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Relations Between College Students' Cell Phone Use During Class and Grades

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In the present study, we examined the relations between daily in-class cell phone use and test grades among college students. Across 2 semesters and 6 separate courses, participants ($N = 218$; 174 females, 44 males; 50 freshmen, 54 sophomores, 76 juniors, and 38 seniors; $M_{\text{age}} = 20.0$ years, age range 18–23 years) completed a brief questionnaire at the end of each class period indicating the number of times they used their cell phone for social networking (e.g., email, texting, using Facebook), to access the Internet for information, for organization (e.g., update one's calendar), or to play a game. Mixed-effects regression model analyses indicated that cell phone use was significantly and negatively associated with test scores regardless of student sex and grade point average ($\beta = -0.287$, $p = .035$). We discuss the results in terms of the ubiquitous nature of cell phone use among today's wired generation and the implications it has for learning, achievement, and postcollege success.

Keywords: cell phone use, college students, test scores, achievement

The dilemma facing college and university instructors regarding student cell phone use (CPUse) during class is one that pits an emphasis on learning and focused attention against the normative communication, information-gathering, entertainment-seeking, and social networking culture and habits of young adults. Although much of the research has used U.S. samples, CPUse by youth has been studied in countries throughout the world, including Australia (Walsh, White, Cox, & Young, 2011), China (Li, 2009; Rosenfeld & O'Connor-Petruso, 2014), Japan (Igarashi, Takai, & Yoshida, 2005), South Africa (North, Johnston, & Ophoff, 2014; Shambare, Rugimbana, & Zhowa, 2012), Spain (Alobiedat, 2012; Sanchez-Martinez & Otero, 2009), Taiwan (Hong, Chiu, & Huang, 2012; Yen et al., 2009), and Turkey (Arslan & Ünal, 2013; Hoştut, 2010). For this so-called "wired generation" (Jacobsen & Forste, 2011), the cell phone has become a digital appendage or "extended self" (Belk, 2013) that is always on and constantly beckons the attention of its owner.

Studies conducted in the United States have shown that today's young adults or "digital natives" (Bennett & Maton, 2010) have higher rates of CPUse (Zickuhr, 2011) and are more likely to accept CPUse in social situations than older adults (Forgays, Hyman, & Schreiber, 2014). The average college student spends between 5 and 9 hr per day using a cell phone (Lepp, Barkley, & Karpinski, 2014; Roberts, Yaya, & Manolis, 2014). Students report spending approximately 3.5 hr per day texting (Rosen, Carrier, & Cheever, 2013), send an average of between 77 and 102 text messages per day (Harman & Sato, 2011; Junco & Cotten, 2012; Lepp et al., 2014), and spend an average of 2 hr per day using instant messaging (Junco & Cotten, 2011). Roberts et al. (2014) examined average daily CPUse for 24 separate activities and found that college students report spending 94.6 min texting, 48.5 min emailing, 34.4 min on the Internet, and 94.7 min using social media (Facebook, Twitter, Pinterest, and Instagram).

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Researchers consistently report that most (>90%) students use cell phones in class each week, that 10% have sent text messages during exams, and that students believe instructors are largely unaware of student CPUse in the classroom (Baker, Lusk, & Neuhauser, 2012; Elder, 2013; Gurrie & Johnson, 2011; Tindell & Bohlander, 2012). Furthermore, studies regularly find that most students text during class (Berry & Westfall, 2015; Hanson, Drumheller, Mallard, McKee, & Schlegel, 2010; North et al., 2014; Olmsted & Terry, 2014; Tindell & Bohlander, 2012).

