on SNS. This included sites, such as *Facebook*, *Twitter*, *tumblr*, *Pinterest*, etc.
(2) Writing: Time spent on all writing applications including *Microsoft Word*, *Open Office Writer*, and *Apple Pages* was included in this category.
(3) Learning management: This category almost exclusively included time spent on the university's *learning management system* (*LMS*) with the exception of one student who, in addition to the courses at the university where the study was conducted, was also taking online courses at another university which used an *LMS*.
(4) Games: The time spent playing online or standalone games was included in this category.
(5) *Email*: Included in this category was the time students spent on web-based *email* services like their university *email* accounts, *Yahoo*, and *GMail*, as well as *email* applications, such as *Outlook*, *Mail*, and *Thunderbird*.
(6) Utilities: Time spent on utilities, such as the system calculator, notepad, anti-virus, and software updater applications was included in this category.
(7) Video: This category included time spent watching any type of video, whether streamed online, local DVD, or local video file.
(8) Search: Time spent using online *search engines* was included in this category.
(9) Reference: The reference category included reading digital books, using reference websites, such as *Wikipedia* or *Dictionary.com*, and using the library's article *search engine*.

Data analyses

Descriptive statistics were run to illustrate the demographic characteristics of the sample and to describe overall computer use. One-way ANOVAs were conducted to test whether there were differences in time spent on computer activities between July and August.

Results

Demographics

Seventy-three percent of the participants were female. The mean age of the participants was 28 (SD = 10). The age of participants ranged from 18 to 51, though 62% were between 18 and 24 years old. Twenty-six percent of students in the sample were first-year students, 19% were sophomores, 14% were juniors, and

40% were seniors. Highest educational level attained by either parent was as follows: 35% had a high school degree or less, 28% completed some college, 23% were college graduates, and 14% had a graduate degree. In terms of race and ethnicity, the sample was overwhelmingly Caucasian, with 89% of students listing that as their race. Additionally, 5% of the sample was African-American, 5% were Latino, 2% were Asian-American, 2% were Native American, and 2% identified as 'other'. The gender, race, and ethnic characteristics of the sample were similar to that of the population of enrolled summer students, excepting an overrepresentation of women in this sample. Furthermore, the demographic characteristics of the population of enrolled summer students was similar to that of the overall university population, excepting a slight overrepresentation of women in the summer population.

Since not all students who completed the survey installed the monitoring software, analyses were conducted to test whether there were differences in background characteristics between those who installed the software and those who did not. Pearson's χ^2 tests indicated that there were no differences between students who installed the software and those who did not on gender (χ^2 (1, 101) = 0.557, $p > .3$), ethnicity (χ^2 (1, 101) = 0.010, $p > .6$), and race (χ^2 (5, 101) = 4.278, $p > .5$).

Technology use

The amount of time students spent on the most popular categories for July and August are reported in Figure 1. Furthermore, the percentage of students who used the most popular activities for July and August are reported in Figure 2. Figure 3 reports the amount of time students spent on and Figure 4 reports the percentage of students who used the most popular computer activities for July and August. Lastly, Figure 5 shows the amount of time students spent on and Figure 6 shows the percentage of students who used the most popular social networking sites for July and August.

One-way ANOVAs testing whether there were differences in the use of specific categories or activities between July and August found significant differences in the use of learning management and videos. Specifically, students spent more time per day on the university's *LMS* in July ($M = 11.55$, SD = 13.48) than in August ($M = 1.13$, SD = 1.31), F (1, 64) = 17.141, $p < .001$, $\eta^2 = .21$. They also spent more time per day watching videos in August ($M = 4.03$, SD = 6.12) than in July ($M = 0.08$, SD = 0.11), F (1, 81) = 17.902, $p < .001$, $\eta^2 = .18$.

