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The Relationship Between Cell Phone Use and Academic Performance in a Sample of U.S. College Students

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Abstract

The cell phone is ever-present on college campuses and is frequently used in settings where learning occurs. This study assessed the relationship between cell phone use and actual college grade point average (GPA) after controlling for known predictors. As such, 536 undergraduate students from 82 self-reported majors at a large, public university were sampled. A hierarchical regression (R^2 = .449) demonstrated that cell phone use was significantly (p < .001) and negatively (β = −.164) related to actual college GPA after controlling for demographic variables, self-efficacy for self-regulated learning, self-efficacy for academic achievement, and actual high school GPA, which were all significant predictors (p < .05). Thus, after controlling for other established predictors, increased cell phone use was associated with decreased academic performance. Although more research is needed to identify the underlying mechanisms, findings suggest a need to sensitize students and educators about the potential academic risks associated with high-frequency cell phone use.

Keywords

education, technology, ICT, mobile phones, smartphones, GPA, self-efficacy

Introduction

Cell phones are an integral part of college life and culture. Even a casual observation of today's college students will reveal cell phones being used, both overtly and covertly, in every possible campus setting, including the classroom. Research suggests that college students frequently use the cell phone during class time despite rules against doing so (Tindell & Bohlander, 2012). As cell phone technology continues its rapid development, the device appears capable of contributing to student learning and improved academic performance. For example, modern "smartphones" provide students with immediate, portable access to many of the same education-enhancing capabilities as an Internet-connected computer, such as online information retrieval, file sharing, and interacting with professors and fellow students (Bull & McCormick, 2012; Tao & Yeh, 2013). Conversely, recent research suggests that many college students perceive the cell phone primarily as a leisure device, and most commonly use cell phones for social networking, surfing the Internet, watching videos, and playing games (Lepp, Li, & Barkley, 2015; Lepp, Barkley, Sanders, Rebold, & Gates, 2013). If typically utilized for leisure rather than education, then cell phones may disrupt learning within academic settings (Levine, Waite, & Bowman, 2007). Thus, the potential relationship between cell phone use and academic performance is not clear.

In support of the "cell phone as disrupter" hypothesis, a recent study by our group (Lepp et al., 2013) found that cell phone use was negatively associated with an objective measure of cardiorespiratory fitness in a sample of typical U.S. college students. Interview data collected for the study explained the negative relationship by suggesting that cell phone use disrupts physical activity and encourages sedentary behavior. Unpublished interview data collected as part of the same study suggest that cell phone use may also disrupt behaviors conducive to academic success. For example, when asked to describe cell phone use habits, one participant stated, "I usually go on my phone if I'm bored sitting there in class. Or during homework I'll take little Twitter breaks." Another student said,

> If I'm in class and I'm bored then I'll use my phone to look on Facebook. I think it's just kind of a habit now that I have, which probably isn't a good one. But, it's just that I always have it [the phone] on me.

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Across the interviews, such statements were more common among high-frequency cell phone users than among low-frequency users. These statements suggest that some students, particularly high-frequency users, may have difficulty regulating their cell phone use during academic endeavors such as class participation, homework, and studying. Thus, the purpose of the present study was to investigate the relationship between cell phone use and academic performance in a large sample of U.S. college students.

Literature Review

Although the cell phone is likely to be on hand while college students are in class and studying, research investigating its relationship to academic performance is limited. In an early study of the phenomenon, Sánchez-Martínez and Otero (2009) used a combination of self-reported monthly cell phone expenses and frequency of use data to identify intensive cell phone users in a large sample of Spanish high school students. In the study, intensive cell phone use was related to school failure as well as other negative behaviors such as smoking and excessive alcohol use. More recent studies operationalize cell phone use as calling and texting while utilizing a variety of measures for academic performance. For example, Jacobsen and Forste (2011) identified a negative relationship between calling, texting, and self-reported grade point average (GPA) among university students in the United States. Similarly, Hong, Chiu, and Hong (2012) found that calling and texting were positively correlated with a self-reported measure of academic difficulty among a sample of female, Taiwanese university students. While these studies provide a starting point for understanding the relationship between cell phone use and academic performance, they neither use objective measures of academic performance nor do they take into account the cell phone's expanding capabilities beyond calling and texting.