Research investigating the habitual or addictive nature of CPUse highlights the motivations for this aspect of young adults' behavior. Hong et al. (2012) found that students who scored higher on a measure of mobile phone addiction had higher levels of social extroversion and anxiety and lower levels of self-esteem than other students. In another study, females scored significantly higher on a measure of cell phone addiction than males, texting consumed the most student CPUse time, and cell phone addiction for both sexes was driven by a desire to connect socially (Roberts et al., 2014). Self-reports of university students have also indicated that they spend more time each week texting (M = 14.35 hr per week) than either attending class (M = 12.35 hr) or studying (M = 11.91 hr), demonstrating that students text continually throughout the day, including during class, in part to "catch up with friends" (Hanson et al., 2010, p. 27). Oulasvirta, Rattenbury, Ma, and Raita (2012) discovered that cell phone checking habits were motivated by entertainment, killing time, and increasing information or awareness. Cell phone checking habits were pervasive among their sample of university students, often occurred during lectures, and served as a "gateway" behavior to increased use. That is, receiving a reward (e.g., receiving an email or Facebook post) induced further CPUse. The authors argued that receiving such rewards helps users to "avoid boredom and cope with a lack of stimuli in everyday situations as well as make them aware of interesting events and social networks" (p. 3). Participants reported that entertainment seeking, boredom, killing time, and taking a small attention break in an attempt to restore one's attention to the speaker motivated CPUse during class. Although several participants revealed that they were annoyed with their own CPUse and were aware of the habitual, addictive nature of their behavior, most did not consider habitual use a problem. Oulasvirta et al. propose that smartphones have increased texting and social networking behaviors because, given that they are always on hand and offer a "wider variety of channels to connect to remote information and people," (p. 5), they serve as a constant situational cue prompting access to friends, social networking sites, and information. Likewise, Lepp, Barkley, and Karpinski (2015) explained that the cell phone creates the temptation to "surf the Internet, check social media (e.g., Facebook), play video games, contact friends, explore new applications, or engage with any number of cell-phone-based leisure activities, which some students fail to resist when they should otherwise be focused on academics" (p. 7).

Researchers have also investigated the "multitasking" nature of texting and social networking while engaged in academic tasks and its relation to learning and achievement. Rosen et al. (2013) investigated task switching by students studying at home and found participants spent an average of 6 min studying before task switching, often because of technological distractions such as texting or accessing Facebook. Furthermore, those who had the shortest attention spans indicated a preference for multitasking and tended to "load their studying environment with easily distracting, emotionally engaging technologies such as text messaging and Facebook" (p. 955). The authors found that higher rates of Facebook use were associated with lower grade point average (GPA) scores. Junco and Cotten (2011) collected survey data from a large sample of university students (N = 4,491) and found that 93% said they had used instant messaging while working on schoolwork, and 57% believed multitasking in this way had a detrimental effect on their academic work. Junco (2012a) also found that the amount of time students spent using Facebook negatively predicted engagement in academic and cocurricular activities. Additional research (Junco, 2012b; Junco & Cotten, 2012) examining the relations between multitasking in the context of schoolwork outside of class and college GPA demonstrated that texting and accessing Facebook negatively predicted college GPA, independent of high school GPA.

Several studies have specifically documented the relationship between overall daily CPUse and college achievement. Harman and Sato (2011) reported a significant negative relationship between college GPA and student estimates of average daily use of text messaging. Likewise, Jacobsen and Forste (2011) found that overall time spent using social networking sites and using one's cell phone to talk or text over the course of 3 days negatively predicted college GPA. The authors reported that 62% of their respondents said they used nonacademic media while in class, studying, or doing homework. However, the study did not specifically analyze the amount of time spent engaged in CPUse during class. Lepp et al. (2014, 2015) measured CPUse through participant estimates of average time spent using their mobile phone each day and found that estimated CPUse and texting negatively predicted GPA.

Very few studies have provided evidence regarding the relationship between in-class CPUse and achievement in higher education. Rosenfeld and O'Connor-Petruso (2014) reported that 67% of U.S. university students agreed it is socially acceptable to send or receive text messages during lectures and class discussions, yet three quarters admitted they miss class information when doing so. Tindell and Bohlander (2012) found that 32% of students believed sending texts during class impairs a student's attention to class information and has a negative effect on grades. Ravizza, Hambrick, and Fenn (2014) compared student self-reports of in-class texting, Facebook use, email use, and nonclass Internet use with grades on a cumulative final exam and found a significant negative correlation between exam grades and nonclass Internet use.

In short-duration experiments, researchers have demonstrated that CPUse impedes students' ability to learn and recall lecture material. Rosen, Lim, Carrier, and Cheever (2011) found that high levels of text messaging interruptions significantly impaired students' recall of lecture material. Wood et al. (2011) compared student performance on multiple-choice tests between participants assigned to different in-class distractor or nondistractor groups and found that participants in the Facebook use and text messaging distractor groups performed significantly worse on tests of lecture material compared with groups engaged in more traditional activities such as paper-and-pencil or word processor note-taking. In another study, students participated in simulated lecture conditions in which experimenters either texted or did not text participants during the lecture. Student test scores were significantly lower after the texting compared with the nontexting condition (Froese et al., 2012). Finally, researchers have assigned university students to either a texting or nontexting condition during a class lecture and found that texting resulted in significantly lower scores on a quiz administered at the end of class (Ellis, Daniels, & Jauregui, 2010; Gingerich & Lineweaver, 2014).