Discussion

The results of this study show that when using time spent as the measure, social networking was the most popular computer activity. When looking at percentage of users, almost all students used SNS, writing applications, *email*, utilities,
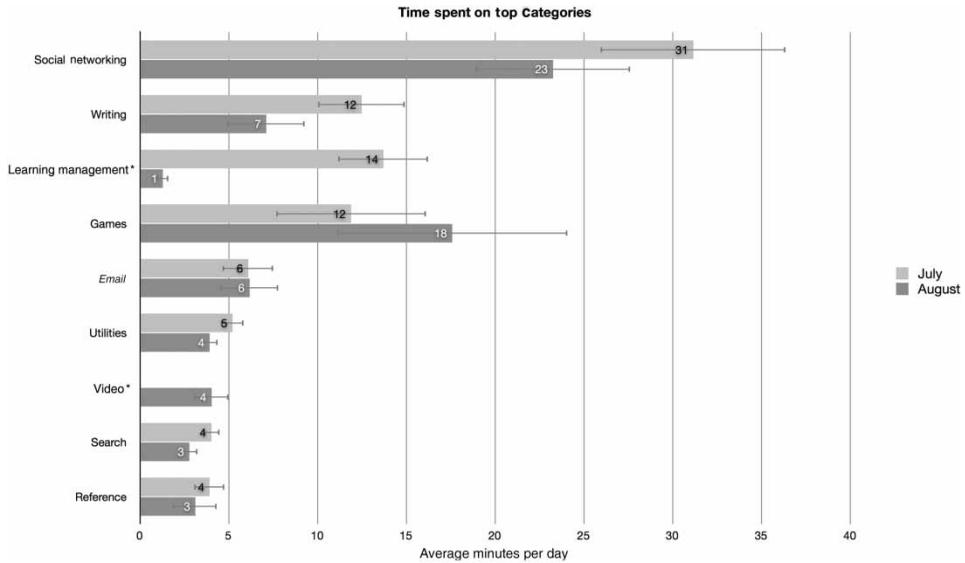
Figure 1.   Mean time spent each day on the most popular categories of computer activities for July and August.
Note: * denotes means which are significantly different at the $p < .001$ level.
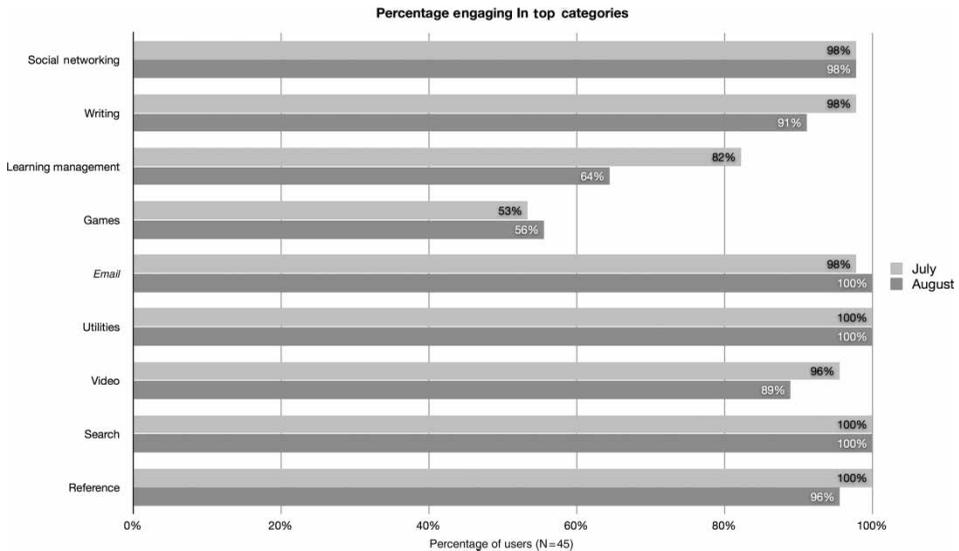

Figure 2.   Percentage of students who engaged in the most popular categories of computer activities for July and August.