Modern cell phones enable users to access a variety of electronic media at almost any time and any place. Popular activities such as playing video games, surfing the Internet, and monitoring social media sites are now all easily accomplished with most cell phones. Researchers have linked each of these activities, independent of cell phone use, to academic performance. For example, heavy video game playing has been associated with lower GPAs (Jackson, von Eye, Fitzgerald, Witt, & Zhao, 2011; Jackson, von Eye, Witt, Zhao, & Fitzgerald, 2011). Also, low levels of Internet use have been associated with improved academic performance (Chen & Peng, 2008). Chen and Tzeng (2010) found that among heavy Internet users information seeking was associated with better academic performance, while video game playing was associated with lower levels of academic performance. Several recent studies have identified a negative relationship between social-networking site use (e.g., Facebook, MySpace, Twitter) and academic performance (e.g., Rosen, Carrier, & Cheever, 2013; Stollak, Vandenberg, Burklund, & Weiss, 2011). In particular, Kirschner and Karpinski (2010) demonstrated that Facebook users have a lower self-reported GPA and spend fewer hours per week studying than nonusers. Likewise, Junco (2012a, 2012b) found a strong, negative relationship between time spent on Facebook and actual cumulative GPA. These negative relationships have been found in populations across the world, including North America, Europe, and Asia (e.g., Chen & Tzeng, 2010; Karpinski, Kirschner, Ozer, Mellott, & Ochwo, 2013).

Recently, multitasking has emerged as a possible explanation for the negative relationship between electronic media use (including cell phone use) and academic performance (Jacobsen & Forste, 2011; Junco & Cotton, 2011; 2012; Karpinski et al., 2013; Kirschner & Karpinski, 2010; Rosen et al.,2013; Wood et al., 2012). Indeed, several studies reveal that students frequently report using a variety of electronic media including cell phones while in class, studying, and doing homework (Jacobsen & Forste, 2011; Junco & Cotton, 2012; Sánchez-Martínez & Otero, 2009; Tindell & Bohlander, 2012). Several recent studies, using a variety of methods, identify a negative relationship between multitasking and academic performance. First, Wood et al. (2012) measured the influence of multitasking with an array of electronic media on students' ability to learn from typical, university classroom lectures. Emailing, MSN messaging, and Facebook use via computer were all investigated as was cell phone texting. Results showed that multitasking with any of the technologies was associated with lower scores on follow-up tests compared with students who did not multitask. Second, Junco and Cotton (2012) used a hierarchical regression to determine the power of multitasking to predict actual cumulative college GPA. Results showed that Facebook-multitasking and texting-multitasking were significantly and negatively related to college GPA after controlling for sex, actual high school GPA, time preparing for class, and a student's Internet skills. Finally, Rosen et al. (2013) observed the study behaviors as well as study settings of a sample of middle school, high school, and university students. Participants were observed for 15 min with on-task and off-task behavior recorded every minute. Results showed that participants typically became distracted by media such as Facebook and texting after less than 6 min of studying. Furthermore, measurements of daily Facebook use and daily texting behavior predicted off-task behavior during study periods as well as self-reported GPA.

In review, emerging research suggests that texting, Internet use, email, and social-networking sites such as Facebook can potentially increase multitasking and task-switching during academic activities and decrease academic performance. Notably, all of these previously investigated activities can now be accomplished with a single, Internet-connected cell phone. Therefore, measurements of cell phone use should not be limited to only texting and calling but should take this wide array of activities into account. Furthermore, and in consideration of the ubiquity of the cell

phone, the relationship between this expanded definition of cell phone use and academic performance warrants investigation.

Self-Efficacy Beliefs and Academic Performance

In addition to improving the way cell phone use is measured, a better understanding of the relationship between cell phone use and academic performance requires incorporating additional, well-established predictors into any statistical models designed to assess this relationship. An abundance of research suggests that self-efficacy beliefs are among the strongest predictors of academic performance (for a comprehensive review, see Pajares, 1996). Generally speaking, self-efficacy describes an individual's belief in his or her capabilities to organize and execute the behaviors necessary for success; as such, self-efficacy beliefs are a key mechanism in human agency (Bandura, 1982). Self-efficacy beliefs are domain specific; thus, research has identified self-efficacy beliefs pertinent to academic performance (Pajares, 1996). The strength of academic self-efficacy constructs is their influence over behavior. Students who report high academic self-efficacy apply greater effort to academic pursuits, are more persistent in the face of obstacles, and exhibit a greater interest in learning (Schunk, 1984, 1989). In addition, research illustrates that academic self-efficacy can mediate the effects of academic ability (Pajares, 1996). As a result, academic self-efficacy is positively correlated with virtually all measures of academic performance, including semester grades, cumulative GPA, homework, test scores, and writing assignments (Multon, Brown, & Lent, 1991; Pajares, 1996).