In sum, evidence suggests that CPUse is ubiquitous among today's college students, that it is negatively associated with academic achievement, and that CPUse impacts learning and achievement in the context of both in-class and out-of-class academic engagement. However, previous studies have only used self-reports of average or typical CPUse or conducted short-term experiments followed by assessments of immediate learning. The purpose of the present study was to advance the understanding of in-class CPUse and achievement in two ways. First, no published studies have continuously measured daily in-class CPUse over an entire semester and compared it to test grades throughout the term. Second, the study addresses an important limitation in the extant literature examining self-reports of typical or average CPUse; namely, that there is only a moderate correlation between self-report measures of typical or average use and server log data of actual use (Boase & Ling, 2013). Therefore, previous studies may have reported results that were only moderately accurate. We hypothesized that higher levels of CPUse would be negatively associated with test grades over the course of the academic term(s), as reflected in results of random coefficient linear mixed-effects modeling analyses (recommended for the analysis of repeated measure correlational data, Hedeker & Gibbons, 2006), and that this relationship would be significant independent of the relationship between test grades and overall GPA.

Method

Participants

Two hundred and eighteen students participated in our study at a medium-sized Southeastern university during the Fall, 2013, and Spring, 2014, semesters. Students were enrolled in the following courses: introduction to psychology, fall (22 females, 14 males; 25 freshmen, 9 sophomores, 1 junior, 1 senior; $M_{age} = 18.7$ years); infant and child development, fall (39 females, 3 males; 1 freshman, 7 sophomores, 17 juniors, 17 seniors; $M_{age} = 20.7$ years), cross-cultural psychology, fall (26 females, 3 males; 1 freshman, 6 sophomores, 13 juniors, 9 seniors; $M_{age} = 20.6$ years); introduction to psychology, spring (19 females, 13 males; 23 freshmen, 6 sophomores, 3 juniors, 0 seniors; $M_{age} = 18.8$ years); adolescent and adult development, spring (43 females, 7 males; 0 freshmen, 11 sophomores, 31 juniors, 8 seniors; $M_{age} = 20.7$ years), and cross-cultural psychology, spring (25 females, 4 males; 0 freshmen, 15 sophomores, 11 juniors, 3 seniors; $M_{age} = 20.2$ years). Students earned extra credit for their participation. One student in the six courses declined to participate and completed an alternative assignment to earn extra credit. The instructor explained the procedures and purpose of the study to students on the first day of the semester. To facilitate data entry and assign extra credit, the instructor explained that students would sign each questionnaire, responses were confidential, CPUse in class was neither encouraged nor discouraged, and each student should feel free to choose whether or not to use his or her cell phone during class. The instructor emphasized on the first class day, and repeatedly throughout the semester, that discrete CPUse (i.e., outside of plain view, below the desk) and responses, questions, or comments written on the questionnaire would not affect student grades. All data were included for students who completed a course. The University Human Subjects Committee approved the procedures used in this study.

Materials

The CPUse questionnaire consisted of a half-page form (8.5" × 5.5") that included six items. Students filled in the date at the top of the form and answered the following questions: (a) rate your understanding of today's class content and (b) rate how interested you were in today's class content (responses for items 1 and 2 were Likert-type [1 = *very low*, 2, 3, 4, 5 = *very high*]). Item 3 was preceded by the instruction "Not including checking the time, how many times did you use your cell phone during this class to," followed by the CPUse items; (c) read or send email, text message, Facebook, Twitter (social media); (d) access Internet, a webpage, for something (information); (e) write myself a note, check my calendar (organization); (f) play a game (game). Responses for items 3–6 were whole numbers listed individually from 0 through 15, indicating frequency of use for each category. (On only 4 of the 18,940 total responses for items 3–6 a participant entered a number higher than 15. These data were entered as is.) At the bottom of the form, students used a blank space to write questions or comments about the day's class, space that students used heavily throughout both semesters. After the end of the course, the university registrar's office provided individual GPA scores, age, and class rank data. It was necessary to use post-course GPA scores because no GPA scores were available for students in the introduction to psychology course during the fall semester.