and used the internet as a reference tool. Using the university's *LMS* was a popular activity for students only when courses were in session. Furthermore, when courses were in session students spent almost as much time on SNS as they did on the schoolwork-related activities of writing, *LMS* use, and using
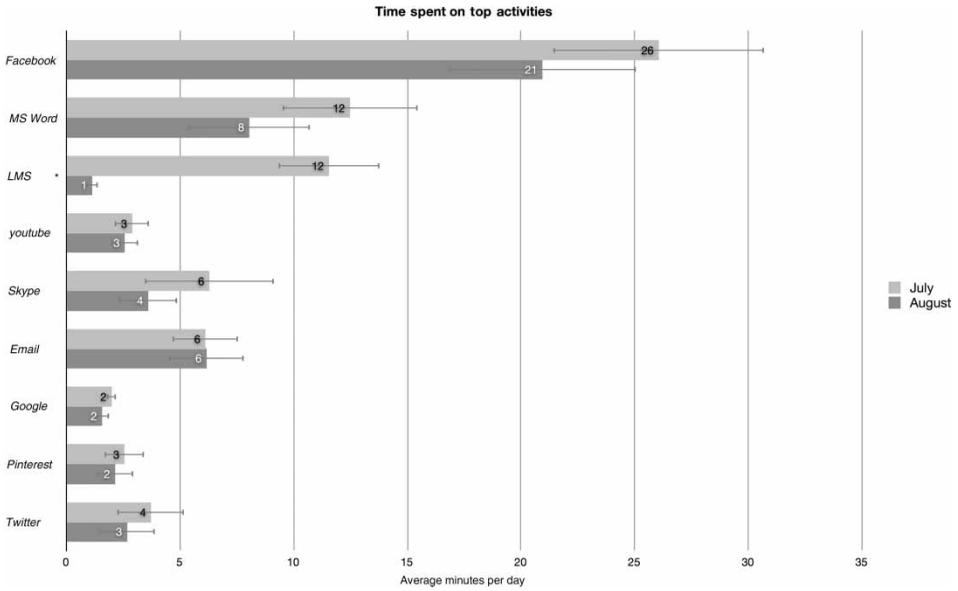
Figure 3.   Mean time spent each day on the most popular computer activities for July and August.
Notes: *LMS*, the university's *LMS*. *Denotes means which are significantly different at the $p < .001$ level.
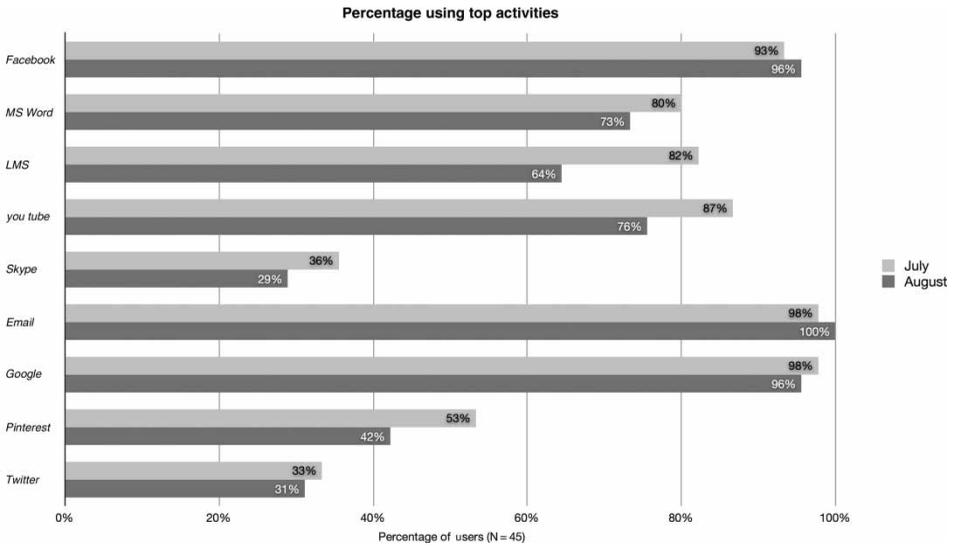