Research has demonstrated that efficacy beliefs are often better predictors of academic performance than other commonly used social-psychological variables (e.g., Klomegah, 2007; Paulsen & Gentry, 1995; Pintrich & Schunk, 2002). For example, self-efficacy proved to be the strongest predictor of college student's academic performance in a model including task value, goal orientations, metacognitive self-regulation, self-regulation, and learning strategies (Al-Harthy & Was, 2010). Two self-efficacy constructs in particular have received much attention for their ability to predict academic performance (Pajares, 1996). These are self-efficacy for self-regulated learning (SE:SRL) and self-efficacy for academic achievement (SE:AA; Zimmerman, Bandura, & Martinez-Pons, 1992). SE:SRL concerns an individual's belief in his or her capabilities to proactively regulate his or her learning on the path to academic achievement. This includes belief in one's ability to resist distractions while learning and to create study environments conducive to learning. As such, it is an important variable to consider when exploring the relationship between potential distractors such as cell phones or other new media and academic performance (LaRose & Eastin, 2004; LaRose, Lin, & Eastin, 2003; LaRose, Mastro, & Eastin, 2001; Odaci, 2011). A related construct is SE:AA, which describes an individual's belief in his or her capabilities to learn material from specific content areas such as math, science, and history. As originally conceived and validated by Zimmerman et al. (1992), SE:SRL influences SE:AA, which in turn influences final academic achievement. As predicted by the original model and subsequently verified, previous academic performance can influence both SE:SRL and SE:AA (Caprara, Vecchione, Alessandri, Gerbino, & Barbaranelli, 2011).

Research Question

Considering the existing research, as well as the unpublished interview data presented in the introduction of this article, it is hypothesized that cell phone use and academic performance are related. However, in assessing this relationship, there is a need to consider important statistical controls such as SE:SRL, SE:AA, and previous academic performance (i.e., high school GPA). Similarly, research suggests that choice in academic major, as well as demographic and behavioral factors, may also be predictive of academic performance and should, therefore, be considered. This study considered four such factors: sex, cigarette smoking, class standing, and undergraduate major. Indeed, there are well-established sex-related differences in college students' academic performance (Peter & Horn, 2005). Likewise, cigarette smoking has been associated with problematic cell phone use and poor academic performance (DeBerard, Spielmans, & Julka, 2004; Sánchez-Martínez & Otero, 2009). Class standing and undergraduate major may also be potential predictors (Kirschner & Karpinski, 2010; Sulaiman & Mohezar, 2006). In addition, there is a need to operationalize cell phone use more broadly (i.e., assess total cell phone use) in consideration of the device's increased functionality. Finally, there is a need to use objective measures of academic performance such as students' official cumulative GPA. This study fulfills these many needs by answering the following question: What is the relationship between total cell phone use (i.e., calling, texting, video games, social networking, surfing the Internet, software-based applications, etc.) and academic performance (i.e., actual college GPA) after controlling for previously identified predictors of academic performance (i.e., actual high school GPA, SE:SRL, SE:AA, sex, cigarette use, class standing, and academic major)?

Method

The dependent variable for this study, academic performance, was objectively assessed using participants' actual cumulative college GPA. In addition, actual high school GPA was used as a statistical control. Because these are sensitive data, and collecting them involves accessing participants' official academic records, participants were assured that data collection, storage, and reporting would guarantee confidentiality and anonymity. Participants were recruited during

class time from courses that typically attract students from a diversity of undergraduate majors. Representative courses include introduction to sociology, general biology, American politics, human nutrition, and world history. During class time, the principal investigators explained the methods to all students present, answered questions, addressed concerns, and ensured that the informed consent document was read, understood, and signed. After this, a survey was distributed and completed during class by all students who consented to participate in the study. On the survey, students provided their university email address, which was later used to access their academic records. If students did not consent to have their GPA retrieved, they did not participate in the study. This method produced an initial sample size of 536 undergraduate students from 82 self-reported majors.