Procedures

Courses were either 50 or 75 min in length. Each course was primarily lecture format but included ample time for student questions and discussion. The instructor made no comments during lectures regarding discrete use of cell phones, and if a student used a cell phone on the desk the instructor unobtrusively reminded the student that CPUse was permissible below the classroom table. There were very few instances when such a reminder was necessary. Each day (not including days on which tests were administered), with approximately 10 min left in the class period, the instructor distributed the questionnaires. When distributing the forms, the instructor reminded students that their honest answers were highly valued and that questionnaire responses did not affect course grades. Participants completed the questions and signed and printed their name at the bottom of the form. Students remained seated until all students completed the form, after which the instructor collected all questionnaires. Students took in-class tests, all worth 100 points each, at equal intervals throughout the semester within each course (between three and five tests, depending on the course), and all tests included multiple-choice and short essay questions.

Statistical Analysis

Mixed-effects regression model analyses (MRMs) provide an assessment of longitudinal, repeated measurement data that are correlational in nature. MRMs include random subject effects in regression models "in order to account for the influence of subjects on their repeated observations" (Hedeker & Gibbons, 2006, p. 47). In other words, random fluctuations across time for each participant serve to describe each subject's trend through the study, and the analysis calculates an individual slope for each participant. In addition, MRMs do not require that participants provide data on the same number of time points (allowing for the inclusion of participants with missing data), and it is not a requirement that participants provide data at the same time points because time serves as a continuous variable (Hedeker & Gibbons, 2006).

We fit a random coefficient linear mixed-effects model to predict test scores considering class, test time (test 1, 2, etc.), and the interaction between class and test time as fixed effects. A random coefficient model enabled the inclusion of student-specific intercepts (first test score) and slopes (changes in student test scores over time). The analysis used average scores on questionnaire items for the class days before each test (pretest periods) to predict test scores. We then determined whether GPA or gender significantly adjusted the model. Subsequently, we examined each questionnaire item to determine whether it significantly improved the model containing GPA, class, test time, and the interaction between class and test time as fixed effects with subject-specific intercepts and slopes. We also used two separate random coefficient linear mixed-effects models to assess the effects of course level (introduction to psychology vs. upper-level courses) and length of course (50 min vs. 75 min) by entering them as fixed effects into the models instead of class. We fit all models using the lmer function in the R programming environment (Bates, Mächler, Bolker, & Walker, 2014).

Results

We obtained 4,735 responses (completed questionnaires) from 218 participants, with an average of 19.96 responses per student (SD = 2.13). We subsequently averaged responses within each pretest period (the classes before each in-class test) resulting in 826 observations on 218 students in six classes across two semesters. In-class test scores averaged 74.49% (out of 100) across the entire sample, and the mean for each class ranged from 67.85 to 78.06. The average GPA for the sample was 2.84 (SD = 0.64), and the means for the six courses were 2.43 (introduction to psychology, fall, SD = 0.82), 2.98 (infant and child development, fall, SD = 0.49), 2.93 (cross-cultural psychology, fall, SD = 0.51), 2.55 (introduction to psychology, spring SD = 0.67), 3.02 (adolescent and adult development, spring, SD = 0.52), and 3.06 (cross-cultural psychology, spring, SD = 0.53).

We fit a random coefficient linear mixed-effects model to predict test scores considering class, test time (test 1, 2, etc.), and the interaction between class and test time as fixed effects. The interaction between class and test time was significant ($p < .0001$); therefore, we retained the interaction and main effects for class and test time in the model. It was then determined that GPA significantly adjusted the model ($p < .0001$), although sex did not ($p = .58$). Subsequently, we dropped sex from the model and examined each questionnaire item separately (understanding, interest, social media use, Internet use, organization use, and game-playing use) to determine whether it significantly improved the model containing GPA, class, test time, and the interaction between class and test time as fixed effects with subject-specific intercepts and slopes. Alternative models were calculated substituting course level (introduction to psychology vs. upper-level courses) and course length (50-min vs. 75-min courses) for class. Course level significantly predicted test scores ($p = .03$) whereas course length did not ($p = .36$). Given the stronger relationship between class and test scores, and that the focus of the study was to investigate the relationship between CPUse and test scores above and beyond other factors, we subsequently focused on the model that included class as a fixed variable.

