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Cover Page Footnote

We would like to acknowledge the contributions of Grier Wright and Matthew McQuaig to this literature review.

Cell Phone Use and Its Effects on Undergraduate Academic Performance

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ABSTRACT

In this literature review, we explore cell phone use and its impact on academic performance of students in college classrooms. We discuss the prevalence of and motivation for cell phone use and how it affects user and peer academic performance as measured by grades earned in class and overall grade point average. Moreover, we include in our discussion the impact of classroom technology use on student-teacher interactions. Potential solutions to guide students and faculty toward more appropriate use of technology in the classroom and development of classroom syllabus policy are provided. Additional implications of research findings as well as suggestions for future research in this field are included in our literature review.

Keywords: technology, students, classroom, academic performance, cell phones

Technology use in the classroom has the potential to reignite student learning by offering more engaging and interactive ways to learn course material. However, the benefits of technology in the classroom may be outweighed by the costs, particularly of the use of cell phones in the classroom. Cell phones have allowed students flexibility in managing their coursework, such as organizing assignments and finding course information, with little or no effort (Tossell, Kortum, Shepard, Rahmati, & Zhong, 2015). On the other hand, they may also cause undergraduate students to perform worse academically. The contrast between student perceptions of cell phones in academics and the reality of cell phones and their effect on academic performance is the fundamental purpose of this literature review.

The most recent literature review published on this topic extended two previous literature reviews by analyzing the effects cell phones have on learning and why these effects occur, based on a variety of theories. Chen and Yan (2016) included literature on cell phone use while driving and generalized the findings to the effects on learning. The present literature review makes a unique contribution in that we primarily analyze the literature on in-classroom cell phone use in the undergraduate student population. Thus, unlike previous reviews, ours is focused rather than broad and so permits a deeper exploration of in-classroom cell phone behavior. At the suggestion of the reviewers, we also discuss outside of class multitasking (i.e. using a cell phone while studying or doing homework) because it may affect in-classroom behavior.

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This review includes an analysis of the body of literature that focuses on the prevalence, perception, and effects of multitasking with cell phones in-class and ways multitasking outside of the classroom translates into the classroom environment. Subsequently, we discuss the conflict between different operational definitions of cell phone usage in the classroom and different definitions of academic performance followed by statistical data collected across the literature describing how prevalent cell phone use in the classroom has become. Finally, we present a discussion of motivators for cell phone use in the classroom; the effects of cell phone use on academic performance; student, peer, and professor perceptions of cell phone use in the classroom; solutions to reduce or resolve cell phone usage in the classroom; and implications and suggestions for future research.

Multitasking

Prevalence, Perceptions, and Effects

Multitasking in class is normal for college students and is often encouraged by their professors. Listening, thinking, answering questions, challenging ideas, and taking notes are all part of the normal, multitasking classroom environment that lead to an enriching and dynamic educational experience. On the other hand, there are some multitasking behaviors, such as talking to other students about matters that are off topic, studying for another class, or using technology for personal use, that may detract from the learning experience and result in lower academic performance. In this review, we specifically focus on exploring the relationship between the personal use of technology in class and how it affects undergraduate academic performance.

Recently, researchers have found that 57% of students multitask in class with their cell phones, behavior that may be exacerbated by overall phone obsession (Lee, 2015). Most often, students who multitask in class are either texting or using Facebook, both of which are negatively correlated with overall semester grade point average (GPA; Junco, 2012). Some students even admit that multitasking hinders their ability to understand and focus on their class lectures, but continue to multitask anyway (Lee, 2015). Students who multitask on their cell phones are usually communicating with others and may perceive themselves to be unaffected by their multitasking habits. However, how students perceive their multitasking to affect their performance may not align with how students actually perform academically.