Measures

The survey took approximately 10 min to complete. Students first provided basic demographic and lifestyle information. Students completed the validated SE:SRL (Zimmerman et al., 1992) and SE:AA scales (Zimmerman et al., 1992). Participants also provided information regarding their cell phone use as operationalized by Lepp et al. (2013) and, finally, their email addresses. Email addresses were used to access each student's official academic records from which college and high school GPAs were collected.

SE:SRL is an 11-item scale that measures how well students believe that they can use a variety of self-regulated learning strategies such as finish homework assignments by deadlines, study when there are other interesting things to do, concentrate on school subjects, and arrange a place to study without distractions (Zimmerman et al., 1992, p. 668). SE:AA is a nine-item scale that measures how well students believe that they can achieve success in important academic domains such as reading, writing, English grammar, mathematics, science, social studies, and computer use. For the items in both self-efficacy measures, students used a seven-point Likert-type scale to rate their perceived capability to do well (i.e., 1 = *not too well* to 7 = *very well*). Responses for the items in each scale were summed, thereby producing a total score. Higher scores indicate greater self-efficacy. Both scales have been previously validated and found to have strong internal consistency (coefficient α = .87 and .70, respectively; Zimmerman et al., 1992). Since their development, both have been consistently shown to be reliable predictors of academic performance in variety settings (Pajares, 1996). Likewise, the SE:SRL and SE:AA scales demonstrated strong internal consistency with this study's sample of undergraduate students (coefficient α = .84 and .73, respectively; $N = 536$).

Total daily cell phone use was measured using the following item:

> As accurately as possible, please estimate the total amount of time you spend using your mobile phone each day. Please consider all uses except listening to music. For example: consider calling, texting, sending photos, gaming, surfing the Internet, watching videos, Facebook, email, and all other uses driven by "apps" and software.

Participants provided best estimates for hours of cell phone use per day and minutes per day. Total use in minutes was calculated for each participant as hours × 60 + minutes. In developing this measure of total cell phone use, two focus groups of undergraduate students reviewed the question for content validity criteria, including (a) clarity in wording, (b) relevance of the items, (c) use of standard English, (d) absence of biased words and phrases, (e) formatting of items, and (f) clarity of the instructions (Fowler, 2002). Most students provided feedback from the criteria categories of (a), (b), (c), and (f). Appropriate alterations were made to the survey based upon the responses and suggestions. In consideration of this measure's construct validity, participants' daily text messaging and daily calling were assessed as this is how cell phone use has been operationalized in previous research (e.g., Jacobsen & Forste, 2011). Total daily cell phone use (calling, texting plus all other uses such as Internet browsing and games) was positively correlated with daily texting ($r = .430$, $p < .001$) and daily calling ($r = .210$, $p < .001$), suggesting that the measures are related but not identical. In addition, we assessed construct validity in a small group ($N = 21$) of undergraduate college students at the same university from which the present sample was culled. Self-reported total cell phone use (minutes) as assessed by this measure had a large, significant correlation ($r = .510$, $p = .018$) to objectively measured cell phone use (minutes) obtained by accessing students' actual cell phone records (unpublished data). Thus, this self-report measure was carefully developed to assure content validity, while subsequent testing provided evidence of construct and criterion validity.

Data Analysis

All analyses were performed using SPSS for Windows (Version 18.0, SPSS Inc, Evenston, Illinois). First, independent samples *t* tests were used to examine differences in GPA between males and females and smokers and nonsmokers. Likewise, ANOVA was used to examine differences in GPA between class (i.e., freshman, sophomore, junior, senior) and a categorization of students based on the college that houses their major (i.e., education, health, and human services; arts and sciences; business and communications). Second, Pearson's correlations were performed to examine the relationships between the following variables: college GPA, SE:SRL, SE:AA, high school GPA, and total cell phone use. Third, hierarchical regression was used to answer this study's central research question:

Research Question 1: What is the relationship between total cell phone use and academic performance after controlling for known predictors? Toward this end, the following model was initially proposed:

$$\begin{aligned}&\text{College GPA} = \text{sex, smoker,}\\&\text{class standing, college major}\\&(\text{Block 1})\\&+ \text{SE : AA } (\text{Block 2}) +\\&\text{SE : SRL } (\text{Block 3}) +\\&\text{high school GPA } (\text{Block 4})\\&+ \text{total daily cell phone use } (\text{Block 5}).\end{aligned}$$

The categorical variables of interest were assessed in the first block of this model: sex, cigarette smoking, class, and college. Blocks 2 to 4 in this model are identical to the model developed by Zimmerman et al. (1992) and supported by others (e.g., Caprara et al., 2011) to predict academic performance. Block 5 added cell phone use to the model and thereby tested whether or not daily cell phone use uniquely predicted college academic performance (GPA) after controlling for these other, previously established variables.