Figure 4.   Percentage of students who used the most popular computer activities for July and August.
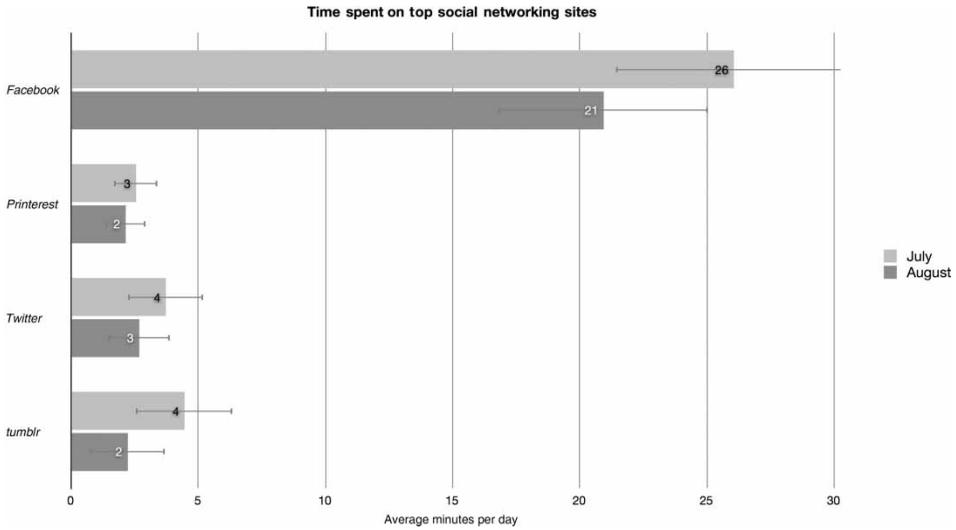
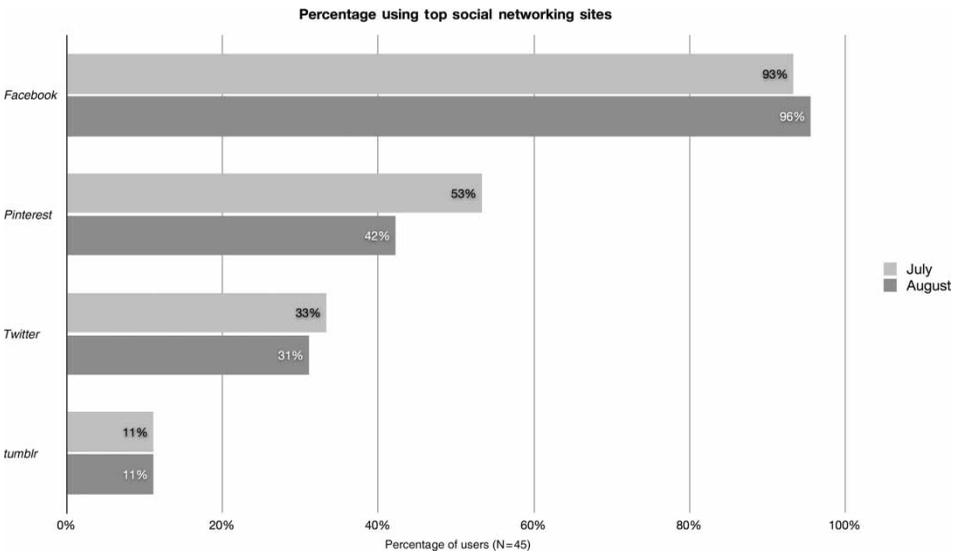Figure 5.   Mean time spent each day on the most popular social networking sites for July and August.

Figure 6.   Percentage of students who used the most popular social networking sites for July and August.

the internet as a reference tool combined. The most popular activities when using time as the measure (Figure 3) were *Facebook*, *MS Word*, *LMS*, *Skype*, and *email*. The most popular activities based on percentage of users (Figure 4) were *email*, *Google*, *Facebook*, *youTube*, and *LMS*. Lastly, *Facebook* was by far the most popular SNS both by time (Figure 5) and percentage of users (Figure 6).

Some of the data from the current study are consistent with the findings from previous research. For example, data from the current study showed that 93% and 96% of students in the sample used *Facebook*, congruent with findings by Hampton et al. (2011) and Junco et al. (2012). Furthermore, data from the current study on time spent on *Facebook* (26 min per day in July; 21 min per day in August) were congruent with findings from Pempek, Yermolayeva, and Calvert (2009), Rideout, Foehr, and Roberts (2010), and with the broad estimate provided by Ross et al. (2009). However, data from the Pempek, Yermolayeva, and Calvert (2009), Rideout, Foehr, and Roberts (2010), and Ross et al. (2009) studies are several years old and estimates of *Facebook* use have generally increased since. In addition to the estimates of around 100 min per day in the studies by Junco (2012a, 2012b), a newer study by Ellison et al. (2011) found that students reported using *Facebook* 81.4 min each day. Another recent study by Kalpidou, Costin, and Morris (2011) found that students spent 60–120 min per day on the site. The results of the current study also contrasted with Hampton et al.'s (2011) finding that *Myspace* was the next most popular SNS used by 29% of students; *Myspace* was not among the four most popular SNS in this sample. Indeed, data from the current study show that when students use SNS, *Facebook* is by far their site of choice.