Translation of Multitasking

Outside-of-class multitasking translates into the classroom environment and decreases academic performance (Bellur, Nowak, & Hull, 2015; Patterson, 2017). Using a 3 x 2 matrix, Patterson (2017) found that both the number of technologies students utilized while studying for an exam and the number of hours students studied had a significant main effect on exam scores. Prior to the exam, students were optimistic about their ability to multitask while studying for an exam, but the exam scores revealed the effects of multitasking while studying. Based on participants' self-reports, the researcher divided participants into two groups based on study time using a median split method. The median split divided participants into a low study group, participants who studied less than two hours for their exam, and a high study group, participants who studied more than two hours for their exam. Additionally, participants were divided into three groups, those who used zero to two technologies,

three to six technologies, and seven or more technologies, while studying. Patterson (2017) found that students who did not use technology while studying or used only one or two types of technology and studied for more than two hours had an average exam score of 76.44%. In contrast, students who used three to six different types of technology and studied less than two hours had an average exam score of 68.48%. The study's results demonstrated the effect of outside of class multitasking with technology on in-class academic performance.

Like Junco (2012), Bellur and colleagues found that students were mostly texting or using Facebook while doing homework, but gender differences contribute to the context of multitasking. They also discovered that females most often multitask by communicating with others, whereas males who multitask engage in entertainment, like watching online videos, while doing homework. Multitasking outside of class directly translates into multitasking within the classroom environment, which has a greater and more negative impact on GPA, than multitasking while doing homework (Bellur et al., 2015). Regardless of whether students are using technology while in class or while studying outside of the classroom, research clearly demonstrates academic performance is negatively affected.

Cell Phones in the Classroom

Operationally Defining Cell Phone Use

Due to the versatility of today's cell phones, cell phone use in the classroom has been studied using a variety of operational definitions. Most research studies have operationalized cell phone usage in class as texting (Froese et al., 2012; Gingerich & Lineweaver, 2014; Lawson & Henderson,

2015; McDonald, 2013). Similarly, Olmsted and Terry (2014) operationalized cell phone usage as texting during class, but also included cell phone usage outside of class to link it to in-classroom behavior. Overall cell phone usage in class (Bjornsen & Archer, 2015; Elder, 2013) and cell phone ringing during a lecture (End, Worthman, Mathews, & Wetterau, 2010) have also been considered. Because researchers do not agree on the operational definition of cell phone use in the classroom, it is difficult to compare and contrast results.

Operationally Defining Academic Performance

Academic performance has been more consistently defined by quiz or test scores on lecture content (Elder, 2013; Froese et al., 2012; Gingerich & Lineweaver, 2014; Lawson & Henderson, 2015) and also by test scores over the course of a semester (Katz & Lambert, 2016), or multiple semesters (Bjornsen & Archer, 2015). Few studies have operationalized academic performance as grade point average (Harman & Sato, 2011; Tossell et al., 2015) or final course grades (McDonald, 2013). End and colleagues (2010) utilized both quiz scores on a lecture and a student's ability to record the correct information from a lecture interrupted by a cell phone ringing to operationally define academic performance. By consistently defining different types of cell phone usage and academic performance, researchers may be able to better determine the extent to which certain types of cell phone usage affect academic performance.

Prevalence of Cell Phones

Statistical data on cell phone use in the classroom may offer insight into how prevalent the effects of cell phone use are on

academic performance (Olmsted & Terry, 2014). Over 95% of undergraduate students own cell phones, as noted across multiple studies (Elder, 2013; Olmsted & Terry, 2014; Pettijohn, Frazier, Rieser, Vaughn, & Hupp-Wilds, 2015). With the widespread ownership of cell phones among students, cell phone usage in the classroom is probable. Of the students who own cell phones, Froese and colleagues (2012) found that 75% have their cell phones with them in every class period. Likewise, in a study published in 2012, Tindell and Bohlander found that even more students, 95%, bring their cell phones to every class meeting. Fortunately, the majority of students try to accommodate to the learning environment by putting their cell phones on “vibrate” during class (Berry & Westfall, 2015; Tindell & Bohlander, 2012) because cell phone ringing can hinder the academic performance of other students (End et al., 2010) as well as be disruptive to the teacher. However, only between 8% and 9% of students turn their phones completely off during class time (Berry & Westfall, 2015; Tindell & Bohlander, 2012).

Over half of cell phone usage in the classroom is allocated to texting while the remaining proportion of cell phone usage is directed to checking social media websites like Facebook and Twitter, behavior that has the potential to cause problems for peers in the classroom (Lee, 2015; Olmsted & Terry, 2014; Pettijohn et al., 2015). Pettijohn and colleagues (2015) found that students who text in-class usually communicate with friends or significant others, like boyfriends, girlfriends, or spouses. Rarely will a student ever leave the classroom to use a cell phone (Pettijohn et al., 2015). In general, research reveals how prevalent cell phone presence and use in class are likely to be. Considering the motivation for using cell phones in class may provide a better understanding of why cell phone

presence in the classroom is so heavy despite knowledge of its negative impact on academic performance.