Finally, to further illustrate the relationship between cell phone use and GPA, a tertile split for cell phone use was performed. Students in this final sample (N = 518) were divided into the following groups: low cell phone use group (M = 94.6 min per day, SD = 41.0, n = 180), moderate use group (M = 235.1 min per day, SD = 45.2, n = 173), and high use group (M = 601.3 min per day, SD = 226.8, n = 164). An ANOVA was then utilized to compare mean GPA across the three cell phone use groups (high, moderate, low). Post hoc t tests were performed for any significant main effect.

Results

Assumption Checking, Descriptive Statistics, and Preliminary Analyses

Before conducting any descriptive or inferential statistics, an examination of outliers (i.e., cell phone use, GPA, age, SE:SRL, SE:AA) was conducted. Following the method of Rosen et al. (2013), total cell phone use values that were more than 3 standard deviations from the mean were truncated to exactly 3 standard deviations from the mean. This procedure was applied to measures of total cell phone use for seven participants. Outliers on any of the remaining variables were removed from the study. This procedure resulted in 18 cases being removed and yielded a final analysis sample of 518 students. The age range of the data set was 18 to 28, with a mean of 20.28 (SD = 1.78). The data set was evenly distributed by class (freshmen = 132, sophomores = 139, juniors = 134, and seniors = 113). Females comprised 69% of the data set (n = 360), which is greater than the percentage of females (59%) in the overall undergraduate student body of the University.

Table 1. Descriptive Statistics.

	N	*M*	*SD*
College GPA	518	3.03	0.601
High school GPA	483	3.22	0.473
SE:SRL	518	56.42	8.96
SE:AA	518	44.44	7.07
Cell phone use	518	300.55	243.52

Note. GPA = grade point average; SE:SRL = self-efficacy for self-regulated learning; SE:AA = self-efficacy for academic achievement.

From this data set, the assumptions of regression were examined, and a preliminary analysis was performed to assess the linearity of the relationship between the study's independent continuous variables (SE:SRL, SE:AA, high school GPA, total cell phone use) and college GPA. Using a Lack of Fit Test, the assumption of linearity was upheld (p = .906). The assumptions of normality and homoskedasticity were also met using residual scatterplots.

On average, students reported spending 300 min per day using their cell phones (SD = 243). The sample's mean GPA was 3.03 (SD = 0.60). Independent sample t tests demonstrated significant differences between males and females (p < .001) and smokers and nonsmokers (p < .001). Females' GPA (M = 3.09, SD = 0.63) was significantly higher than males' (M = 2.88, SD = 0.62), and nonsmokers' GPA (M = 3.07, SD = 0.64, n = 432) was significantly higher than smokers' (M = 2.80, SD = 0.58, n = 85). An ANOVA demonstrated significant differences in mean GPA between the four classes (p < .001). Freshmen had a mean GPA of 3.21 (SD = 0.67), sophomores had a mean GPA of 2.93 (SD = 0.64), juniors had a mean GPA of 3.02 (SD = 0.55), and seniors had a mean GPA of 2.94 (SD = 0.48). Finally, the 82 self-reported majors were categorized into three groups based on the college housing the major (education, health, and human services; arts and sciences; business and communications). An ANOVA found no significant difference in mean GPA between these three groups (p = .081). Thus, this variable was not included in further analysis.

Table 1 provides descriptive statistics for the continuous variables used in this model. Table 2 illustrates the results of Pearson's correlations. There are several significant correlations worth noting. There was a significant, negative correlation between cell phone use and college GPA (p < .001). There was a significant, positive correlation between both measures of self-efficacy (SE:SRL, SE:AA) and college GPA (p < .001). There was a significant, negative correlation between both measures of self-efficacy (SE:SRL, SE:AA) and cell phone use (p ≤ .041). Finally, high school GPA was significantly and positively correlated with college GPA (p < .001).

Table 2. Pearson Correlation Coefficients (*r*).