The mean ranges across all pretest periods; the parameter estimates and *p* values from the random coefficient linear mixed-effects models for each questionnaire item with GPA, class, test time, and the class-by-test-time interaction as fixed effects; and models for each item without GPA are shown in Table 1. Mean ranges are presented because each subject's pretest period had a unique mean value, and calculating means across all pretest periods would average observations that are not independent. Understanding and interest positively predicted test scores; a one-unit increase in understanding predicted a 1.636 increase in test score (p = .04) whereas a one-unit increase in interest predicted a 1.544 increase in test score (p = .006). Social media use negatively predicted test scores; a one-unit increase predicted a 0.287 decrease in test score (p = .035). Internet access for information, organizational use, and playing a game did not significantly predict test scores, and the frequency of use for these items was much lower than social media use.

We estimated additional models without including GPA. Understanding and interest again positively predicted test scores; a one-unit increase in understanding predicted a 2.715 increase in test score (p = .0042) whereas a one-unit increase in interest predicted a 2.353 increase in test score (p = .0005). Social media use again significantly predicted test scores; a one-unit increase in use predicted a 0.609 decrease in test score (p = .0004). Playing a game significantly predicted test scores; a one-unit increase predicted a 3.108 decrease in test score (p = .006). Internet use and organization again did not significantly predict test scores. Thus, the size of the coefficients for all questionnaire items was magnified when not adjusting for GPA, most notably social media use and game playing. The average social media use for pretest periods 1–5 were as follows: period 1 (M = 2.84, SD = 2.57), period 2 (M = 2.99, SD = 2.77), period 3 (M = 3.59, SD = 3.03), period 4 (M = 2.90, SD = 2.79), and period 5 (M = 2.44, SD = 3.22). The average game-playing use for pretest periods 1–5 were as follows: period 1 (M = 0.07, SD = 0.26), period 2 (M = 0.06, SD = 0.27), period 3 (M = 0.09, SD = 0.40), period 4 (M = 0.14, SD = 0.60), and period 5 (M = 0.11, SD = 0.45).

To illustrate the fundamental relationship between social media use and test scores (without controlling for GPA), we used the overall median across the five pretest periods (2.4) to dichotomize social media use into high (greater than the overall median) and low (less than or equal to the overall median) categories. We used the overall median because median social media use within each pretest period changed (2.2, 2.5, 2.9, 2.0, 1.5 for pretest periods 1–5, respectively), and using different median scores within each pretest period would not have a consistent definition. (However, we note that when we plotted the high and low groups using unique median scores for each pretest period, the graph was almost identical to Figure 1.) Figure 1 depicts the average test scores for subjects in the high-use and low-use groups. The mean test scores for the low-use group on tests 1–5 were 71.84, 77.69, 76.04, 77.24, and 77.84, respectively, whereas the mean test scores for the high-use group were 68.95, 76.30, 73.00, 74.67, and 77.50. It is evident in Figure 1 that the low social media use group consistently scored higher on in-class tests than did the high social media use group. The average social media use scores further elucidate the difference in test scores for the high- and low-use groups across the five tests. The low-use group used social media an average of 0.9, 0.9, 1.0, 1.0, and 0.8 times across pretest periods 1–5, respectively, whereas the high-use group averaged 4.9, 5.1, 5.5, 5.2, and 5.7 instances of social media use across the pretest periods.

Table 1
Means, Parameter Estimates, and p Values From Random Coefficient Linear Mixed-Effects Models Predicting Test Score for Each Questionnaire Item With GPA, Class, Test Time, and Class × Test Time Interaction as Fixed Effects and Models Without GPA

Item	Mean range	P-est.[1]	p	P-est.[2]	p
1. Understanding	4.37–4.63	1.636	.04	2.715	.0042
2. Interest	3.99–4.51	1.544	.006	2.353	.0005
3. Social media	2.44–3.59	−.287	.035	−0.609	.0004
4. Internet	0.24–0.36	.319	.54	−0.407	.51
5. Organization	0.04–0.09	−.500	.73	−1.231	.45
6. Game	0.06–0.14	−.960	.33	−3.108	.006

Note. Mean range = mean scores were calculated within each pretest period and the range across all pretest periods is reported, P-est.[1] = parameter estimates including GPA, P-est.[2] = parameter estimates without GPA.