Motivators for Cell Phone Use

Cell phone usage has become habitual for students outside and inside the classroom environment (Elder, 2013). Pettijohn and colleagues (2015) found three motivators for cell phone texters during class time: boredom, checking for emergencies, and texting to resolve work conflicts. Although 32% of in-class student texters reported leaving the classroom to check for emergencies, one may infer that 68% remained in class. Furthermore, habitual texting outside of class translates into the classroom environment (Olmsted & Terry, 2014). Students who text in class may have a larger number of people whom they text on a regular basis, they often text while studying for their courses or while driving, and they become anxious or have anxious thoughts when they are unable to access their cell phones (Olmsted & Terry, 2014). Thus, the literature indicates that many college students are motivated to use cell phones in the classroom, as part of staying socially connected and reducing anxiety that may result from a fear of missing out on something socially important.

Effects on Academic Performance

The negative effects of cell phone usage in the classroom on academic performance have been demonstrated across multiple studies (Bjornsen & Archer, 2015; Elder, 2013; End et al., 2010; Froese et al., 2012; Gingerich & Lineweaver, 2014; Lawson & Henderson, 2015; McDonald, 2013). Froese and colleagues (2012) found that students who texted in class during a 6-minute lecture spent an average of 2.69 minutes texting a confederate, time that could

have been spent focusing on the material. Additionally, when quizzed on the lecture material, students who texted during the lecture performed 27% worse on the quiz than students in the no-texting condition.

Similarly, Gingerich and Lineweaver (2014) ran two experiments, each with a texting and a no-texting condition, both of which demonstrated a significant negative effect on academic performance. In the first experiment, students who texted during the lecture had an average quiz score of 60.14%, and students who did not text had an average quiz score of 79.22%. The second experiment replicated these results with students in the texting condition scoring an average of 73.41% and those in the no-texting condition scoring an average of 83% on the quiz. However, it may be that students who text in-class perform worse overall academically, and they do not specifically perform worse on quiz questions that require information disrupted by text messages (Lawson & Henderson, 2015). Thus, students' scores on a particular measure may be confounded with their overall academic performance.

Studies that have examined overall cell phone use in-class have found different results than studies that have strictly operationalized cell phone usage as texting. For example, Bjornsen and Archer (2015) found that, instead of texting in class, students who often use their cell phones in class to utilize social media are affected the most negatively academically. Yet Elder (2013) found no significant difference on quiz performance by students who did or did not use their cell phones in class, even though students who used their cell phones in class perceived their quiz performance to be worse than their no cell phone use counterparts did. This finding may indicate that students are

aware of the negative effects cell phone use in the classroom has on academic performance, yet they continue to use their phones.

Perspectives of Cell Phone Use

Student Perspectives

Student attitudes about the effects of cell phone usage in the classroom are relatively neutral (Elder, 2013). Only 8% of students feel that their cell phone usage in class hinders their academic performance (Berry & Westfall, 2015). Students also understand there is a fine line between cell phone usage in class, obsessive cell phone usage in class, and the degree of appropriateness (Berry & Westfall, 2015). Many students indicate that they know they will perform worse academically if they text during a lecture (Froese et al., 2012; Gingerich & Lineweaver, 2014). On the other hand, some students tend to be optimistic about using cell phones in class for academic instead of personal purposes, despite knowledge of the possible negative consequences.

In a study by Tossell and colleagues (2015), students who had never owned a smartphone or tablet were given a smartphone to use for a whole year. Participants were asked before and after the study whether they thought cell phones were beneficial to them academically. At the beginning of the study, 63% of the participants believed that the compactness of their cell phones allowed them to have on-the-go access to their courses and expected their cell phones would play a fundamental part in their academic achievement for that school year. At the end of the study, participants had a negative perspective of cell phone usage in academia in that they believed

that cell phone usage had become an addiction and a distraction from their education. Instead of using their cell phones for academic purposes, students more often used them for communicating with others and for entertainment.