	College GPA	High school GPA	SE:SRL	SE:AA
High school GPA	.611***			
SE:SRL	.341***	.242***		
SE:AA	.200***	.275***	.456***	
Cell phone use	−.234***	−.168***	−.090*	−.239***

Note. GPA = grade point average; SE:SRL = self-efficacy for self-regulated learning; SE:AA = self-efficacy for academic achievement.
*$p < .05$. ***$p < .001$.

Table 3. Hierarchical Regression Predicting College GPA: Model Summary.

	Sex/class/smoke	SE:AA	SE:SRL	HS GPA	CP use
	Block 1	Block 2	Block 3	Block 4	Block 5
R^2	.058	.101	.165	.425	.449
ΔR^2	.058	.043	.064	.259	.024
ΔF	9.755	22.922	36.580	213.86	20.454
p	.000	.000	.000	.000	.000

Note. GPA = grade point average; SE:SRL = self-efficacy for self-regulated learning; SE:AA = self-efficacy for academic achievement; HS = high school; CP = cell phone.

Hierarchical Regression

As described above, the preliminary analysis supported testing the following hierarchical regression model:

$$\begin{aligned}&\text{College GPA} = \text{sex, smoker,}\\&\text{class standing (Block 1)} +\\&\text{SE:AA (Block 2)}\\&+ \text{SE:SRL (Block 3)} +\\&\text{high school GPA (Block 4)} +\\&\text{total daily cell phone use (Block 5).}\end{aligned}$$

Table 3 provides the model summary results for the hierarchical regression predicting college GPA with total cell phone use as the final block in the model. Each block significantly added to the prediction of the criterion variable. In Block 1, females had a significantly greater GPA than males (β = .120, $p = .007$), nonsmokers had a significantly higher GPA than nonsmokers (β = .155, $p = .001$), and class standing proved significant as well (β = −.111, $p = .013$). In Block 2, there was a significant, positive relationship between college GPA and SE:AA (β = .210, $p < .001$). In Block 3, there was a significant, positive relationship between college GPA and SE:SRL (β = .289, $p < .001$). In Block 4, there was a significant, positive relationship between college GPA and high school GPA (β = .553, $p < .001$). Finally, there was a significant, negative relationship between total daily cell phone use and college GPA (β = −.164, $p < .001$). This total model explained 44.9% of the variance in college GPA ($R^2 = .449$).

Finally, the ANOVA comparing GPA across the three cell phone use groups (low, moderate, high) revealed a significant main effect ($F = 11.70$, $df = 2$, $p < .001$). Specifically, the high cell phone use group had a GPA ($M = 2.84$, $SD = 0.61$) that was significantly lower ($p < .001$) than both the moderate use group ($M = 3.06$, $SD = .61$) and the low use group ($M = 3.15$, $SD = 0.45$). There was not a statistically significant difference between the low use and moderate use groups ($p = .175$).

Discussion

This study was exploratory in nature. Therefore, the findings are best understood as initial steps into a new line of inquiry. The study's aim was to assess the relationship between cell phone use and academic performance after controlling for known predictors of academic performance. A hierarchical regression was used for this purpose allowing for the development of a model which used sex, cigarette smoking behavior, class standing, SE:AA, SE:SRL, and high school GPA to predict college GPA. Each of these variables were significant predictors of college GPA. Females, as has been the recent trend, had higher GPAs than males (Peter & Horn, 2005). Smokers, as suggested in previous research, had lower GPAs than nonsmokers (DeBerard et al., 2004; Sánchez-Martínez & Otero, 2009). Class was a significant predictor as well, with freshmen and juniors doing slightly better academically than sophomores and seniors in this sample. As expected, SE:SRL, SE:AA, and high school GPA were all positively associated with GPA (Zimmerman et al., 1992). Finally, total cell phone use (min/day) was added to the end of this regression model. After controlling for the previously established predictors of academic performance, total cell phone use was found to be a significant negative predictor of GPA. These results suggest that given two college students from the same university with the same class standing, same sex, same smoking habits, same belief in their ability to self-regulate their learning and do well academically, and same high school GPA—the student who uses the cell phone more on a daily basis is likely to have a lower GPA than the student who uses the cell phone less.