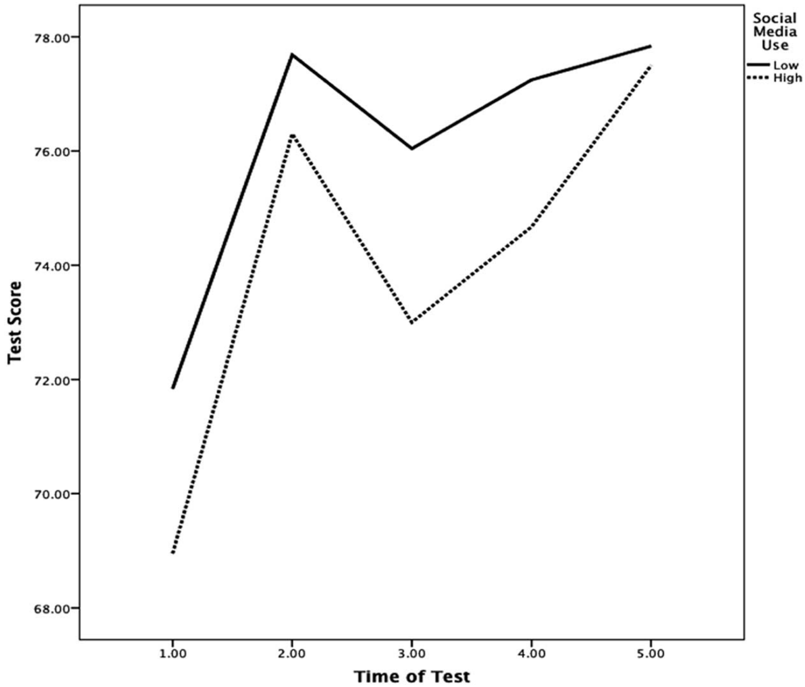

Figure 1. Average test scores for each test time for high and low social media use groups.

Discussion

Previous studies have reported a negative association between self-reported average daily CPUse and academic achievement (Harman & Sato, 2011; Jacobsen & Forste, 2011; Lepp et al., 2015; Ravizza et al., 2014) and have demonstrated that short-term CPUse in the classroom context negatively affects learning and achievement among college students (e.g., Froese et al., 2012; Rosen et al., 2011; Wood et al., 2011). In the current study, in-class test scores were negatively associated with daily reports of CPUse beyond the association between GPA and test scores, thus supporting and extending previous research demonstrating the negative relationship between CPUse and test grades independent of measures of overall ability (Ravizza et al., 2014). In fact, the strength of the association obtained here between GPA and test scores included the inflated effect of using post-course GPA scores, which included grades for courses used in the study. In our view, it is likely that the relation between CPUse and test grades would have been greater in the present study if we had access to precourse GPA scores for all participants given that the obtained relation between CPUse and test scores confounded test scores and GPA to an unknown degree.

Nonetheless, our results provide unique evidence of the significant negative relationship between daily CPUse during class and test grades over the course of a complete semester, a relationship that was significant beyond overall academic achievement as reflected in GPA. More specifically, when controlling for GPA, lower test scores were associated with higher social media use, rather than accessing the Internet, organization use, and playing a game on one's cell phone, indicating that attending to and communicating with people within one's social network was the specific type of in-class CPUse that was related to lower test grades. Our findings suggest that students who specifically engage in higher social media use during class, across the range of GPA, perform at lower levels academically and may, as a result, run an increased risk of failing classes, failing out of college, and/or completing college with a lower

GPA, which for some could potentially affect postcollege employment or graduate school opportunities.

In discussions regarding the results of this study, colleagues often asked, "Do you think they were telling the truth?" There is of course no way to be certain, and asking participants to record their CPUse at the end of class hypothetically could have affected their actual use. It is also possible that some students underreported CPUse to influence the professor's view of the students, which could have affected the association found between CPUse and test scores depending on which students underreported—those with higher or lower test scores. However, discussions with participants throughout the two semesters strongly suggested that participants were aware that questionnaire responses would not affect their test or course grades and felt free to choose their own frequency of CPUse. In addition, we found that participants who earned test scores above 95 ranged between 0.0 and 10.5 for their average social media use across all testing periods, and there was substantial variability (SD = 3.55) among these students. Furthermore, among students who reported no social media use for the entire semester, test scores ranged from 35.0 to 100 (M = 76.5, SD = 12.13). In other words, it does not appear that underreporting occurred in a way that systematically affected test scores.