In addition to the data provided about SNS use, the current study showed other ways in which students use their computers. Unlike findings by Rideout, Foehr, and Roberts (2010), students in this sample did not use IM suggesting that the technology is becoming less popular and possibly has been supplanted by text messaging (Rosen 2012). The current sample also spent much less time watching videos, but about the same amount of time using *email* as the Rideout, Foehr, and Roberts (2010) sample. Furthermore, data from the current study show that students who played games on their computers spent a large amount of time on them relative to other activities. Additionally, students spent significantly more time using the university's *LMS* when they were taking classes, presumably for course assignments (such as posting to discussion boards, turning in papers, etc.). Lastly, *Google* was the most popular *search engine* in this sample with as many students using *Google* as *email* when classes were in session.

Limitations

A principal limitation of this study was the possibility that students who chose to install the software had unmeasured characteristics that they did not share with those who declined to participate and that these characteristics might have influenced how they used their computers. In this study, there were no differences between students who chose to install the monitoring software and those who did not on demographic variables; however, future research will want to test whether other variables are related to student willingness to allow researchers to monitor their computer activity. Though the sample was

representative of enrolled summer students and the enrolled summer students were representative of the overall university population, the university's population may not generalize to all universities. Another limitation of this study is the possibility of observer effects or that students behaved differently because they knew their internet activities were being monitored. Students who were being monitored may not have used their computers in the same ways as they were when not being monitored.

A further limitation was the possibility that students used other devices to go online not to circumvent the computer monitor, but as part of their regular pattern of technology use. Research by the Pew Internet and American Life Project found that 63% of undergraduate cell phone owners use their devices to go online (Smith, Rainie, and Zickuhr 2011). Furthermore, students may have circumvented the computer monitor by using another computer. Therefore, it is possible that monitoring student computer activity might miss capturing all of the time they spend online. Future research will want to examine ways to collect data not only from computers but from mobile devices as well. Lastly, though the sample was representative of enrolled summer students (and the enrolled summer students were representative of the overall university population), the activities in which students engage in during summer sessions might be different. Students typically do not carry heavy class load in the summer giving them more free time for recreational pursuits.

Conclusion

In addition to providing normative data on how college students use their computers, this study suggests that type of computer activity varies little whether students are taking classes or not. The results also suggest that students may be able to somewhat regulate their computer use in ways that could benefit them academically. For instance, students spent significantly more time using the university's *LMS* when classes were in session and less time watching videos. However, they did not spend significantly less time engaging in other forms of entertainment, such as using SNS or gaming while classes were in session nor did they spend more time conducting online searches or using the internet as a reference tool when courses were in session. As other researchers have posited, perhaps SNS are used for entertainment and also for academically relevant activities and processes like building and maintaining relationships with peers and involvement in campus life (Ellison et al. 2007, 2011; Junco 2012b; Valenzuela et al. 2009).

Previous research suggests that the ways in which SNS are used are most important in predicting outcomes (Junco 2012a, 2012b, 2012c). In other words, students can and do use *Facebook* and other social technologies in ways that improve their engagement and increase their social and academic integration (Junco 2012b). However, all of the previous research on the outcomes of SNS use has relied on self-report measures. There are large differences between previously reported amounts of time spent on *Facebook* and

actual time assessed in the current study. Additionally, results from the Junco (2013) study show that there is a significant difference between self-reported and actual use of SNS. These differences may substantially change the results of research on the academic outcomes of *Facebook* use. Future research should attempt to incorporate logging methods in order to evaluate actual relationships between SNS use and academic variables.

While the results of the current study do not allow drawing conclusions about the ways in which students used SNS during and after the academic semester, future research may want to investigate how types of use change based on external demands (such as increased amounts of academic work) and how these different SNS activities affect academic outcomes. While this study provides the first examination of how students are actually using their computers, more research is warranted. Specifically, future research should focus on the motivators for using types of computer activities and how these motivators mediate technology usage. Furthermore, additional research should include actual measurements of how students are using their mobile devices to access the internet and for social networking activities to obtain a clearer picture of how these technologies are used.

Notes on contributor

Reynol Junco is a faculty associate at the Berkman Center for Internet & Society where he focuses on studying how youth interact with digital media. Rey's primary research interest is using quantitative methods to analyze the effects of social media on youth psychosocial development, engagement, and learning.

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