Previous research suggests that college students' cell phone use may be a distraction in academic settings (Levine et al., 2007). Two previous studies using large random samples of college students found that 89% ($N = 302$) and 83% ($N = 251$) of the students surveyed perceived the cell phone primarily as a leisure device rather than as an educational tool (Barkley & Lepp, 2013; Lepp et al., 2013). Because the cell phone is ever-present and commonly used for leisure, it is likely that it occasionally distracts from learning in class, in the library, in the dormitories, and in any other setting utilized by students for academic purposes. In addition, there is a growing amount of research that suggests electronic media in any form encourages multitasking (Jacobsen & Forste, 2011; Junco & Cotton, 2011, 2012; Karpinski et al., 2013; Kirschner & Karpinski, 2010; Wood et al., 2012) and task-switching

(Rosen et al., 2013), both of which are negatively related to academic performance.

Considering these explanations, it is likely that the modern cell phone creates a 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. As such, the negative relationship between cell phone use and academic performance identified here could be attributed to students' decreased attention while studying or a diminished amount of time dedicated to uninterrupted studying. Indeed, a similar argument has been proffered to explain the negative relationship between general social-networking site use or Facebook use and academic performance (Karpinski et al., 2013; Kirschner & Karpinski, 2010). Future research should examine the many potential underlying reasons for the negative relationship identified here, including time spent studying and multitasking. Of course, this line of research has demonstrated only relationships and not causality. Thus, there is a need to explore these relationships over time and with experimental designs.

There is also a need to better understand how specific cell phone uses are related to academic performance. While this study found that cell phone use as a whole was negatively associated with academic performance, the relationship may vary with particular uses. In other words, contrary to the findings presented here, there may be specific uses that are positively related to academic performance. For example, Norris (1996) found that while TV watching as a whole was negatively associated with political participation, watching TV news and public affairs programming was positively associated with political participation. Likewise, Chen and Tzeng (2010) found that using the Internet for information seeking was associated with better academic performance, while using the Internet for video game playing was associated with lower levels of academic performance. Finally, Junco (2012a) found that the total amount of time college students spend on Facebook, as well as the total number of times students check Facebook, were negatively associated with campus engagement. However, some Facebook activities such as creating events and RSVPing for events were positively associated with campus engagement. Thus, assessing cell phone use as a whole is likely to provide only a partial understanding of an undoubtedly complex relationship. Additional research assessing time devoted to specific cell phone uses such as gaming, social networking, information search, and the use of educational software (apps) is needed.

While these findings build upon and extend previous research in this area, there are limitations. First, cell phone use was self-reported. Although the self-report measure used in this study was carefully developed to assure content validity and a subsequent test provided evidence of criterion validity, research by Boase and Ling (2013) illustrates that continuous, open-ended self-report cell phone measures are at risk of over reporting use. In lieu of objective data, future studies may seek to further validate this measure. Furthermore, future studies should assess the time devoted to common specific uses such as social networking, gaming, and information search, in addition to measuring overall use as was done here. Second, the sample consisted of undergraduate college students from a single, large, public university in the Midwestern United States. Although the behavioral norms governing cell phone use appear to be consistent among today's college students (Anderson & Rainie, 2011; Tindell & Bohlander, 2012), attempts to generalize these results to other populations should be made with caution. Therefore, future research should include college students from different types of universities and from different geographic regions. In addition, high school and junior high school students should be studied as recent research suggests that the relationships identified here may be evident in younger students as well (Rosen et al., 2013).

Conclusion

This research utilized a more holistic measure of cell phone use than previous studies. The measure accounts for the cell phone's expanded capabilities in the realm of social networking, gaming, and Internet use. After controlling for SE:SRL, SE:AA, and other important predictors such as actual high school GPA, this measure of cell phone use was a significant and negative predictor of college students' academic performance, objectively measured as cumulative GPA. Presently, cell phone use is a dominant and defining characteristic of this generation of college students and often occurs during class time, while completing homework, and while studying (Smith, Raine, & Zickuhr, 2011; Tindell & Bohlander, 2012). Therefore, more research is needed to better understand the mechanisms underlying this relationship. Even so, educators and administrators in higher education may wish to carefully consider policies regarding cell phone use in the classroom, laboratories, and other settings where learning occurs. Undoubtedly, the capability of the cell phone to entertain, connect, and inform will continue its rapid development. As such, cell phones and related devices will only increase in popularity and use. Therefore, there is a need to better understand how this technology can be harnessed to make a genuine contribution to student learning. We may discover conditions where learning is enhanced by having the cell phone on; likewise, we may discover conditions where learning is enhanced by having it off.

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