The ubiquitous nature of in-class CPUse among today's wired generation is indeed a conundrum, not only from the perspective of college faculty who struggle to compete with students' digital appendages for student attention during class but (also) from the perspective of the digital natives themselves. Researchers have documented the distracting nature of students' CPUse in the college classroom, although student and faculty assessments of the degree and nature of the distraction often vary (e.g., Berry & Westfall, 2015; Elder, 2013; Thornton, Faires, Robbins, & Rollins, 2014). In one study, although 32% of students believed CPUse in the classroom affected student attention and grades and 29% believed it is a distraction to adjacent students, 61% believed students should be allowed to send and receive text messages during class as long as they are not disturbing other students, and only 11% said it is never okay to text during class (Tindell & Bohlander, 2012). Indeed, studies almost a decade old demonstrated that 77% of students believe that in-class CPUse seldom or never interferes with learning in the classroom (Braguglia, 2008), and students hold more positive attitudes regarding CPUse in the classroom than older adults (Campbell, 2006). It is possible that a number of today's millenial students are making a conscious decision to sacrifice their learning and achievement in service of the "extended self." It is also possible that some students are betting on their ability to multitask successfully whereas others are simply engaging in CPUse without giving much thought to the consequences. In addition, the behavior of some students may reflect an addiction to CPUse. In the context of all of the these possibilities and more, several faculty members have begun to adopt the "if you can't beat 'em, join 'em" approach and promote incorporating CPUse into classroom activities (e.g., Hanson et al., 2010; Librero, Ramos, Ranga, Triñona, & Lambert, 2007; Smith-Stoner, 2012; Tessier, 2013). Given the evidence regarding the pervasive CPUse by university students and its relation to learning and achievement, we suggest faculty responses to such use may continue to fall into one of three categories: continue to ban CPUse in the classroom and adopt penalties for student transgressions, ignore CPUse and take the approach that impaired attention to class information and activities and its relation to achievement are the responsibility of the student, or incorporate CPUse into classroom activities. Considering the results of our study and those described above, we suggest that the third approach may be most likely to win the battle for student attention. However, it may also be the most challenging approach for faculty, given the structural changes it would require to the standard lecture/discussion model of higher education, and might inadvertently encourage further nonacademic CPUse in the classroom.

There are limitations to the present study that can serve to suggest improvements in future research. We did not measure actual time of CPUse in the classroom. Including a "time used" category on the questionnaire was considered, but it was rejected primarily because of the assumed questionable validity of such reports, given the difficulty participants would have estimating the amount of time spent using their phone as well as the negative impact that keeping a record of time used during class would have on attention to class information. In addition, in the interest of questionnaire brevity (and time used per class for completion), we also collapsed specific types of use into categories that are more global. We suggest that future studies consider the use of a cell phone app (e.g., Oulasvirta et al., 2012) to record usage time as well as more specific categories of use (e.g., text vs. email), although there are numerous potential problems that would need to be resolved involving privacy and blocking access to other phone data and out-of-class CPUse. Using an app to record CPUse would also eliminate the problem of relying on participant memory (however brief) as an accurate record of use. Future studies would also benefit by including measurements of class participation, attention during class, and out-of-class studying time to examine possible moderating effects on the relationship between in-class CPUse and grades. Such measures or items were considered for the present study but were not included to ensure that time taken away from each class period to complete the daily questionnaire was kept to a minimum. We also recommend using pre- and poststudy GPA scores or other independent measures of student ability in comparison with outcome (test) scores. Future studies should include classes conducted by more than one instructor (given the varieties of instructional methods used by different instructors that could impact CPUse) as well as samples from cultures outside of the United States (which could demonstrate unique relations between CPUse and grades resulting from different cultural norms). It would also be beneficial to include separate conditions within one study to compare "free CPUse" with "limited use" and "no use" effects on grades.

Although today's smartphones have placed an astounding level of information, entertainment, and modes of communication in the hands of millions of students worldwide, they can also temporarily sever the user's attention to his or her immediate experiences, people, and contexts. One author has proposed that the obsessive, self-focused nature of CPUse among a growing segment of the population reflects a new condition labeled an "iDisorder" (Rosen, 2012), suggesting a pattern of behavior that is maladaptive and dysfunctional. Our results lend further credence to the growing body of evidence suggesting a negative and, hence, maladaptive association between context-specific CPUse and academic success.

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