Peer Perspectives

With cell phones creating distraction in the college classroom for individual students, the peer perspective on cell phone use in the classroom must also be considered. In other words, students who sit next to cell phone users are also impacted in tangible ways. Approximately 90-97% of students report that they are aware of their classroom neighbors' cell phone use (Berry & Westfall, 2015; Tindell & Bohlander, 2012). In contrast, 84% of students claim to not be bothered by their peers using their cell phones during class (Elder, 2013), and 77.2% report not being bothered when their peers are texting during class (Pettijohn et al., 2015). One explanation for these findings is that students may be more sensitive to cell phone noises, such as a vibration or unwarranted alarm ring, by their peers during class than the act of seeing a cell phone being used in class (Berry & Westfall, 2015; End et al., 2010).

End and colleagues (2010) set up two conditions, the first being one in which a cell phone did not ring during a lecture and the second condition being one in which a cell phone did ring at specific intervals during a lecture. The goal of the study was to find whether or not a cell phone ring during a lecture hindered student recall of information presented in the lecture on a multiple-choice quiz. Researchers also explored whether the cell phone's ringing during two specific time intervals similarly interfered with note taking. Results showed that students in the cell phone

ringing condition performed significantly worse on quiz items that required information presented when the cell phone rang. Additionally, students in the cell phone ringing condition were unable to correctly record information from the lecture during the two cell phone ringing intervals.

Professor Perspectives and Methods of Prevention

Professors, just like peers, are highly aware of cell phone usage in their classrooms and believe cell phone use is a major factor of distraction to students and their learning (Berry & Westfall, 2015). Yet some professors are no longer willing to try to control their students' cell phone usage in the classroom even though they are aware of the negative effects (Lawson & Henderson, 2015). Frequent student cell phone use in class may be due to ineffective cell phone policies set by professors. McDonald (2013) compared three different cell phone policies in three sections of the same course. One section was threatened with loss of points for cell phone use during class, and another section had no cell phone policy. The most effective policy stated, "Cell phones were [sic] to be turned off and not used during class. This is an issue of respect for others and your professor" (p. 36). McDonald (2013) found that students in the section with the moderate cell phone policy stated above had the highest average final course grade, 81%. However, cell phone policies that may work for one class may not work for others, so it is the professor's responsibility to tailor an effective policy for that specific course (Lawson & Henderson, 2015).

Other strategies that may help reduce cell phone use in the classroom include reducing class size, interactive instruction, such as group activities or discussions (Berry

& Westfall, 2015), and offering incentives to students who put away their cell phones for the entirety of the class (Katz & Lambert, 2016). Katz and Lambert (2016) offered students the opportunity to earn extra credit points in their introductory level psychology course for every class period in which they agreed to give up their cell phones for the entire lecture. Students who gave up their cell phones more frequently had higher test scores than students who gave them up less often. The classroom environment was also transformed by becoming more academically enhanced. Students claimed at the end of the study that they had been able to focus more on the lecture material in class and the relationships between peers and the professor had been improved (Katz & Lambert, 2016). Students, peers, and professors' perspectives about cell phone use in the classroom vary by individual and by course.

Implications and Future Research

Cell phone usage in the undergraduate classroom environment continues to be an important issue in higher education (Berry & Westfall, 2015). In this review, we highlight the overall prevalence of cell phone use, its effects on academic performance, and student, peer, and faculty perspectives about cell phone use in undergraduate classrooms to extend and make an original contribution to the existing literature. Further research needs to be conducted that taps into the motives behind student cell phone use and methods to better control cell phone usage in the classroom (Lee, 2015). Additionally, researchers should consider assessing the relationship between cell phone use and academic performance under different circumstances, such as taking a free response test or performing an activity after being distracted by a cell phone ringing while directions are

being given (Gingerich & Lineweaver, 2014). Future studies must also be more rigorous when controlling for participant characteristics such as academic performance (Katz & Lambert, 2016). By controlling for academic aptitude, for example, by ensuring all participants are within the same GPA range, future researchers would be able to create samples that limit confounding variables that may mask the effects of cell phone use on academic performance. It would be interesting to determine whether there are characteristics that allow some students to be more affected by the technical disruption. The conclusions from such research could help educators better understand and guide their students towards more appropriate cell phone usage in the classroom.

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